County Project Number Y12-731

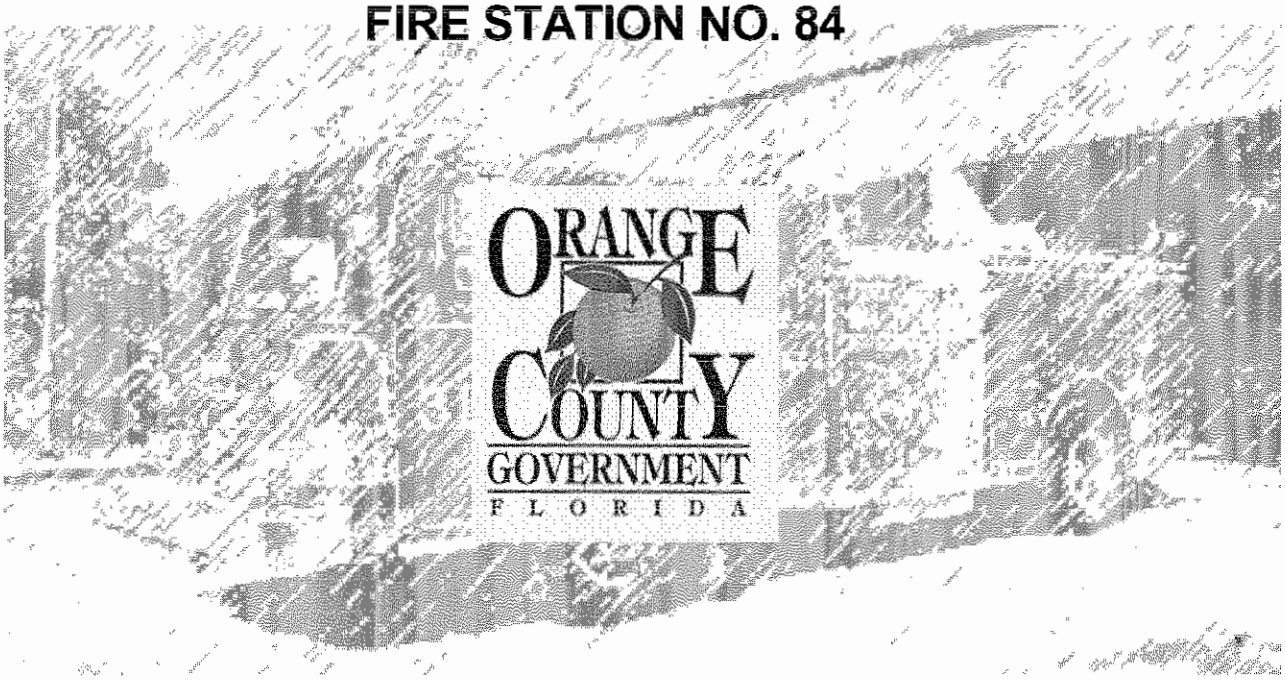
SPECIFICATION MANUAL

VOLUME I

Division 1 through Division 14

ORANGE COUNTY

FIRE STATION NO. 84



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Bid / Permit Set

December 6, 2011

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Division 1
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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 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: The Project involves the construction of new fire station facilities that consist primarily of offices, living quarters, apparatus bays, and related site construction, including roadway and parking spaces.

1. Project Location: Orange County, Florida.
2. Owner: Board of Orange County Commissioners, Orange County, Florida

B. Work of this Contract consists of, but is not limited to

1. Construction administrative and procedural requirements as necessary to produce a complete and properly functioning facility.
2. Sitework, foundation, and slab work, including earthwork excavation and compaction for building and utilities.
3. Cast-in-place concrete, precast concrete, concrete unit masonry and brick veneer work.
4. Metal work, including light gauge metal framing, and related metal fabrications.
5. Rough carpentry and architectural woodwork.
6. Thermal, moisture protection, insulation, sheet metal roofing, waterproofing, joint sealants, and firestopping.
7. Wood and steel doors, frames, access doors, aluminum storefront and entrances, sectional doors and building hardware.
8. Gypsum board, acoustical suspended ceiling systems, hard tile, resilient flooring, painting and related finishes.
9. Louvers, storm shutters, signage, and fire accessories.
10. Toilet room accessories, lockers, flagpole and other specialty items.
11. Food Service Equipment.
12. Related mechanical, plumbing and electrical work.

C. Architect Identification: The Contract Documents, as dated on the Documents, were prepared for Project by C. T. Hsu + Associates, P. A., 820 Irma Avenue, Orlando, Florida 32803.

D. General Contractor:

1.03 CONTRACTS

A. Project will be constructed under a General Construction Agreement – Bid Advertisement and Award through Orange County Purchasing Department.

1.04 USE OF PREMISES

A. Contractor shall have full use of existing site premises for construction operations during construction period. Contractor's use of premises is limited only by the County's right to perform work or to retain other contractors on portions of Project, when established at designated times.

1.05 OWNER-FURNISHED PRODUCTS

A. The County may choose to furnish certain portions of work, materials, equipment and systems. When such is to be furnished, the County will provide descriptions of work to Contractor, who will in turn notify related parties.

1. The County will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Unless noted otherwise, the County will arrange and pay for delivery of the County-furnished items according to Construction Schedule.
3. After delivery, the County will inspect delivered items for damage. Contractor shall be present for and assist in the County's inspection.
4. If the County-furnished items are damaged, defective, or missing, the County will arrange for replacement.
5. The County will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
6. The County will furnish Contractor the earliest possible delivery date for the County-furnished products. Using the County-furnished earliest possible delivery dates, Contractor shall designate delivery dates of the County-furnished items in Construction Schedule.
7. Architect / Engineer shall review Shop Drawings, Product Data, and Samples and return them to appropriate parties noting discrepancies or anticipated problems in use of product.

1.06 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: These Specifications are organized into Divisions and Sections using the 16-division format and the CSI "MasterFormat" numbering system.

1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the Table of Contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Concrete Access Pavement Repair on main access driveway as designated in Civil pavement drawing, Sheet C-1 Demolition and Sheet C-2 Site-Geometry Plan.

END OF SECTION

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. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.03 MINOR CHANGES IN THE WORK

A. Architect will issue through the General Contractor, supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.04 PROPOSAL REQUESTS

A. The County-Initiated Proposal Requests: Architect or the County will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect or General Contractor are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within 20 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity

duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.05 CHANGE ORDER PROCEDURES

A. On the County's approval of a Proposal Request, Architect will issue a Change Order for signatures of the County and Contractor on AIA Document G701.

1.06 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714, Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.03 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with Continuation Sheets.
b. Submittals Schedule.

2. Submit the Schedule of Values to the County at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

a. Project name and location.
b. Name of Architect.
c. Construction Manager's name and address.
d. Architect's project number.
e. Contractor's name and address.
f. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value.

        1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager and paid for by the County.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between the County and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: The date for each progress payment is the 15th day of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days before the date for each progress payment.

D. Payment Application Forms: Use forms provided by the County for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect / Construction Manager will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal: Submit signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. the County reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to the County.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire the County's insurance.
16. Initial settlement survey and damage report if required.

J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for the County occupancy of designated portions of the Work.

K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when the County took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Project meetings.

B. Contractor shall have each subcontractor participate in coordination requirements

1.03 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.04 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings in areas of limited space availability for maximum utilization of space for efficient installation of different components and where coordination is required for installation of products and materials fabricated by separate entities.

1. Indicate relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Refer to Division 15 Section "Basic Mechanical Materials and Methods" and Division 16 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.

B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.05 PROJECT MEETINGS

A. Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner, Construction Manager, if one is retained by Owner, and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Construction Manager, if one is retained by Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing.
    d. Designation of responsible personnel.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for processing Applications for Payment.
    g. Distribution of the Contract Documents.
    h. Submittal procedures.
    i. Preparation of Record Documents.
    j. Use of the premises.
    k. Responsibility for temporary facilities and controls.
    l. Parking availability.
    m. Office, work, and storage areas.
    n. Equipment deliveries and priorities.
    o. First aid.
    p. Security.
    q. Progress cleaning.
    r. Working hours.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Construction Manager, if one is retained by Owner, of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Submittals.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.
    l. Manufacturer's written recommendations.
    m. Warranty requirements.
    n. Compatibility of materials.
    o. Acceptability of substrates.
    p. Temporary facilities and controls.
    q. Space and access limitations.
    r. Regulations of authorities having jurisdiction.
    s. Testing and inspecting requirements.
    t. Required performance results.
    u. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner, Construction Manager, if one is retained by Owner, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.
14) Documentation of information for payment requests.

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Daily construction and field condition.
5. Special reports.
6. Construction photographs.

1.03 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either the County or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.04 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and the County, and other information specified.

B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's and Construction Manager's final release or approval.
7. Scheduled dates for purchasing.
8. Scheduled dates for first installation.

C. Preliminary Construction Schedule: Unless directed otherwise, submit two printed copies; one a single sheet of reproducible media, and one a print.

D. Preliminary Network Diagram: Unless directed otherwise, submit two printed copies; one a single sheet of reproducible media, and one a print; large enough to show entire network for entire construction period.

E. Contractor's Construction Schedule: Unless directed otherwise, submit two printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

1. Submit an electronic copy of schedule, using software indicated, on CD-R media, formatted to hold 650 MB of data, or on 3-1/2-inch diskettes, formatted to hold 1.44 MB of data, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.

F. CPM Reports: Concurrent with CPM schedule, and unless directed otherwise, submit three printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

G. Construction Photographs: Unless directed otherwise, submit two prints of each photographic view within seven days of taking photographs.

1. Format: 8-by-10-inch smooth-surface matte prints on single-weight commercial-grade stock, enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.
2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:

    a. Name of Project.
    b. Name and address of photographer.
    c. Name of Architect and Construction Manager.
    d. Name of Contractor.
    e. Date photograph was taken.
    f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

3. Media: Submit a complete set of photographic media in protective envelopes, with each submittal of prints as a Project Record Document. Identify date photographs were taken.

    a. Provide digital images on CD-R Discs.

H. Daily Construction Reports: Submit three copies at weekly intervals.

I. Special Reports: Submit three copies at time of unusual event.

J. Field Condition Reports: Submit three copies at time of discovery of differing conditions.

1.05 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: Employ an experienced specialist in CPM scheduling and reporting if Contractor personnel lack sufficient experience.

B. Photographer Qualifications: Employ an individual of established reputation who has been regularly engaged as a professional photographer for not less than three years.

1.06 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. Auxiliary Services: Provide auxiliary services requested, including access to Project site and use of temporary facilities including temporary lighting.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule or preliminary network diagram. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

    a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule. Issue updates as they occur, when agreed by all parties.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work.

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include necessary number of days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and the County's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: When phasing is required, arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by the County: Include a separate activity for each portion of the Work performed by the County.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. County-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:
   a. Uninterruptible services.
   b. Partial occupancy before Substantial Completion.
   c. Use of premises restrictions.
   d. Provisions for future construction.
   e. Seasonal variations.
   f. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Permanent space enclosure.
    c. Completion of mechanical installation.
    d. Completion of electrical installation.
    e. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, interim milestones, and Final Completion.

F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

G. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.03 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within 15 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.04 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 15 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Purchase of materials.
    c. Delivery.
    d. Fabrication.
    e. Installation.

2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the Schedule of Values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.05 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.

4. High and low temperatures and general weather conditions.
5. Accidents.
6. Meetings and significant decisions.
7. Unusual events (refer to special reports).
8. Stoppages, delays, shortages, and losses.
9. Meter readings and similar recordings.
10. Emergency procedures.
11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.
13. Construction Change Directives received.
14. Services connected and disconnected.
15. Equipment or system tests and startups.
16. Partial Completions and occupancies.
17. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals (as a minimum), update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, the County, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.02 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified commercial photographer to take Final Completion photographs.

B. Photographic Media: Provide either of the following.

1. Digital: Minimum image resolution of 1600 by 1200 pixels. Minimum camera resolution of 3.1 megapixels.
2. Photographic film: Medium format, 2-1/4 by 2-3/4 inches.

C. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.

D. Periodic Construction Photographs: Unless directed otherwise, take not less than four color photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken.

1. Field Office Prints: Retain one set of prints of periodic photographs in field office at Project site, available at all times for reference. Identify photographs the same as for those submitted to Architect and Construction Manager.
2. Digital Media File Type: tif or jpeg.

E. Final Completion Construction Photographs: Unless directed otherwise, take not less than eight color photographs after date of Substantial Completion for submission as Project Record Documents. Architect and Construction Manager will direct photographer for desired vantage points.

1. Digital Media File Type: tif.

END OF SECTION

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. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information that requires responsive action.

B. Informational Submittals: Written information that does not require approval. Submittals may be rejected for not complying with requirements.

1.04 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, the County, or other parties is required, allow 21 days for initial review of each submittal.
3. If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Allow 15 days for processing each resubmittal. Allow 21 days for processing each concurrent resubmittal review.
5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect..
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect and Construction Manager.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Unique identifier, including revision number.
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Other necessary identification.

E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
3. Transmittal Form: Unless directed otherwise, use AIA Document G810 .

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit four copies of each submittal, unless otherwise indicated. Architect will return three copies. Mark up and retain one returned copy as a Project Record Document.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.

j. Standard product operating and maintenance manuals.
k. Compliance with recognized trade association standards.
l. Compliance with recognized testing agency standards.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
4. Number of Copies: Submit one (1) original (reproducible, when possible) and six (6) copies of each submittal unless directed otherwise. Architect will retain two (2) copies, return two (2) copies to Owner, and return two (2) copies and original (or reproducible) to Contractor.

a. Mark up and retain one returned print as a Project Record Drawing.

D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

E. Samples: Prepare physical units of materials or products, including the following:

1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
2. Samples for Initial Selection: When required by individual Specification Sections, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:

    a. Generic description of Sample.
    b. Product name or name of manufacturer.
    c. Sample source.

5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:

    a. Size limitations.
    b. Compliance with recognized standards.
    c. Availability.
    d. Delivery time.

6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.

    a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
    b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

7. Number of Samples for Initial Selection: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one submitted set with options selected.
8. Number of Samples for Verification: Submit four sets of Samples. Architect will retain two Sample sets; the remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.

    a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

9. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples not incorporated into the Work, or otherwise designated as the County's property, are the property of Contractor.

F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

G. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."

H. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for action.

I. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

J. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."

K. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."

L. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use appropriate AIA form unless directed otherwise. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

2.02 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit four copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

H. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

I. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

J. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

M. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Operation and Maintenance Data."

O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

R. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

S. Construction Photographs: Comply with requirements in Division 1 Section "Construction Progress Documentation."

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Review and Acceptance Stamp: Stamp each submittal with a uniform, review and acceptance stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Reviewed
2. Revise and resubmit.
3. Furnish as corrected.
4. Rejected.

C. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

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. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. In most situations, mockups will establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.04 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.05 REGULATORY REQUIREMENTS

A. Copies of Regulations: Be aware of, and when requested, obtain copies of specific regulations applicable to particular portions of work involved. Retain at Project site to be available for reference by parties who have a reasonable need.

1.06 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

D. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.

2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

1. Contractor responsibilities include the following:

a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
d. When testing is complete, remove assemblies; do not reuse materials on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.08 QUALITY CONTROL

A. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.

1. Contractor's responsibility is to engage a qualified testing agency to perform these quality-control services.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Special Tests and Inspections: Contractor will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction

1. Testing agency will notify Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect, with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and reinspect corrected work.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

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 DEFINITIONS

A. Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Installer": Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

J. "Experienced": When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

K. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: 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 Architect for a decision before proceeding.

1. 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 Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.

E. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of November, 2001.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	 (800) 872-2253 (202) 272-5434

CFR	Code of Federal Regulations Available from Government Printing Office www.access.gpo.gov/nara/cfr	 (888) 293-6498 (202) 512-1530
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterways Experiment Station www.wes.army.mil	 (601) 634-2355
DOD	Department of Defense Specifications and Standards Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	 (215) 697-6257
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	 (215) 697-6257
	Available from General Services Administration www.fss.gsa.gov/pub/fed-specs.cfm	(202) 619-8925
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MILSPEC	Military Specification and Standards Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	 (215) 697-6257
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	 (800) 872-2253 (202) 272-5434

1.04 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AAN	American Association of Nurserymen (See ANLA)	
AASHTO	American Association of State Highway and Transportation Officials www.aashto.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute/ACI International www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AFPA	American Forest & Paper Association (See AF&PA)	
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association www.hardboard.org	(847) 934-8800

AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America www.alca.org	(800) 395-2522 (703) 736-9666
ALSC	American Lumber Standard Committee	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen) www.anla.org	(202) 789-2900
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts www.aosaseed.com	(505) 522-1437
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(941) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800

ASCA	Architectural Spray Coaters Association www.ascassoc.com	(609) 848-6120
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industries International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (See WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(817) 326-6300
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010

BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312
CCFSS	Center for Cold-Formed Steel Structures www.umr.edu/~ccfss	(573) 341-4471
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CGSB	Canadian General Standards Board www.pwgsc.gc.ca/cgsb	(819) 956-0425
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000

CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eifsfacts.com	(800) 294-3462 (770) 968-7945
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FCI	Fluid Controls Institute www.fluidcontrolsinstitute.org	(216) 241-7333
FGMA	Flat Glass Marketing Association (See GANA)	
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FSC	Forest Stewardship Council www.fscoax.org	52 951 5146905
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association) www.glasswebsite.com/gana	(785) 271-0208
GRI	Geosynthetic Research Institute www.drexel.edu/gri	(215) 895-2343

GTA	Glass Tempering Division of Glass Association of North America (See GANA)	
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (See CSA)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISSFA	International Solid Surface Fabricators Association	(702) 567-8150

I3A	International Imaging Industry Association (Formerly: PIMA - Photographic & Imaging Manufacturers Association) www.pima.net	(914) 698-7603
ITS	Intertek Testing Services www.itsglobal.com	(800) 345-3851 (607) 753-6711
IWS	Insect Screening Weavers Association (Now defunct)	
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association) www.lma.org	(201) 664-2700
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
LSGA	Laminated Safety Glass Association (See GANA)	
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(614) 228-6194
ML/SFA	Metal Lath/Steel Framing Association (See SSMA)	
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613

NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NAAMM	North American Association of Mirror Manufacturers (See GANA)	
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NAIMA	North American Insulation Manufacturers Association (The) www.naima.org	(703) 684-0084
NAMI	National Accreditation and Management Institute, Inc.	(304) 258-5100
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(414) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFPA	National Fire Protection Association www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-6372

NGA	National Glass Association www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSA	National Stone Association (See NSSGA)	
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association (Formerly: NSA - National Stone Association) www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo and Mosaic Association, Inc. www.ntma.com	(800) 323-9736 (703) 779-1022
NWWDA	National Wood Window and Door Association (See WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting and Decorating Contractors of America www.pdca.com	(800) 332-7322 (703) 359-0826
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (508) 230-3516
PGI	PVC Geomembrane Institute //pgi-tp.ce.uiuc.edu	(217) 333-3929
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400

RFCI	Resilient Floor Covering Institute www.rfci.com	Contact by mail only
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabfurn.com	(516) 294-5424
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.screenmfgassociation.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPI/SPFD	Society of the Plastics Industry (The) Spray Polyurethane Foam Division (See SPFA)	
SPRI	SPRI (Single Ply Roofing Institute) www.spri.org	(781) 444-0242

SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association) www.ssma.com	(312) 456-5590
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, and Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TPI	Truss Plate Institute	(608) 833-5900
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 705-9898
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USITT	United States Institute for Theatre Technology, Inc. www.culturenet.ca/usitt	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (See WCSC)	

WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 661-4261
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WIC	Woodwork Institute of California www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc. www.bocai.org	(708) 799-2300
CABO	Council of American Building Officials (See ICC)	
FBC	Florida Building Code www.floridabuilding.org	(850) 487-1824
IAPMO	International Association of Plumbing and Mechanical Officials (The) www.iapmo.org	(909) 595-8449
ICBO	International Conference of Building Officials www.icbo.org	(800) 284-4406 (562) 699-0541
ICC	International Code Council, Inc. (Formerly: CABO - Council of American Building Officials) www.intlcode.org	(703) 931-4533
SBCCI	Southern Building Code Congress International, Inc. www.sbcci.org	(205) 591-1853

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-0990
DOC	Department of Commerce www.doc.gov	(202) 482-2000
EPA	Environmental Protection Agency www.epa.gov	(202) 260-2090
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(202) 708-5082
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley Laboratory (See LBNL)	
LBNL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-5605
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
RUS	Rural Utilities Service (See USDA)	(202) 720-9540

TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CAPUC (See CPUC)

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Products Laboratory //txforestservice.tamu.edu	(936) 639-8180

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:

1. Sewers and drainage.
2. Water service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Heating, cooling and humidity control facilities.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Telephone service.

C. Support facilities include, but are not limited to, the following:

1. Temporary roads and paving.
2. Dewatering facilities and drains.
3. Project identification and temporary signs.
4. Waste disposal facilities.
5. Field offices.
6. Storage and fabrication sheds.
7. Lifts and hoists.
8. Temporary elevator usage.
9. Temporary stairs.
10. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest control.
5. Site enclosure fence.
6. Security enclosure and lockup.

7. Barricades, warning signs, and lights.
8. Covered walkways.
9. Temporary enclosures.
10. Temporary partitions.
11. Fire protection.

1.03 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.04 USE CHARGES

A. Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's construction forces.
2. Occupants of Project.
3. Architect.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. Water Service: When available on site, use water from Owner's existing water system without metering and without payment of use charges. When not existing or available on site, pay for temporary water service use charges obtained through temporary installations, whether metered or otherwise, for water used during construction activities.

D. Electric Power Service: When available on site, use electric power from Owner's existing system without metering and without payment of use charges. When not existing or available on site, pay for temporary electric power service use charges obtained through temporary installations, whether metered or otherwise, for electricity used during construction activities.

1.05 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.06 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts.

2.02 EQUIPMENT

A. Provide equipment suitable for use intended.

B. Field Offices: Prefabricated, mobile units or job-built construction with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. Drinking-Water Fixtures: Drinking-water fountains or containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.

F. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

G. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

H. Heating, Cooling and Humidity Control Equipment: Unless Owner authorizes use of permanent system, provide temporary equipment and systems for heating, cooling and humidity control that are adequate to comply with environmental conditions and requirements specified in other Sections of these Specifications.

1. Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
2. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
3. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
4. Provide temporary desiccant dehumidifiers, direct expansion dehumidifiers, chillers, cooling coils and related equipment as manufactured by Munters Corporation or other manufacturers with equivalent products for temporary cooling and control of humidity.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Comply with governing regulations to filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.

C. Water Service: When available, use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. When not available on site install water service and distribution piping, in compliance with applicable codes, in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use. At Substantial Completion, or other designated time, remove temporary installations and restore conditions appropriate for final acceptance.
2. Provide rubber hoses as necessary to serve Project site.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.

3. Drinking-Water Facilities: Provide bottled-water, drinking-water units.

   a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Provide temporary weatherproof, grounded electric power service and distribution system, in compliance with applicable codes, and of sufficient size, capacity, and power characteristics required during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
   1. When available and Owner approves, connect temporary service to Owner's existing power source, as directed by electric company officials.

H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

   1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.

   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office.
   1. Provide an answering machine on superintendent's field office telephone .
   2. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when away from field office.

3.03 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: As required by conditions, construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period.

C. Dewatering Facilities and Drains: Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.

D. Project Identification and Temporary Signs: Prepare Project identification and other signs. Install signs where directed or approved. Do not permit installation of unauthorized signs.

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.

1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

F. Common-Use Field Office: Provide an insulated, weathertight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 10 persons at Project site. Keep office clean and orderly.

G. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

H. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Pest Control: Minimize attraction and harboring of rodents, roaches, and other pests. When required or directed, engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

E. Site Enclosure Fence: Before construction operations begin install specified or acceptable enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.

F. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

G. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

I. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION

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. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.03 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.04 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form at the end of this Section

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
   i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time.
   j. Cost information, including a proposed credit in the Contract Sum.
   k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
   l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.07 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal," "or equavalent," or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.

    a. Substitutions may be considered, unless otherwise indicated.

2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.

    a. Substitutions may be considered, unless otherwise indicated.

3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

    a. Substitutions may be considered, unless otherwise indicated.

4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

    a. Substitutions may be considered, unless otherwise indicated.

5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
6. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.
7. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Substitutions may be considered, unless otherwise indicated.

8. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

    a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.

9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.

b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.02 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution offers Owner opportunity to utilize "green" or recyclable / recycled materials, or products with components made from largely recycled materials.
3. Requested substitution does not require extensive revisions to the Contract Documents.
4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
5. Substitution request is fully documented and properly submitted.
6. Requested substitution will not adversely affect Contractor's Construction Schedule.
7. Requested substitution has received necessary approvals of authorities having jurisdiction.
8. Requested substitution is compatible with other portions of the Work.
9. Requested substitution has been coordinated with other portions of the Work.
10. Requested substitution provides specified warranty.
11. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.03 COMPARABLE PRODUCTS

A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

SUBSTITUTION REQUEST FORM

The undersigned hereby submits for consideration the following request for substitution in lieu of the specified item noted:

Section	Page	Paragraph/Line	Specified Item

Proposed Substitution: _____

Complete product description, drawings, photographs, performance and test data, samples, and other information necessary for evaluation of requested substitution is to be attached. Fill in ALL blanks.

A. Has applicable product data, performance characteristics, test results, cut sheets, drawings and other supporting documentation for substitution items been included and marked for comparison purposes? Yes __ No __. If "No", explain :_____

B. What differences exist between the requested substitution and the specified item? _____

C. Does the requested substitution affect dimensions, locations, or configurations: Yes ____ No __. If "Yes", explain: _____

D. Will changes be required to the building or other construction in order to properly install or accommodate the requested substitution? Yes ___ No ___. If "Yes", explain: _____

E. What effect does the requested substitution have on other trades? _____

F. Does the manufacturers warranty on the requested substitution differ from that specified? Yes ___ No ___. If "Yes", explain: _____

G. Does the requested substitution affect applicable code requirements? Yes ___ No ___.
If "Yes", explain: _____

H. Will the requested substitution adversely affect the construction progress schedule?
Yes ___ No ___. If "Yes", explain: _____

I. Will maintenance and service parts be locally available for the requested substitution?
Yes ___ No ___. If "No", explain: _____

J. Will the requested substitution require waiving of any qualification or other requirements?
Yes ___ No ___. If "Yes", explain: _____

K. Are there any license fees or royalties associated with the requested substitution? Yes ___
No ___. If "Yes", explain: _____

L. Identify the recycled materials or components, or the features which lead to the claims to being "Green": _____

M. Prior (to Bid) Approval Substitution Request - Reason for Substitution Request: _____

N. Substitution Request After Execution of Contract - Identify monetary credit and reduction of Contract time to be realized if this Substitution Request is accepted. If none, identify specific reason under which this Substitution Request is being made. _____

O. The undersigned will pay for Architect's (and consultants') review time, and for changes to the building design, including review, re-design, engineering, drawing and other costs, caused by the requested substitution. The following Purchase order or billing number is to be used for billing Contractor for costs incurred in evaluating, and if applicable accommodating the requested substitution:

_____

For Contractor's use only:

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

The undersigned states that the performance, function, quality and durability are equivalent or superior to the specified item. If Contractor is a corporation, the legal name of the corporation shall be set forth below, together with signature(s) of the officer or officers authorized to sign contracts on behalf of the corporation and corporate seal; if Contractor is a partnership, the true name of the firm and the name(s) of the general partner(s) shall be set forth below with the signature(s) of the partner or partners authorized to sign contracts on behalf of the partnership; and if the Contractor is an individual, his signature shall be placed below. Failure to provide legally binding signature(s) will result in non-consideration of Substitution Request.

Submitted By:

(Corporate Seal)
Attest (if Corporation)

_____
Signature, Date

_____
Name

_____
Title

_____
Firm

By _____
(Signature)

_____
Street Address

_____
Name

_____
City, State, Zip

Title: _____

Witnesses: _____
(if partnership or individual)

_____

END OF SECTION

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. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection and correction of installed Work.
8. Correction of the Work.

1.03 SUBMITTALS

A. Qualification Data: For land surveyor and professional engineer to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Certificates: Submit certificate signed by land surveyor professional engineer certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.

E. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.

1.04 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Professional Engineer Qualifications: A professional engineer who is legally registered in the State of Florida and who is experienced in providing engineering services of the kind indicated or required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect, Construction Manager and Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Construction Manager's written permission.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.04 FIELD ENGINEERING

A. Identification: Identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.05 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Unless required or directed otherwise, maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.07 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during cooler weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.08 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.09 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

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. This Section includes procedural requirements for cutting and patching.

1.03 DEFINITIONS

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

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

1.04 SUBMITTALS

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

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

1.05 QUALITY ASSURANCE

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

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

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

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.
7. Fire-rated assemblies.

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

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.06 WARRANTY

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

PART 2 - PRODUCTS

2.01 MATERIALS

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

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

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

PART 3 - EXECUTION

3.01 EXAMINATION

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

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

3.02 PREPARATION

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

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

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

3.03 PERFORMANCE

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

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

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Unless directed or required otherwise, cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

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

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

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

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

END OF SECTION

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. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic media, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.

9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.04 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect and Construction Manager.
    d. Name of Contractor.
    e. Page number.

1.06 PROJECT RECORD DOCUMENTS

A. Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings, and Product Data, where applicable.

1.07 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the Table of Contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

j. Remove labels that are not permanent.
k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to unusual operating conditions.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

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. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, finishes systems and equipment.

1.03 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return 1 copy of draft and mark whether general scope and content of manual is acceptable.

B. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.04 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

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

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

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

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

2.02 MANUALS, GENERAL

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

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name, address, and telephone number of Construction Manager.
7. Name and address of Architect.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software CD's or diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.03 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.

2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

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

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.04 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.

4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

2.05 PRODUCT MAINTENANCE MANUAL

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

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

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.

4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

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

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

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

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

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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

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

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

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

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

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

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

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

F. Comply with Division 1 Section "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

END OF SECTION

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. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

1.03 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit two complete training manuals for Owner's use.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.04 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors, including overhead sectional and / or coiling doors .
2. Equipment, including food-service equipment.
3. Fire-protection systems, equipment and accessories.
4. Intrusion detection systems, if any.
5. HVAC systems, including air-handling / distribution equipment and systems.
6. HVAC instrumentation and controls.
7. Electrical service and distribution, including as applicable, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
8. Packaged engine generators, including transfer switches, if any.
9. Lighting equipment and controls.
10. All types of communication systems and equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project Record Documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.

5. Adjustments: Include the following:

    a. Alignments.
    b. Checking adjustments.

c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

END OF SECTION

Division 2
Site Construction

PART I - GENERAL

1.1 SCOPE:

A. The work consists of furnishing all labor and equipment necessary for the removal of trees, vegetation, above and below grade improvements, and waste materials from designated areas of the site.

1.2 DESCRIPTION OF WORK:

A. Site clearing shall be performed as designated on the Drawings.

B. Site clearing work includes, but is not limited to:

Removal of trees
Removal of grass and other vegetation
Topsoil stripping
Grubbing
Removal of above grade improvements
Removal of below grade improvements

1.3 JOB CONDITIONS:

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads and other adjacent facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place.

C. Protect improvements on adjoining properties and within public rights-of-way.

D. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

E. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Provide protection for roots over 1" diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues.

2. Temporarily cover exposed roots with wet burlap to prevent roots from drying out;

cover with earth as soon as possible.

3. Replace trees which cannot be repaired and restored to full-growth status, as determined by arborist, in a manner acceptable to the Owner.

PART II - PRODUCTS

2.1 Not Applicable to this Section

PART III - EXECUTION

3.1 SITE CLEARING:

A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions as required to create a clean, usable, and buildable site within the areas designated for construction as indicated on the drawings. Removal includes digging out stumps and roots.

B. Carefully and cleanly cut roots and branches of trees where such roots and branches obstruct new construction.

C. Clearing and Grubbing: Clear site of trees, shrubs, grass and other vegetation.

D. Completely remove stumps, roots, and other debris.

E. Use only hand methods for grubbing inside drip line of trees on adjacent properties.

F. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

G. Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.

3.2 REMOVAL OF IMPROVEMENTS:

A. Remove above-grade and below-grade improvements necessary to permit construction and other work indicated.

B. Abandonment or removal of certain underground piping or conduit may be shown on the mechanical or electrical drawings, and is included under those sections. Removal of abandoned underground piping and conduit interfering with construction is included under this section.

1. Existing utilities interfering with construction shall not be abandoned in place. Such utilities shall be relocated, adjusted or removed as necessary to facilitate construction work.

2. The Contractor shall coordinate with the utility owners to take utilities out of service prior to relocation or removal.

C. The Contractor shall coordinate with the Owner as to the disposition of materials, equipment and devices the Owner may elect to retain. All other materials and debris shall be disposed of as waste materials.

D. The Contractor is advised that uncharted utilities may be found to exist within the construction areas and should Perform clearing and grubbing operations with extreme caution.

1. Should the Contractor discover any unforeseen site conditions that conflict with the information provided or would in any way prevent construction the improvements indicated on the drawings, the Contractor shall notify the Architect immediately, in writing, as to the nature of the conflict or discrepancy. The Architect, or his representative, will expeditiously investigate the discrepancy for a determination of the impact to the Contract.

2. No claim by the Contractor will be allowed if the Contractor fails to provide such written notice.

3.3 DISPOSAL OF WASTE MATERIALS:

1. Burning on Owner's Property: Burning shall not be permitted.

2. Removal from Owner's Property: Remove waste materials, unsuitable spoil material, and excess top soil from Owner's property and dispose of off site in legal manner. It is the Contractor's responsibility to obtain any and all necessary permits for site clearing operations, and for the transportation and disposal of waste materials, including the cost of the permits.

END OF SECTION

SECTION 02200
EARTHWORK

PART I - GENERAL

1.1 DESCRIPTION

A. Earthwork shall include, but not be limited to:

1. Import or export of any and all material as required to fill and complete grading and off-site work.

2. Excavation, backfilling and compaction for structures, and appurtenances and any related groundwater control and dewatering. All dewatering shall be the responsibility of the Contractor.

3. Excavation, shoring, trenching, backfilling, bedding and any dewatering required for utility and other underground lines and appurtenances installed by this Contractor. Particular attention is called to the requirement that no intrusion upon or disturbance of adjacent properties will be allowed.

4. Final grading, shaping and compaction of site and roadways after the mass grading and earthwork is complete.

5. Removal of all materials not to be incorporated into the work.

B. Related Work Specified Elsewhere:

1. Section 02361 - Termite Control

2. Section 02513 - Asphaltic Concrete Paving

3. Section 02514 – Portland Cement Concrete Paving

4. Section 02675 - Water Distribution and Service Piping

5. Section 02720 - Sewage Collection System

6. Section 02735 - Storm Sewer System

7. Report of Geotechnical Exploration and Geotechnical Engineering Evaluation as prepared by Universal Engineering Sciences, Inc.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform earthwork in compliance with applicable requirements of governing authorities and codes having jurisdiction.

2. Perform earthwork operations as described in the Geotechnical Reports. The recommendations included in the Geotechnical Reports are a requirement of this contract. Where the recommendations of the Geotechnical Reports and this section differ, the more stringent requirement shall apply.

B. Testing Agency: In addition to complying with all other requirements specified in this section, refer to and comply with testing requirements identified elsewhere in the Contract Documents.

1. Prior to the execution of any earthwork operations, the Testing Agency shall be notified to review procedures and assist in the proper implementation of these Specifications. Earthwork preparation, compaction and testing shall be done in accordance with the Specifications and as set forth by the Testing Agency or his designated representative.

C. Reference Specifications and Standards:

1. ASTM: D2922 (Nuclear Method), or ASTM D1556 (Sand-Cone Method) or ASTM D2937 (Drive Sleeve Method).

2. ASTM: D3017 (Nuclear Method), or ASTM D1557 Moisture Density Relations of Soils, using 10-1b, Rammer and 18-in. Drop.

3. AASHTO T-180.

1.3 SUBMITTALS: Comply with the requirements of Section 1330 - Submittals

A. Submit copies of all soil testing reports directly to the Architect from the testing services.

1.4 PROJECT CONDITIONS

A. Locate existing underground utilities in the area of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult with the utility owner immediately for directions. Cooperate with utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

C. Do not interrupt existing utilities except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

D. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations. Refer also to Article 3.2, Protection, for additional requirements.

E. Use of Explosives:

1. The use of explosives is not permitted.

PART II - PRODUCTS

2.1 SOIL MATERIALS FOR STRUCTURES AND SITE GRADING

A. On-site materials: Materials obtained by selective stockpiling of the excavated soils. Stockpile materials acceptable to Geotechnical Engineer, and in accordance with the Geotechnical Engineering Investigation.

B. Borrow materials: Non-expansive clean earth and granular materials, with less than 5% passing No. 200 sieve and free of roots or organic materials. Materials with soil fines between 5% and 12% may be used with the permission of the Architect and provided strict moisture control practices are implemented. Do not use rocks or lumps larger than 4 inches in any dimension.

C. Crushed Stone: Crushed stone shall be provided by the Contractor from off-site sources and in the quantities required for completion of the work and of the quality specified and approved. Crushed stone shall consist of washed clean, hard, durable, angular pieces and shall be satisfactorily free from loam, clay, fine sand and deleterious materials. Crushed stone shall be uniformly graded and range in sizes from 1 inch to 3/8 inch and conforming to ASTM D693, Size No. 57.

D. Top Soil: All soil above the lower root line of fine vegetation (grasses and sod).

PART III - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which earthwork is to be performed and promptly notify the Architect in writing, of conditions detrimental to the proper and timely completion of work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 PROTECTION

A. Protect public and adjacent properties, on and off site, in accord with applicable laws and ordinances.

B. Protect from damage all existing on-site features, scheduled or indicated to remain, including flora scheduled to remain.

C. Utilities:

1. Protect and support active utility lines in a manner to prevent damage. Use methods approved by the Architect and all applicable utility companies.

2. Remove abandoned lines encountered during excavation and dispose of off site.

3. Open trenches: The Contractor shall comply with the provisions of the Trench Safety Act, Chapter 90-96, Laws of Florida and with the O.S.H.A. Safety Standards, 29 C.F.R., S. 1926.650, Subpart B. Cover or barricade all open trenches at the close of the workday.

4. Where excavation for utility lines occurs in the vicinity of existing utilities, whether indicated or not, the Contractor shall be responsible to maintain the existing utility service and to protect and support the utility line in a manner to prevent its damage or failure.

    a. In the event that damage or failure does occur, immediate repair and replacement shall be made in an acceptable manner as part of the work of this Section.

D. Dust Control:

1. Throughout the entire construction period effectively control dust in work areas, whether on-site or off-site, to prevent adversely affecting adjacent properties.

E. Water Control:

1. Do not allow rain, surface or sub-surface water, or other fluid, to accumulate in excavations nor under or about buildings, manholes, catch basins, tanks, vaults, etc.

2. Should such conditions develop or be encountered, constantly control and legally dispose of the water by temporary pumps, piping, ditches, dewatering or other approved methods. All methods subject to Architect's review and approval.

    a. Do not allow rain or surface water from construction areas to run off or contaminate areas beyond the limits of the site.

    b. Maintain adequate pumping equipment and backup equipment on hand at all times to provide for emergencies.

F. Bracing, Cribbing and Shoring:

1. Provide temporary or permanent cribbing, sheeting and shoring as necessary to safely retain earth banks and protect excavations from saving or other damage.

2. Remove cribbing and shoring after use. When or where it is impractical to remove, obtain approval to leave it in place. Note locations of such in-place shoring and bracing on project record documents.

G. Environmental Protection:

1. Erosion Control and Maintenance:

    a. The Contractor shall furnish and install erosion/sediment control fencing. Said fencing shall be constructed of erosion control fabric with both sediment filtration capabilities and a high slurry flow rate. All fencing to be installed as indicated on the Drawings.

b. Swales and retention ponds shall be provided as necessary to control surface drainage during construction.

c. Erosion control features shall be repaired as required and maintained until such time as the Architect deems them unnecessary.

3.3 PREPARATION

A. Layout work and Reference Points:

1. Before starting layout work, check through and verify all principal governing dimensions and make a general check of elevations and grades called for on the drawings.

2. Locate benchmarks, monuments and other reference points for elevation and location of new work. Notify the Architect of any apparent discrepancies in indicated locations.

3. Protect reference points from dislocation or damage. Replace or repair immediately any points damaged, destroyed or dislocated.

4. Accurately locate new work on site according to the Contract Documents.

5. Erect batter boards and set grade stakes securely to remain in place until corners and heights are permanently established.

6. Denote areas allocated for storage of various materials. Select storage and working areas to avoid interference with subsequent operations.

3.4 EXCAVATION

A. Excavation consists of removal and disposal of material of every nature encountered (including man-made objects) when establishing required grade elevations.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions. General Unauthorized excavation, as well as remedial work directed by the Architect, and as recommended by Geotechnical Engineer, shall be at the Contractor's expense.

C. Additional Excavation:

1. When excavation has reached required subgrade elevations, notify the Architect and Testing Agency, who will make an inspection of conditions. Do not excavate below indicated depths.

2. If inspection indicates unsuitable materials, additional excavation and corrective work will be authorized and paid for as prescribed by the Contract Documents.

D. Excavation Requirements:

1. The subgrade under the proposed construction shall be stripped of organic matter or soft and yielding materials.

2. De-muck areas as required to achieve required grades, and as indicted on the drawings.

3. Proof-roll the site with a large, self-propelled, non-vibratory roller in static mode. Proof-rolling shall consist of at least 10 overlapping passes in each of two perpendicular directions and shall be performed in the presence of and as directed by a qualified representative of the Testing Agency.

4. Excavate materials of every nature to dimension, and elevations indicated. Use equipment of suitable type for materials and conditions involved.

5. Extend excavation a sufficient distance from structures to allow for forming and shoring, application of dampproofing, and approvals. Do not excavate below indicated depths.

6. Correct unauthorized excavation made below depths indicated, as directed by the Architect, at no additional cost to the Owner.

7. Remove any organic peat or inadequate soils below required subgrade elevation and replace with suitable fill according to Paragraph 3.6(B).

8. After the subgrade has been stripped and the areas have been excavated, the subgrade immediately beneath the proposed footings and structures shall be compacted to a minimum of 98% of the Modified Proctor maximum dry density for a depth of 36-inches.

3.5 DEWATERING

A. All work areas occurring below the groundwater level shall be maintained in a dry condition while work is taking place at those elevations.

B. Dewatering methods shall be those selected by the Contractor. Method selected shall ensure that adjacent permanent ground water levels will be unaffected.

C. The Contractor shall be responsible for maintaining excavations and subgrades continuously while work in each area is being done. Water level shall be reduced to a level of 24 inches below the bottom of all excavations and compaction surfaces.

3.6 FILL, BACKFILL AND COMPACTION

A. Backfill consists of bedding, backfill and restoration of the surface.

B. Structures: (Buildings, manholes, catch basins, tanks, vaults, etc.)

1. Excavation and backfilling procedures beneath all structure shall be in accordance with the soils report.

2. After excavation, remove any organic peat or inadequate soils below required subgrade elevation, replace with suitable fill and compact in uniform maximum 10 to 12 inch lifts of clean granular fill to a minimum of 98% of the Modified Proctor maximum dry density for a depth of 24-inches below the required subgrade elevation. (See 3.8.)

3. Use mechanical compactors for compaction of backfill.

4. Place backfill as promptly as work permits, but only after walls are supported by completion of structure or are braced to resist the imposed loading.

    a. Place backfill against walls below grade after dampproofing systems have been completed and approved.

5. If approved by the Architect, hand held compaction equipment may be used. Maximum lifts in this case shall be 6 inches.

D. Compaction:

1. Bring each layer to optimum moisture content before compaction. Add water by uniform sprinkling. Jetting or flooding is prohibited.

2. When moisture content and condition of each layer is satisfactory, compact to a minimum of 98% of the Modified Proctor maximum dry density, or as elsewhere specified. (See 3.8.)

    a. Compact areas not accessible to motor-driven equipment with mechanical or heavy hand tampers.

3. Rework compacted areas failing to meet specified maximum density as determined by tests. Re-compact and re-test as required to achieve a minimum of 98% of the Modified Proctor maximum dry density.

4. Correct unauthorized excavation made below depth indicated, as acceptable to Test Agency, at no additional cost to Owner.

5. Landscape areas: Compaction below all landscape, planting or sod areas shall be a minimum of 95% of the Modified Proctor maximum dry density for the full depth of fill. (See 3.8.)

6. Pavements, walks and slabs: Compaction below all pavements, walks and slabs shall be a minimum of 98% of the Modified Proctor maximum dry density for the full depth of fill. (See 3.8.)

3.7 GRADING

A. General:

1. Uniformly grade areas within limits of grading and adjacent transition areas as work included in this Section. Smooth finished surface within specified tolerances, compact with uniform levels of slopes between points where elevations are shown, or between such points and existing grades.

2. Allowable tolerances for grades:

a. All cuts and fills shall be graded to necessary subgrade elevations within a tolerance of 0.0 below to 0.10 feet above grades indicated on drawings.

b. Structures at or on grade shall be within 0.02 feet.

3. All elevations and contours shown on the drawings are to finish grade unless otherwise indicated, and allowance shall be made for pavement thickness and sodding.

B. Grading outside building lines:

1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes.

C. Grading Surface of Fill Under Structure Slabs:

1. Grade smooth and even, free of voids, compacted as specified and to required elevation.

3.8 FIELD QUALITY CONTROL

A. Test Methods:

1. Maximum density of backfill materials will be determined by ASTM D1557 Method A (5-layer method), or AASHTO T-180 where called for on drawings.

2. Field tests will be determined by ASTM D2922 (Nuclear Method), or ASTM D-1556 (Sand-Cone Method) or AASHTO T238-79, or ASTM D 2937 (Drive Sleeve Method) unless other applicable method is approved.

B. Required Tests (to be performed by Testing Agency):

1. Backfill material: Determine suitability of backfill material not previously evaluated.

2. Maximum density tests: Determine optimum moisture content and maximum density of backfill materials placed and compacted.

3. Compaction Inspection: Determine degree of backfill compaction.

4. Bedding conditions: Determine and evaluate condition of bedding to receive utility lines.

C. Inspection and Controls (to be performed by Testing Agency):

1. General inspection of stripping of surfaces and removal of root mat, peat, clay and other unsuitable materials or conditions.

2. Detailed inspection of exposed subgrades prior to finishing or placing compacted fills.

3. Continuous control of placing and compacting all compacted fills.

4. Observation and consultation in processes of bank shaping, safety in excavations, dewatering and identification of materials encountered.

D. Areas which do not comply with the specified densities shall be reworked and compacted by the Contractor at no additional cost to the Owner. The cost of retesting such work shall be paid for by the Contractor.

3.9 DAMAGED WORK AND REPAIRS

A. Repairs:

1. Sections of walks, curbing, concrete paving and other permanent features which have been damaged during and as a result of construction operations in connection with the Contract shall be removed and the full section between joints shall be replaced.

B. Replacement of Grass and/or Shrubs:

1. All grass areas and/or shrubs which have been rutted and/or damaged or broken during and as a result of construction operations in connection with this Contract shall be removed and replaced. This shall apply to the grass and shrubs outside the Contract limits as shown on the site plan as well as new work within the Contract limits.

C. Protection of Graded Areas:

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

D. Reconditioning Compacted Areas:

1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

E. Debris:

1. During construction, debris shall be removed from site as soon as practical and the exterior site shall be kept clean at all times.

2. Debris shall be disposed of as waste material at an approved off-site disposal facility.

END OF SECTION

SECTION 02361
TERMITE CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following for termite control:

1. Soil treatment.

1.03 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. PCO: Pest control operator.

1.04 SUBMITTALS

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

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

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.07 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.08 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

C. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AgrEvo Environmental Health, Inc.; a Company of Hoechst and Schering, Berlin.
2. American Cyanamid Co.; Agricultural Products Group; Specialty Products Department.
3. Bayer Corp.; Garden & Professional Care.
4. DowElanco.
5. FMC Corp.; Pest Control Specialties.
6. Zeneca Professional Products.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.03 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.04 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade : Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

PART I - GENERAL

1.1 SCOPE:

A. This section includes the furnishing and installation of galvanized chain link fencing and accessories at locations indicated on the drawings.

1.2 QUALITY ASSURANCE:

B. Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

1.3 SUBMITTALS:

A. Shop drawings: gates, fencing, and controls.

B. Product Data: motor operators, opening and closing provisions, and accessories.

PART II - PRODUCTS

2.1 GENERAL:

A. Dimensions shown for pipe are fence industry nominal or actual outside dimensions. Nominal dimensions are fractional, actual dimensions are given in decimals.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

Allied Tube and Conduit Corp.
Anchor Fence, Inc.
Armorlink Corporation
Colorguard Corp.
Davis Walker Corp.
Dominion Fence and Wire Prod.
United States Steel

2.2 STEEL FENCES:

A. Fabric: No. 9 ga (0.148") finished size steel wires, 2" mesh, with both top and bottom selvages knuckled for all fabric.

B. Furnish one-piece fabric widths for fencing up to 12' high.

C. Fabric finish, galvanized, ASTM A-392, Class I, with not less than 1.2 oz. zinc per sq. ft. of

surface.

D. Framework: Galvanized steel, ASTM A-120 or A-123, with not less than 1.8 oz. zinc per sq. ft. of surface.

E. Hardware and Accessories: Galvanized, ASTM A-153, with not less than 1.8 oz. zinc per sq. ft. of surface.

2.3 FRAMING AND ACCESSORIES:

A. End, Corner and Pull Posts: Minimize sizes and weights as follows:

Up to 6' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.

-Over 6' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.

B. Line Posts: Space 10' O.C. maximum, unless otherwise indicated, of following minimum sizes and weights:

Up to 6' fabric height, 1.90" OD steel pipe, 2.72 lbs. per lin. ft.

Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft.

C. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

Gate Opening	Gate Posts	Weight Per Lin. Ft.
Single to 4' or Double to 8' Incl.	2-1/2" OD* (2.375")	3.65

*Fence Industry OD - Actual OD in parenthesis.

D. Top rail manufacturer's longest lengths, 1-5/8" OD weighing 2.27 lbs. per lin. ft. with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1.66" OD pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.

E. Tension Wire: 6 gage, coated coil spring wire.

F. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use 1.66" OD pipe, 2.27 lb. per ft. for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

G. Post Tops: Weathertight closure cap (for tubular posts), one cap for each post.

H. Furnish caps with openings to permit passage of top rail.

I. Stretcher Bars: One piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

1. Stretcher Bar Bands: Space not over 15" O.C., to secure stretcher bars to end, corner, pull, and gate posts.

J. Hog Rings: Minimum 11 ga. Galvanized steel.

2.4 SWING GATES AND PEDESTRIAN GATES:

A. Gates: Fabricate swing gate perimeter frames of 1.90" OD pipe. Metal and finish to match framework. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Space so that frame members are not more than 8' apart.

B. Assemble gate frames by welding or with special fittings and rivets, for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at not more than 15" O.C. Attach hardware to provide security against removal or breakage. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

C. Gate Hardware: Furnish the following hardware and accessories for each gate.

Hinges: Size and material to suit gate size, non-lift-off type, offset to 180° gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.

Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

Wire Ties: For tying fabric to line posts, use 6 ga. galvanized wire ties spaced 12" O.C. For tying fabric to rails and braces, use wire ties spaced 24" O.C. For tying fabric to tension wire, use 11 ga. galvanized hog rings spaced 24" O.C.

D. Concrete: Provide concrete consisting of portland cement, ASTM C-150, aggregates ASTM C-33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., 1" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air. Prepare to conform to ASTM C-941.

E. Wheel: Provide one 100 mm (4 in.) diameter rubber wheel, allowing adjustment to maintain gate frame plumb and in proper alignment.

2.5 CANTILEVER SLIDING VEHICLE GATE:

A. Cantilever Gates: Comply with ASTM F 1184.

B. Mesh section: (see article 2.2.A).

C. Bracing: Provide diagonal adjustable length truss rods, of 9.5 mm (3/8") galvanized steel, in each panel of gate frames.

D. Top Track/Rail: Enclosed, combination one-piece track and rail, aluminum extrusion with weight of 5.54 kg/m (3.72 lb/ft). Track to withstand reaction load of 907 kg (2,000 lb) Track does not receive Polymer coating.

E. Truck assembly: Swivel type, zinc die cast, with 4 sealed lubricant ballbearing rollers, 50 mm (2 in.) in diameter by 14 mm (9/16 in.) in width, and 2 side rolling wheels to ensure truck alignment in track. Mount trucks on post brackets using 22 mm (7/8 in.) diameter ball bolts with 13mm (1/2 in.) shank. Truck assembly to withstand same reaction load as track.

F. Gate Hangers, Latches, Brackets, Guide Assemblies, and Stops: Malleable iron or steel, galvanized after fabrication. Provide positive latch with provision for padlocking. These fittings do not receive Polymer coating.

G. Bottom Guide Wheel Assemblies: Each assembly shall consist of two 100 mm (4 in.) diameter rubber wheels, straddling bottom horizontal gate rail, allowing adjustment to maintain gate frame plumb and in proper alignment. Attach one assembly to each guide post. These fittings do not receive Polymer coating.

H. Gate Posts: Gate posts shall be 76.2 mm (3 in.) hot-dipped galvanized steel square sections weighting 10.8 kg/m (7.04 lb/ft.). Pipe shall have a minimum 1.8 ounce/ft zinc coating meeting ASTM F1234. The steel shall meet requirements of ASTM A500, Grade B with a minimum yield strength of 40,000 psi. Provide 1 latch post and 2 support posts for single gate.

I. Concrete: Provide concrete consisting of portland cement, ASTM C-150, aggregates ASTM C-33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., 1" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air. Prepare to conform to ASTM C-941.

J. Provide motor and accessories as required for push-button entry and detector loop closure operation as shown on plans.

PART III - EXECUTION

3.1 INSTALLATION:

A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

B. Excavation: Drill holes for posts of diameters and spacings shown, in firm, undisturbed or compacted soil. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface, unless otherwise noted.

C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.

D. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

E. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

F. Center Rails: Provide center rails at all fence with fabric height more than 8.0 foot and also where shown. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary. Install center rails at mid-height unless otherwise indicated differently.

G. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

H. Tension Wire: Install tension wires before stretching fabric and tie to each post. Fasten fabric to tension wire using hog rings spaced 24" O.C. maximum.

I. Fabric: Leave a maximum of 2" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

J. Stretcher Bars: Thread through or clamp to fabric 4" O.C., and secure to posts with metal bands spaced 15" O.C.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

A. The work shall consist of furnishing all materials, labor and equipment for compacting subgrade, constructing a base course, priming the base course and constructing an asphaltic concrete surface course.

B. SUBMITTALS: Comply with the requirements of Section 01300 - Submittals

C. MATERIAL CERTIFICATES: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item meets or exceeds specified requirements.

D. CODE COMPLIANCE: Comply with the Orange County requirements, latest editions, if more stringent than herein specified.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All materials furnished hereunder shall comply with the applicable sections of the Florida Department of Transportation's (FDOT) "Standard Specifications for Road and Bridge Construction", latest edition, which are hereby incorporated into these specifications by reference.

B. MATERIALS:
General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.
1. Subgrade Stabilizing Material: FDOT Section 160 and Section 914.
2. Base Course: Limerock-Sand-Cement (Durarock) Base Course, FDOT Section 270 and Section 911, 1999 Edition.
3. Asphaltic Concrete: Comply with FDOT Section 330 requirements and Section 331 for Type S-1 and Type S-3.
4. Prime and Tack Coats: Cutback asphalt, grade RC-70, meeting FDOT Section 300.
5. Lane Marking Paint: FDOT Section 971, color as indicated.

PART 3 - EXECUTION

3.1 GENERAL:

A. All operations hereunder shall be conducted in strict compliance with the requirements of the Orange County requirements and with applicable sections of the FDOT Standard Specifications as follows:

B. Subgrade Stabilization: FDOT Section 160.

C. Construction of Base Course: FDOT Section 270, 1999 Edition, for Soil Cement Base
   1. Place in maximum 6" lifts and compact each lift to a minimum dry density of 98% of the maximum density (AASHTO T-134), LBR 100.
   2. Perform compaction testing the full depth at a frequency of one test per 10,000 square feet, or at a minimum of two test locations, whichever is greater.

D. Construction of Wearing Course: FDOT Section 330.

E. Pavement Markings: FDOT Sections 710 and 711.

END OF SECTION

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment, and services to complete the Portland Cement Concrete Paving work, as indicated on the Plans and Details, as specified herein or both.

B. Including but not necessarily limited to the following:

1. Concrete work for curbs, walks and site slabs-on-grade

2. Concrete reinforced pavement.

3 Expansion, contraction, and construction joints.

4. Natural gray concrete paving flatwork.

5. Concrete finishing and curing.

1.3 RELATED WORK

A. Section 02200 - Earthwork

1.4 SUBMITTALS: Comply with the requirements of Section 1330 - Submittals

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Perform work in accordance with local building and other applicable codes.

B. Inspection and Testing:

1. Hardrock Aggregate: Test by approved testing laboratory in accordance with ASTM C33.

2. Limerock Aggregate: Test by approved testing laboratory for conformance with local acceptable standards and specified requirements.

a. Do not deliver aggregates (hardrock and limerock) to site, or to ready-mix plant, until pit source has been approved, and plant, capacity, and ability to produce a

uniform and continuous product has been verified.

b. Take samples from aggregate stockpiles assigned to Project.

3. Test Cylinders - As per ASTM C-39.

a. Minimum of three (3) concrete test cylinders shall be taken for every 75 or less cubic yards of concrete placed.

b. Minimum of one (1) additional test cylinder shall be taken during any cold weather concreting, and be cured on job site under same conditions as the concrete it represents.

c. Test cylinders at age of seven (7) days and twenty-eight (28) days.

1) Seven-day Strength: Not less than 60% of specified ultimate 28-day strength.

d. Mix Adjustment: Should test results indicate concrete strength below specified seven-day or 28-day minimum requirements, laboratory will adjust mix proportions in future batches as necessary to achieve specified minimum requirements.

e. Concrete Failures: Should test result show that concrete strength requirements for any portion of work falls below 28-day minimum requirements, secure core or prism specimens of hardened concrete and test in accordance with ASTM C42.

1) Laboratory will secure and test specimens under Owner's direction.

4. Slump Test - As per ASTM C-143:

a. Minimum of one (1) slump test shall be taken for each set of test cylinders taken.

C. Unless otherwise indicated, conform to all materials, workmanship and practice to the requirements of the following standards:

1. Florida Building Code (Latest Edition).

2. The following publications from the American Concrete Institute (ACI) - latest edition:

Number/Title

211.1 Recommended Practice for Selecting Proportions for Normal Weight Concrete

211.2 Recommended Practice for Selecting Proportions for Structural Concrete

301 Specifications for Structural Concrete for Buildings

302 Recommended Practice for Concrete Floor and Slab Construction

304 Recommended Practice for Measuring, Mixing, Transporting Concrete

305 Hot Weather Concreting

306 Recommended Practice for Cold Weather Concreting

308 Recommended Practice for Curing Concrete

309 Recommended Practice for Consolidation of Concrete

318 Building Code Requirements for Reinforced Concrete

347 Recommended Practice for Concrete Formwork

3. American Society for Testing and Materials (ASTM) Standard:

C31-69 Making and Curing Concrete Test Specimen in the Field

C33-74a Concrete Aggregates

C39-72 Compressive Strength of Cylindrical Concrete Specimens

C42-68 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C94-74a Ready-Mixed Concrete

C150-76a Portland Cement

C171-69 Sheet Materials for Curing Concrete

C172-71 Sampling Fresh Concrete

C192-69 Making and Curing Concrete Test Specimens in the Laboratory

C260-741 Air-Entraining Admixtures for Concrete

C309-74 Liquid Membrane-Forming Compounds for Curing Concrete

C330-75a Lightweight Aggregates for Structural Concrete

C418 Test for Abrasion Resistance of Concrete by Sandblasting

C494-71 Chemical Admixtures for Concrete

C595-75 Blended Hydraulic Cements

C618-73 Fly Ash and Row or Calcined Natural Pozzolan for Use as an Admixture

C803 Penetration Resistance of Hardened Concrete

C805 Rebound Number of Hardened Concrete

C823 Examination and Sampling of Hardened Concrete in Construction

D. Where provisions of pertinent codes and standards conflict with this specification, the more stringent provisions govern.

1.5 QUALIFICATIONS OF WORKMEN

A. Provide at least one (1) person at all times during execution of this portion of the work who is thoroughly trained and experienced in placing the types of concrete specified to direct all work performed under this section. For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.

1.6 PLANT QUALIFICATION

A. Meet all requirements of the Check List for Certification of Ready Mix Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C94.

1.7 SUBMITTALS

A. Procedures: Submit shop drawings in accordance with the General Requirements of the Owner-Construction Management Contract

B. Test Reports: Report of concrete compression, yield and slump tests.

C. Certificates:

1. Submit manufacturer's certification that concrete mix materials meet specified requirements.

2. Material content per cubic yard of each class of concrete furnished:

a. Dry weights of cement.
b. Saturated surface-dried weights of fine and coarse aggregate.
c. Quantities, type and name of admixtures.
d. Weight of water.

3. Ready-mix delivery tickets, ASTM C94.

D. Product Data: Manufacturer's product literature and application/installation procedures for all products intended for use in the work such as, but not limited to, joint sealants, admixtures, and curing materials.

E. Submit shop drawings and the following to Architect:

1. Plant Qualifications: Submit satisfactory evidence indicating compliance with the specified qualification requirements.

2. Materials: Submit satisfactory evidence indicating that all materials listed in Part 2 meet the specified requirements.

3. Design Mix: Submit the design mix to be used for review prior to placing of concrete. The design of the mix is the responsibility of the Contractor, subject to the limitations of the specifications.

F. Do not place concrete until submittals have been approved by the Architect.

1.8 TRANSMIT-MIX DELIVERY SLIPS

A. Keep a record at the job site showing time and place of each pour of concrete, together with transit-mix delivery slips certifying contents of the pour. Make the record available to the Architect for his inspection upon request. Upon completion of each portion of the work, deliver the record and the delivery slips to the Architect.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original containers, clearly labeled with manufacturer's name and address and product identification.

B. Store materials in original containers protected from direct contact with the ground and from the elements.

1.10 JOB CONDITIONS

A. Allowable concrete temperatures:

1. Hot Weather: Maximum 90 Degrees F as per ASTM C-94 and ACI 305.

2. Cold Weather: In accordance with ACI 306.

B. Do not place concrete during rain, unless adequate protection is provided.

C. Grade Control: Establish and maintain the existing lines and grades, including crown and cross-slope as indicated on the drawings. All concrete surfaces must positively drain toward drainage structures. Any pavement surface which does not positively drain or allows water to pond shall be removed and replaced by the contractor at no additional cost to the Owner.

D. Maintain temperature of concrete above 50 Degrees F for seven (7) days after placing. Protect work against frost and rapid drying.

E. Traffic Control:

1. Restrict vehicular and pedestrian traffic during all paving operations, as required for other construction activities. Obtain Owner approval prior to rerouting any traffic.

2. Provide flagmen, barricade, warning signs, and warning lights for movement of traffic and safety, and to cause the least interruption of work.

PART II - PRODUCTS

2.1 CONCRETE MATERIALS

A. General: Use ready-mixed concrete, batched, mixed, and transported in accordance with ASTM C94 unless otherwise indicated.

B. Cement: For all concrete use domestic Portland cement that conforms to the requirements of ASTM C150-76a, Type I.

C. Fine Aggregate, Hardrock: ASTM C33, consisting of washed sand having hard, strong, durable particles which do not contain more than one percent (1%) by weight of such deleterious substance as clay lumps, shale, schist, alkali, mica, coated grains or soft and flaky particles.

D. Coarse Aggregate Hardrock:

1. Use clean, coarse limestone aggregate in accordance with ASTM C33-74a.

E. Water: Clean and potable, free from deleterious amounts of acids, alkalis, salts, or organic matter.

2.2 CONCRETE MIXES

A. It is intended that concrete for all parts of the concrete work be homogenous, and when hardened, possess the required strength, durability, watertightness, appearance, resistance to deterioration and abrasion, and other qualities as specified or required.

B. It is also intended that all concrete of the same specified concrete mix shall match throughout the site. Concrete placed adjacent to concrete of the same specified mix that was placed in a previous pour shall be uniform in color to that concrete.

C. Mix Proportioning: Use only mixes designed by a laboratory selected or approved by Owner. Ready-mixed concrete in accordance with ASTM C94.

1. Provide concrete which will develop ultimate compressive strength at 28 days equal to 4,000 PSI.

D. Entrained Air: All concrete which will be exposed to water or air shall be designed to entrain 4%-6% air.

E. Design Slumps: Slabs on Grade shall be four inches (4") plus/minus one inch (+1").

F. Concrete mix design shall be in accordance with ASTM C94.

2.3 CONCRETE ADMIXTURES

A. Concrete Admixture Types:

1. ASTM C494, water reducing.

2. ASTM C494, water reducing and retarding.

3. Air Entraining: ASTM C260. For all concrete exposed to water or air.

   a. Do not use air entraining admixture in concrete with Ipanex special waterstop admixture.

B. Quality: Conform to ASTM designations specified for the various types.

1. Do not use admixtures which cause excessive (up to 10% more than concrete without admixtures) shrinkage.

2. Do not use admixtures which contain calcium chloride or triethanolamine.

3. Do not use admixtures which cause corrosion of embedded steel.

2.4 CURING COMPOUND

A. Use only compounds that will not affect bond of coatings or toppings in accordance with ASTM C309, Type 1 or Type 2.

2.5 CEMENT GROUT

A. Cement Grout: Mix one part Portland Cement, 2-1/2 parts fine aggregate, and water enough for required consistency. Depending on space, consistency may range from mortar consistency to a mixture that will flow under its own weight. Use for leveling, preparing setting pads or beds, for filling non-structural voids, and similar uses. Do not use for grouting under bearing plates or structural members in place.

B. Non-Shrink Grout: Acceptable compounds and manufacturers:

1. Master Flo 713, by Masters Builders Company
2. Five Star Grout by U.S. Grout Corporation
3. Upcon by the Upco Co.
4. Horn Non-Metallic Grout by A.C. Horn, Inc.

2.6 FORMWORK AND ACCESSORIES

A. Formwork: Matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete, conform with ACI 347, Chapter 4, "Materials for Formwork".

B. Use forms with a depth equal to the plan dimensions for the depth of concrete being deposited against them. Forms shall be straight, free from warp or bends, and of sufficient strength when staked to resist the pressure of the concrete without deviation from line and grade. Clean the forms each time they are used, and saturate with water prior to placing the concrete.

C. Lumber

1. Softwood framing lumber: Kiln dried, PS-20.

D. Plywood:

1. Exterior type softwood plywood, PS 1-66.

E. Form Coatings: Non-staining clear coating which does not contain oil or wax and will not prevent proper adhesion of applied finishes.

1. "Formshield", by A.C. Horn, Inc.

2. "Release", by Burke Concrete Accessories.

3. "Magic Kote", by Symons.

4. Form Release-80 or Form Release-100 by Lambert Corp.

5. "Cast-Off" by Sonneborn Building Products.

F. Metal Construction Joints: "Keyed-Kold", by Burke Concrete Accessories.

G. Pressure Sensitive Tape: 3M or equivalent, polyurethane, or mylar faced adhesive backed paper tape, one inch (1") wide. Use for formwork joints.

H. Formwork Product Handling:

1. Store materials above ground on framework or blocking, and cover with protective waterproof covering. Provide for adequate air circulation throughout material stacks.

2.7 PREFORMED EXPANSION JOINT FILLER AND SEALANT

A. Expansion Joint Filler: Premolded type, ASTM D1751. Approved manufacturers:

1. A.C. Horn Company
2. Homasote Company
3. W.R. Meadows Company

B. Minimum 1/2" thick asphaltic impregnated fiberboard expansion joint filler. Locations as indicated on plans. Expansion joint filler to be full depth of slab thickness at joint as indicated on drawings. Contractor shall install expansion joints as detailed on the drawing where concrete pavement abuts all vertical surfaces including but not limited to all buildings, structures, curbs, columns, walls, light poles, etc.

C. Expansion Joint Handling:

1. Deliver materials in manufacturer's original containers, clearly labeled with manufacturer's name and address and product identification.

2. Store materials in original containers protected from direct contact with the ground

and from the elements.

3. Store materials above ground on framework or blocking, and cover with protective waterproof covering. Provide for adequate air circulation throughout material stacks.

D. Expansion joint backer rod shall be round, closed cellpolyethylene rod with a diameter of 1/8" (3 mm) larger than the width of the joint.

PART III - EXECUTION

3.1 BARRICADES

A. Provide substantial temporary barricades around all areas of operation and maintain until work under this section is completed and approved.

B. Install temporary traffic markers, signals, and signs as per D.O.T. Standard Specifications to:

1. Eliminate potentially hazardous conditions.

2. Maintain adequate traffic patterns free of conflict with work under this Contract.

3.2 INSPECTION

A. Examine all surfaces over which concrete is to be applied.

1. Ensure that no defects, low sections, depressions, or holes are present which would jeopardize the standard of finish specified.

B. Compact subgrade using heavy vibratory equipment. Check for unstable areas. Check for areas requiring additional compaction.

C. Assure that compacted subgrade or base and formwork are completed and that excess water has been removed from excavations.

1. Verify elevations of base are correct.

D. Verify that expansion joint materials and other embedded items are in their proper locations and adequately secured against shifting during placement of concrete.

E. Place no concrete until forms, base, reinforcement, and other embedded items have been reviewed and approved by Owner's Representative or Architect with a minimum of 24 hours notice.

3.3 PLACEMENT OF LIMEROCK BASE

A. In locations where compacted backfill cannot achieve 98% compaction, place and level limerock base over prepared subgrade to a compacted depth of twelve inches (12") or as required by soils and subsurface investigation, true to lines and levels. Compact to 98%

compaction as per AASHTO T-180.

3.4 FORMWORK

A. Provide formwork design for all concrete paving. Coordinate design, construction, and placement with all other trades and contractors.

B. Set the forms straight, free from warp or bends, and true to line and grade. Set forms with a 1/8" per foot cross slope or as shown on plans. Construct all concrete paving slab thickness as indicated on plans.

C. Contractor is responsible for the design, construction, removal, and complete safety of formwork and shoring.

D. Design formwork so it will be sufficiently tight to prevent leakage during concrete placement.

E. Construct formwork as required to obtain the exact size, shape, line level, alignment, location, elevation and grades, as indicated on drawings for the finished structure.

F. Fill voids of plywood joints with sealant and tool smooth.

G. Form vertical surfaces to full depth and securely position to required lines and levels. Ensure form ties are not placed so as to pass through concrete.

H. Arrange and assemble formwork to permit easy dismantling and stripping, and to prevent damage to concrete during formwork removal. Avoid hammering or prying against concrete surfaces.

I. Cleaning and Tightening:

1. Thoroughly clean form and remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed.

2. Re-tighten forms during or immediately after concrete placement, as may be required, to eliminate any leaks.

J. Taping of Joints:

1. Apply pressure sensitive tape over all formwork joints which will be exposed in the finish work.

2. Tape joints before form release agent is applied to formwork.

K. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be embedded in concrete. Apply in compliance with manufacturer's instructions.

L. Edge Forms and Screeds Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab

surfaces. Provide and secure units to support types of screeds required.

M. Coordinate work of other sections in forming and setting openings, slots, recesses, sleeves, bolts, anchors, and other embedded items.

N. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

O. Do not remove forms and shoring until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it. Remove load supporting forms when concrete has attained seventy-five percent (75%) of required 28-day compressive strength, provided construction is re-shored.

3.5 JOINTS (EXPANSION, CONSTRUCTION, AND CONTRACTION)

A. Form expansion joints one-half inch (1/2") thick with a preformed joint filler. Expansion joints to be located as indicated on plans. Expansion joint to be at full depth of slab at joint location. Recess joint filler to one-half inch (1/2") from surface.

B. Construct doweled expansion joints as designated on the drawings and in the specifications. Insert one end of dowel in Schedule 40PVC pipe and cap so concrete does not bond to dowel in order to permit horizontal movement. Dowels shall be installed level, parallel to one another, parallel to the length of the slab, and positioned as detailed at one-half of the slab's thickness. The expansion joint material shall be centered over the mid-length of the dowels, and installed as specified above. In order to meet the foregoing requirements, use fabricated dowel baskets placed directly on the subgrade as recommended. Contractor shall submit shop drawings of dowel basket for approval if used.

C. Construct pour joints (construction joints) at any break in concrete placement lasting more than one (1) hour.

1. Construction pours shall be continuous pours except where joints are indicated. No additional joints other than those shown on plans are allowed.

2. Key all pour joints.

3. Pour joints may be substituted for control joints when treated as part of paving design as indicated on plans.

D. Construct control joints (contraction joints) at locations indicated on plans.

1. For four-inch (4") depth concrete slabs on grade, saw cut control joints shall be one-quarter inch (1/4") width and one inch (1") in depth.

2. For eight-inch (8") depth concrete slabs on grade, saw-cut control joints shall be one-quarter inch (1/4") width and two-inch (2") depth.

3. Form open-type contraction joints by staking a metal bulkhead in place and depositing the concrete on both sides. After the concrete has set sufficiently to preserve the width and shape of the joint, remove the bulkhead. Finish joint to match

appearance of saw cut.

4. Accurately lay out areas according to plans and make all joints straight and true with clear-cut angles.

3.6 INSPECTION

A. Assure that excavation and formwork are completed, and excess water is removed.

B. Check that reinforcement is secured in place.

C. Verify that expansion joint materials, anchors, and other embedded items are secured in position.

3.7 PLACING CONCRETE

A. Equipment forms and reinforcing shall be clean and wet down, reinforcing firmly secured in place, runways set up and not resting on or displaying reinforcing.

B. At locations where new concrete is doweled into existing work, drill holes in existing concrete, insert steel dowels as indicated on drawings and pack solid with non-shrink grout. Cover exposed end with capped Schedule 40 PVC sleeve to allow free movement as indicated on drawings.

C. Place concrete in the forms to the required depth. Tamp and spade until mortar entirely covers its surface.

D. Place concrete, screed and wood float surfaces to a smooth and uniform finish.

E. Avoid working mortar to surface.

F. Round all edges, including edges of expansion, contraction and control joints, with 1/4 inch radius edging tool.

G. Ensure finished surfaces do not vary from true lines, levels or grade by more than one-eighth inch (1/8") in ten feet (10') when measured with straight edge.

H. Apply curing compound on finished surfaces immediately after placement. Apply in accordance with manufacturer's recommendations.

3.8 CONCRETE PAVING INSTALLATION

A. Placing concrete according to ACI.

1. Before placing any concrete in formwork, thoroughly clean and remove all foreign matter and water from forms or structural excavations.

2. Mix and deliver concrete only in quantities for immediate use.

3. Do not re-temper or use set concrete.

4. If earth at bottom of forms has dried out, re-wet so that soil is moist but free of standing water and mud.

5. Convey concrete from mixer to final position by methods which will prevent separation or loss of materials.

6. Maximum height of concrete free fall is four feet (4').

7. Regulate rate of placement so concrete surface is kept level throughout; a minimum being permitted to flow from one area to another. Control rate of pour consistent with form design.

8. Deposit concrete in continuous operation until section being placed has been completed.

9. Ensure finished surfaces do not vary from true lines, levels or grade by more than 1/8 inch in 10 feet when measured with straight edge.

10. Apply curing compound on finished surfaces except exposed aggregate concrete pavement immediately after placement. Apply in accordance with manufacturer's recommendations.

3.9 CONCRETE FINISHES

A. All concrete flatwork finishes shall be slip resistant with a coefficient of friction of 0.5 according to ASTM C418. The contractor shall verify slip resistance requirements of all sample panels of finishes prior to executing the work and provide abrasive aggregate as specified, if necessary.

B. Tamp freshly-placed concrete with approved metal grid tampers not less than 12 inches x 12 inches in size so as to bring fines to top, then rod to uniform surface at required levels.

1. Float and trowel finish as soon as surface becomes workable.

2. Provide slopes as indicated on drawings, pitch to drains.

3. Work and measure concrete flatwork until it is level to within 1/8 inch in 10 feet in any direction.

3.10 PROTECTION

A. Protect freshly placed concrete from damage due to water, falling objects, or persons marring finish surface of concrete. Surfaces damaged due to lack of protective measures shall be removed and replaced with fresh concrete at no additional cost to the Owner.

B. Protect finished surface from damage by work of other trades due to subsequent work.

C. Protect slab surfaces to be left exposed from damage during subsequent construction operations and make necessary repairs to damaged areas, returning to original condition.

3.11 BACKFILLING AND COMPACTING

A. After the concrete has set sufficiently, refill the spaces adjacent to the concrete to the required elevation with suitable material. Place and thoroughly compact to ninety percent (90%) of relative density.

3.12 FIELD QUALITY CONTROL

A. Test Cylinders: Take sample test cylinders of each mix design.

1. Test cylinders in accordance with ASTM C39. Test cylinders at (7) days.

2. Perform slump tests for each set of test cylinders.

B. Certifications:

1. Provide batch tickets signed by the dispatcher and the laboratory inspector at the ready-mix plant. Each batch ticket shall state batch quantities of cement, water, fine aggregates, coarse aggregates, and admixture contained in each truck load.

2. Mixer truck driver shall deliver a properly signed ticket with each load of ready-mix concrete.

C. Contractor shall provide all test specimens as required by laboratory.

3.13 DEFECTIVE CONCRETE

A. Concrete will be deemed defective when:

1. Tests on core or prism specimens fail to show strengths specified.

2. Not formed as indicated or detailed.

3. Not plumb or level where so indicated.

4. Not true to intended grades and levels.

5. Cut, filled or resurfaced, unless under direction of Owner.

6. Debris is embedded therein.

7. Not fully in conformance with provision of Contract Documents.

8. Expansion and control joints which do not conform to plan locations or are not straight and true.

9. Does not positively drain toward drainage structures or water ponds on walkway surface.

B. Defective concrete shall be removed and replaced, or at discretion of the Owner's Representative, adequately strengthened and resurfaced in a manner acceptable to Owner.

3.14 CLEAN-UP

A. Remove all debris and excess material immediately from project site.

B. Take down all barricades and temporary traffic markers, signals and signs only after all work included in this section is finished and inspected, and only after so directed by Owner's Representative.

C. Leave project area neat, orderly, and free of any hazardous conditions.

3.15 GUARANTEE

A. The Contractor shall guarantee all work and materials contained in the section of the specification and as indicated on the drawing for a two (2) year period commencing on the date on which all of the work or designated portion thereof is substantially complete according to the General Conditions.

B. The Contractor shall remove and replace any of his work that expands, settles, spalls, cracks (beyond normal shrinkage), chips, or deteriorates during the designated guarantee period at no additional cost to the Owner.

END OF SECTION

PART I - GENERAL

1.1 SCOPE:

A. Drawings and general provisions of the Contract, including DIVISION 1 specification sections, apply to work of this section.

B. For water main construction within the public right-of-way and utility easements (as delineated on the plans) refer to Orange County Utilities, specifications, latest edition, which are incorporated into these specifications by reference.

1.2 DESCRIPTION OF WORK:

A. Extent of water service piping work is shown on the drawings.

B. Exterior water service piping work includes, but is not limited to, the following:

Water main and service piping
Control valves
Fire hydrants
Water meters
Backflow preventors

C. Comply with requirements of Section 03300 - Cast-in-Place Concrete for concrete work required in connection with exterior water service piping.

1.3 QUALITY ASSURANCE:

A. Installer: A firm with at least two (2) years of successful installation experience on exterior water service piping projects similar to this project.

B. Code Compliance: Comply with applicable portions of National Standard Plumbing Code, local plumbing codes, Orange County Utilities latest edition, the regulations of the Florida Department of Environmental Protection, and NFPA 24.

1.4 SUBMITTALS: Comply with the requirements of Section 01330 - Submittals.

A. Product Data: Submit manufacturers technical data and installation instructions for each major component for the water system materials and products.

B. Submit the following record drawing information, signed and sealed by a Registered Land Surveyor (State of Florida) containing the following:

1. Location of water main tied to the project coordinate system or an acceptable base line (base line shall be tied to property lines).

2. Location of each valve, fitting, service line, blow off points, etc.

3. Length and location of service lines.

4. Fire hydrant locations, shut off valve, type of hydrant used, and distance from centerline of pumper nozzle to finish grade.

5. Valve types used.

6. Type of material used, mains and services. Indicate all locations of changed materials including mechanical joint vs. slip joints.

7. Indicate depth of cover over water mains if other than 36-inch, or at 100 ft. intervals (minimum).

C. Maintenance Data: Submit maintenance data and parts lists for water system materials and products. Include this data, shop drawings, product data and record drawings in a maintenance manual to be presented to the Owner at project close-out.

PART II - PRODUCTS

2.1 PRESSURE PIPE (4" AND LARGER):

A. PVC Pipe: Polyvinyl chloride (PVC) pressure pipe shall conform to the requirements of AWWA C-900, DR18 with outside diameter equal to that of standard ductile iron pipe.

1. PVC Pipe Fittings: Shall be of same class and rating of PVC pipe. Fittings for AWWA C-900 PVC pipe shall be ductile iron, mechanical joint fittings as specified above.

2. Pipe Joints: Integral bell formed with a race designed to accept the gasket in accordance with AWWA C-900. The spigot end shall have a bevel and a stop mark on the outside diameter to indicate proper insertion depth.

a. Provision shall be made for expansion and contraction at each joint.

b. When assembled, the gasket shall be compressed radially on the pipe spigot so as to effect a positive seal under all combinations of joint tolerances and is the only element depended upon to make the joint flexible and watertight.

c. All surfaces of the joint upon or against which the gasket may bear shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint.

3. Gaskets: The gasket shall be molded to circular form and to the proper cross section and shall consist of a vulcanized high grade elastomeric compound conforming to AWWA C-900, Elastomeric Seals for joining plastic pipe.

4. Joint Lubricant: The joint lubricant shall have been tested and approved for potable

water service. No lubricant shall be used that will harbor bacteria or damage the rings.

B. Ductile Iron Pipe: Ductile iron pipe shall be cement-mortar lined, Class 350, mechanical or push-on joint and shall meet all the requirements of the following: ANSI/AWWA C-104/A-21.4; ANSI/AWWA C-111/A-21.11 (for rubber gasket joints); ANSI/AWWA C-150/A-21.50 (for thickness design); and ANSI/AWWA C-151/A-21.51 (for D.I.P. molds).

1. Lining: All ductile iron pipe and fittings shall be cement-mortar lined and seal coated in conformance with ANSI A-21.4.

2. Joints: Pipe joints shall be mechanical or push-on joints, except where specifically shown or detailed otherwise.

3. Pipe Fittings: All fittings 4" in diameter and larger shall be ductile iron with mechanical or push-on joints and shall conform to ANSI A-21.10 (AWWA C-110) for short body fittings with a 250 psi pressure rating for fittings up to 12" in diameter.

4. Mechanical Joint Fittings: Mechanical joint ductile iron fittings shall conform to ANSI/AWWA C-110/A-21.10 and ANSI/AWWA C-111/A-21.11 and shall be of a class at least equal to that of the adjacent pipe. Mortar lining and seal coat for fittings shall be same thickness specified for pipe.

5. Gaskets: The rubber-ring gaskets shall be suitable for the specified pipe sizes and pressure and shall conform to applicable parts of the latest Federal Specification WW-F-421, and shall be furnished with the pipe.

6. Joint Lubricant: The joint lubricant for push-on joint pipe shall have been tested and approved for potable water service. No lubricant shall be used that will harbor bacteria or damage the gaskets.

2.2 PRESSURE PIPE (UNDER 4"):

A. Polyvinyl Chloride (PVC) pressure pipe, Class 200 SDR 21 conforming to ASTM D-2241 with cement-solvent welded joints or push on elastomeric joints. PVC pipe shall bear NSF logo for potable water use.

2.3 CONTROL VALVES:

A. General: Provide valves and flow control devices as indicated. All valves 4" and larger shall be furnished with mechanical joint ends.

1. Minimum working pressure, 200 psi unless otherwise indicated.

B. Gate Valves (4" and larger): Resilient seat type with non-rising stem, epoxy coating internally/externally, cast iron body and bronze fittings conforming to AWWA C-509-94 or latest edition. Gate valves located on fire protection mains must be FM approved.

C. Valve Boxes: Shall be of cast iron with adjustable top. The size shall be large enough for operation of the valve on which it is used with a minimum shaft diameter of 5-1/4". The cover shall have the word "WATER" cast on it.

D. Gate Valves (Smaller than 4"): Shall be non-rising stem, handwheel operated, wedge discs, all bronze with flanged ends, conforming to Fed. Spec. WW-V-54, Class B, Type

1. For below ground installation, valves shall be furnished with mechanical joint ends or iron pipe thread and 2" square operating nut.

2.4 THRUST RESTRAINTS:

A. General: Provide mechanical pipe joint restraints as necessary to prevent movement of pipe or piping system appurtenances in response to thrust exerted by water under pressure.

1. All mechanical restraints shall be galvanized or otherwise rust-proofed.

2.5 METER ASSEMBLIES:

A. General: Orange County shall furnish/install all water meters. Orange County shall furnish meter boxes, Contractor to install. Refer to drawings for water line and meter sizes.

1. The Contractor shall coordinate with the Construction Manager and Orange County Utilities for the provision/installation of all meters to be provided and installed by the Utility.

PART III - EXECUTION

3.1 INSTALLATION:

A. General: Install water piping system in compliance with local governing regulations.

B. Water Service Piping: Extend water service piping of size and in locations indicated to water service entrance at buildings. Connections shall be made 5'-0" outside of building lines.

C. Polyvinyl Chloride (PVC) Pipe and Fittings: Install in accordance with Uni-bell Handbook of PVC Pipe and in accordance with AWWA C-900.

D. Control Valves: Install in accordance with manufacturer's instructions.

E. Fire Hydrant Assemblies and backflow preventer assemblies: Install in accordance with the Orange County Utilities requirements.

F. Interior Inspection: Inspect conduit to determine whether line placement or other damage has occurred.

1. If the inspection indicates poor alignment, debris, displaced pipe, infiltration or defects, correct such defects to satisfaction of Architect.

G. Cleaning Conduit: Clear interior of conduit of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.

I. Place plugs in end of uncompleted conduit at end of day or whenever work stops.

J. Disinfection: At completion of water service line installation, flush and disinfect in conformance with AWWA C-651 and local authorities having jurisdiction.

3.2 TESTING:

A. Hydrostatic and Leakage Test: All pipe of whichever size and material installed on the project for the purpose of conveying water or liquid under pressure shall be tested after installation in accordance with the applicable portions of the hydrostatic tests for PVC pipe in AWWA C605 and for ductile iron pipe in AWWA C600. Acceptable leakage must be less than the number of gallons per hour as determined by the following formula:

$$L = \frac{ND\sqrt{P}}{133{,}200} \quad \text{(PVC Pipe)}$$

Where:

L = Allowable leakage, in gallons per hour
N = Length of pipeline tested, in feet.
D = Nominal diameter of pipe, in inches
P = Average test pressure during leakage test, in psig

$$L = \frac{SD\sqrt{P}}{133{,}200} \quad \text{(Ductile Iron Pipe)}$$

Where:

L = Allowable leakage, in gallons per hour
S = Length of pipeline tested, in feet.
D = Nominal diameter of pipe, in inches
P = Average test pressure during leakage test, in psig

B. All potable water lines shall be tested to 150 psi test pressure for two (2) hours duration. All pressure mains associated with the fire protection system shall be tested to 200 psi for two (2) hours as required by NFPA 24.

1. All gauges and appurtenances necessary shall be furnished by the Contractor. All leaks shall be repaired by removing and replacing defective pipe and joints with pipe and joints free of defects, after which the lines shall be retested. Such repair and retesting shall be done until the lines pass the specified test.

C. All valves shall be hydrostatically tested with the line in which they are installed.

D. Perform operation testing of hydrants and valves by opening and closing under water

pressure to ensure proper operation.

3.3 BACKFILLING:

Conduct backfilling operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

3.4 PLACING SYSTEM INTO SERVICE:

A. General: The water system shall not be placed into service until all required testing has been completed, approved by the Engineer, and a Clearance for Use certification has been issued by the Florida Department of Environmental Protection

END OF SECTION

PART I - GENERAL

1.1 SCOPE:

A. This section includes sanitary sewers and structures appurtenant thereto. Excavating, trenching, backfilling, and density tests are specified elsewhere. Sewage collection system work includes, but is not limited to, the following:

Sanitary sewer conduits
Manholes, frames, and covers

B. For sanitary sewer related construction within the public right-of-way and utility easements, refer to "Orange County Manual of Standards and Specifications for Wastewater and Water Main Construction, latest edition.

C. Refer to applicable DIVISION 2 sections for excavation and backfilling work related to sewer collection systems.

D. Refer to applicable DIVISION 3 sections for concrete work related to sewer collection systems.

1.2 QUALITY ASSURANCE:

A. Installer: A firm specializing and experienced in sewer work for not less than two years.

B. Code Compliance: Comply with applicable portions of a local plumbing codes, Orange County, and the State of Florida Department of Environmental Protection.

1.3 SUBMITTALS: Comply with the requirements of Section 01330 - Submittals.

A. Product Data: Submit manufacturers technical data and installation instructions for each major component for the sewage collection system materials and products.

B. Record Drawings: At project close-out, submit record drawings of installed sewage collection system piping and products, signed and sealed by a Registered Land Surveyor (State of Florida) containing the following:

1. Location of each manhole. Location of each sewer service and force main at connection. Invert elevations of building services at tie-in. Rim elevations, bottom elevations and invert elevation of all pipes entering manholes. Slope of each segment (mains & services). Length and location of all plugged stub outs. Type of materials used. Location and type of each force main valve. Force main depth of cover at 100 feet min. intervals (or closer if under 30 inch cover). Complete record drawing of the lift station (if applicable), including location, data on pumps & equipment. All horizontal locations required on As-Built drawings shall be located according to the project coordinate.

C. Maintenance Data: Submit maintenance data and parts lists for sewage collection system materials and products. Include this data, shop drawings, product data and record drawings in a maintenance manual to be presented to the Owner at project close-out.

PART II - PRODUCTS

2.1 CONDUIT MATERIALS:

A. General: Furnish ells, tees, reducing tees, wyes, couplings, increasers, transitions, and end caps of same type and class of material as conduit, or of material having equal or superior physical and chemical properties as acceptable to the Architect/Engineer.

B. Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe and Fittings: ASTM D-3034, SDR35.

C. PVC Pipe Joints: Joints for PVC sewer pipe shall be rubber gasketed type complying in all respects to the physical requirements of ASTM D-3212 and ASTM F-477. Lubricant for jointing as approved by the pipe manufacturer shall be used for connecting PVC pipes.

D. PVC Pipe: Polyvinyl chloride (PVC) pressure pipe shall conform to the requirements of AWWA C-900and ASTM D1785 with outside diameter equal to that of standard ductile iron pipe. PVC pipe shall be Class 160, or DR 25.

1. PVC Pipe Fittings: Shall be of same class and rating of PVC pipe. Fittings for AWWA C-900 PVC pipe shall be ductile iron, mechanical joint fittings as specified above.

2. Pipe Joints: Integral bell formed with a race designed to accept the gasket in accordance with AWWA C-900. The spigot end shall have a bevel and a stop mark on the outside diameter to indicate proper insertion depth.

   a. Provision shall be made for expansion and contraction at each joint.

   b. When assembled, the gasket shall be compressed radially on the pipe spigot so as to effect a positive seal under all combinations of joint tolerances and is the only element depended upon to make the joint flexible and watertight.

   c. All surfaces of the joint upon or against which the gasket may bear shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint.

3. Gaskets: The gasket shall be molded to circular form and to the proper cross section and shall consist of a vulcanized high grade elastomeric compound conforming to AWWA C-900, Elastomeric Seals for joining plastic pipe.

4. Joint Lubricant: The joint lubricant shall have been tested and approved for potable water service. No lubricant shall be used that will harbor bacteria or damage the rings.

E. Concrete Manholes: Precast manhole sections shall be minimum 5" thick and 48" in diameter, conforming to ASTM C-478. Cones shall have same wall thickness and reinforcement as manhole section. Top and bottom of all sections shall be parallel. Joints shall be tongue-and-groove or Keylock type. Joints shall be formed using an approved joint sealer.

1. Prior to the delivery of any size of precast section on the job site, yard tests will be conducted at the point of manufacture. The precast sections to be tested will be selected at random from the stockpiled material which is to be supplied for the job. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C-14.

F. Coating System: All sanitary sewer manholes shall be provided with an interior and exterior coal tar epoxy coating. After the concrete has cured for 28 days, minimum, the precast units shall be coated by the manufacturer. The units shall be touched up in the field by the Contractor, if damaged. Interior and exterior surfaces of the manholes shall be coated in accordance with System A, B, or C below.

SYSTEM A (TNEMEC)

Surface Preparation: SP-C2.

Finish: 2 coats of Tnemec 413 Tneme-Tar at 8.3-mil dry thickness, 11.4 wet (140 SFPG) per coat. Thin first coat 10 percent. Apply second coat within 96 hours.

Total Thickness (dry): 16.6-mil.

SYSTEM B (PORTER)

Surface Preparation: SP-C2.

Primer: 1 coat of Porter Tarset Concrete Primer at 4.0-mil dry thickness (260 SFPG).

Finish: 2 coats of Porter 7013 Tarset C-200 Coal Tar Epoxy Black at 6.0-mil dry thickness (200 SFPG) per coat.

Total Thickness (dry): 16-mil.

SYSTEM C (KOPPERS)

Surface Preparation: SP-C2.

Finish: 2 coats of Koppers Bitumastic 300M Water Epoxy at 8.0-mil dry thickness (200 SFPG) per coat.

Total Thickness (dry): 16-mil.

G. Sewer Main Connection to Manholes: Manholes shall be provided with manufacturer installed rubber boots with stainless steel clamps for connection of gravity lines.

H. Manhole Joint Seals: Preformed plastic gaskets shall meet all requirements of Federal

Spec. SS-S-00210.

I. Manhole Frames and Covers: Traffic-bearing cast iron of size and shape detailed on the drawings. Covers shall have the word "sewer" in 2" raised letters. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects. Plane or grind bearing surfaces to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

J. Base Rock: Clean 3/4" gravel or crushed rock uniformly graded from coarse to fine conforming to requirements of FDOT specifications, 1996.

K. Concrete: All concrete work shall conform to the requirements of SECTION 03300 - CONCRETE WORK.

L. Cleanouts: Provide as indicated, pipe extension to grade with brass ferrule and brass countersunk cleanout plug.

1. Provide a 12-inch by 12-inch concrete collar, 6 inches thick around all exterior cleanouts

PART III – EXECUTION

3.1 INSTALLATION OF CONDUIT:

A. General: All PVC sewer shall be installed in accordance with Uni-Bell, UNI-B-5.

B. Pipe Distribution: Distribute material on the job no faster than it can be used to good advantage. Unload pipe which cannot be physically lifted by workers from the trucks, by a forklift, or other approved means. Do not drop pipe of any size from the bed of the truck to the ground.

C. Pipe Preparation and Handling: Inspect all pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying. Use proper implements, tools, and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. Remove all damaged pipe from the job site. Do not drop or dump pipe into trenches under any circumstances.

3.2 LINE AND GRADE:

A. Gravity Sewer Pipe: All sewer lines between manholes shall be absolutely straight and true. No curvature shall be tolerated. Do not deviate from line or grade, as established by the Engineer, more than 1/2" for line and 1/4" for grade, provided that such variation does not result in a level or reverse sloping invert.

1. Establish line and grade for pipe by the use of lasers or by transferring the cut from offset stakes to batter boards set in the trench at maximum intervals of 25 feet. Maintain a minimum of three sets of batter boards with string line ahead of the pipe

laying at all times.

B. Laying and Jointing Pipe: Pipe laying shall proceed upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined, the inside of the joint, and the rubber ring immediately before joining the pipe. Make assembly of the joint in accordance with the recommendations of the manufacturer of the type of joint used. Provide all special tools and appliances required for the jointing assembly.

1. After the joint has been made, check pipe for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. Apply sufficient pressure in making the joint to assure that the joint is "home" as defined in the standard installation instructions provided by the pipe manufacturer. To assure proper pipe alignment and joint makeup, place sufficient pipe zone material to secure the pipe from movement before the next joint is installed.

2. When pipe is laid within a movable trench shield, take necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.

3. Take the necessary precautions required to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, at the close of the day's work, or whenever the workers are absent from the job, close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints.

4. Plug or close off pipes which are stubbed off for manhole construction or for construction by others, with temporary plugs.

5. Take all precautions necessary to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.

6. Where nonreinforced pipe is connected to manholes or concrete structures, make connection so that the standard pipe joint is located not more than 3 feet from the outside edge of the structure.

7. When cutting and/or machining the pipe is necessary, use only tools and methods recommended by the pipe manufacturer.

3.3 UNDERGROUND STRUCTURES:

A. Rock Base: Prior to setting precast concrete base section, remove water from the excavation. Place a minimum of 6" of rock base and thoroughly compact with a mechanical vibrating or power tamper.

B. Manhole Joint Seals: Carefully inspect precast manhole sections to be joined. Sections with chips or cracks in the tongue shall not be used. Joint seals shall be installed in strict conformance with the manufacturer's recommendations. Only pipe primer furnished by the joint seal manufacturer will be approved.

C. Precast Concrete Manholes: Place precast concrete sections as shown on the drawings.

Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 3 inches above finish surface, unless otherwise indicated.

1. Install frames and covers on top of manholes to positively prevent all infiltration of surface or groundwater into manholes.

2. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring as shown in the Manhole Details on the drawings.

3. Provide rubber joint gasket complying with ASTM C-443.

4. Apply bituminous mastic coating at joints of sections.

D. Manhole Invert: Construct manhole inverts in conformance with details shown on the drawings and to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow. Where a full section of pipe is laid through a manhole, break out the top section and cover exposed edge of pipe completely with mortar. Trowel all mortar surfaces smooth.

3.4 BACKFILLING:

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.Place backfill and compact in accordance with provisions of SECTION 02200 – EARTHWORK

B. .

3.5 CLEANING AND TESTING:

A. Prior to final acceptance, the sewer collection system shall be thoroughly cleaned and visually inspected in the presence of the Engineer and local authorities. Visual inspection shall include closed circuit television inspection.

1. Closed circuit television inspection shall be in conformance with Section V, "Recommended Specifications for Sewer Collection System Rehabilitation" published by the National Association of Sewer Service Companies.

B. Following visual inspection, leakage testing may be required at the discretion of the Engineer and/or local authorities.

C. Acceptable methods of testing shall be low pressure air exfiltration or water exfiltration in accordance with the local authority requirements. The Contractor shall furnish all necessary tools, supplies, labor and equipment for testing.

1. Low pressure air exfiltration tests shall be performed in accordance with Uni-Bell, UNI-B-6.
2. Water exfiltration tests shall be in accordance with Uni-Bell, UNI-B-5.

D. Visual inspection and testing shall be performed on the same day. Notify Engineer one week in advance.

END OF SECTION

PART I - GENERAL

1.1 SCOPE:

A. This section includes storm sewers and structures appurtenant thereto. Excavating, trenching, backfilling and density tests are specified elsewhere. Storm sewer system work includes, but is not limited to, the following:

Storm sewer conduits
Storm sewer structures required by drawings

B. Refer to Section 02200 for excavation and backfilling work related to storm sewer systems.

C. Refer to Section 03300 for concrete work related to storm sewer systems.

1.2 QUALITY ASSURANCE:

A. Installer: A firm specializing and experienced in storm sewer work for not less than two years.

B. Code Compliance: Comply with applicable portions of local plumbing codes, the requirements of St. Johns River Water Management District (Fire Station No. 85), South Florida Water Management District (Fire Station No. 56) and the Florida Department of Environmental Protection.

1.3 SUBMITTALS: Comply with the requirements of Section 01330 - Submittals.

A. Product Data: Submit manufacturers technical data and installation instructions for each major component for the storm sewer system materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed storm sewerage piping and products. Record drawings must be signed and sealed by a Professional Land Surveyor licensed in the State of Florida. Drawings shall include as a minimum: horizontal locations, tied to project coordinate system, of all structures (area drains, catch basins, manholes, headwalls, etc.) and piping, rim elevations of all structures with invert elevations of all pipes entering structures, diameter and material of all piping, and the slope of each pipe segment. Verify all elements of drainage control structures, including rim elevations, elevation of slots, weirs and orifices, and invert elevation of all pipes entering structures. Refer to "EARTHWORK" Section 02200 for "as-built" survey requirements regarding grading, swales, lakes and drainage retention areas.

D. Maintenance Data: Submit maintenance data and parts lists for storm sewer system materials and products. Include this data, shop drawings, product data and record drawings in a maintenance manual to be presented to the Owner at project close-out.

PART II - PRODUCTS

2.1 GENERAL:

A. Except as otherwise provided, all storm sewer materials shall comply with the applicable sections of the Florida Department of Transportation (FDOT) "Standard Specifications for Road and Bridge Construction" current edition which are hereby incorporated into these specifications by reference. Further, all construction details included in the current edition of FDOT's "Roadway and Traffic Design Standards" are incorporated into these specifications by reference.

2.2 CONDUIT MATERIALS:

A. Polyvinyl Chloride (PVC), ASTM D-3034, SDR 35 pipe and fittings. Joints and fittings shall have elastomeric gasket joints manufactured in accordance with ASTM D-3212 and ASTM D-477.

B. High Density Polyethylene Pipe (HDPE) in accordance with AASHTO M294, Type S, and ASTM D-3350. Joints shall provide a water tight seal using elastomeric gaskets manufactured in accordance with ASTM D-3212 and ASTM F-477.

C. Round Reinforced Concrete Pipe (RCP) in accordance with ASTM C-76. Joints shall be bell and spigot type. The spigot end shall be grooved to accommodate a rubber O-ring gasket to provide a water tight seal conforming to the requirements of ASTM C-443.

2.3 STORM SEWER STRUCTURES:

A. Provide materials and perform all work in accordance with Section 425 of the referenced FDOT Standard Specifications.

B. Manhole Joint Seals: Preformed plastic gaskets shall meet all requirements of Federal Spec. SS-S-00210.

C Manhole Frames and Covers: Traffic-bearing cast iron of size and shape detailed on the drawings. Covers shall have the word "STORM" in 2" raised letters. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects. Plane or grind bearing surfaces to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

D. Catch Basin Frames and Grates: Use cast iron grates and cast-in angle iron seats on all catch basin structures. Grates in paved areas shall be traffic bearing.

E. Base Rock: Clean 3/4" gravel or crushed rock uniformly graded from coarse to fine conforming to requirements of FDOT specifications, 1996.

F. Concrete: All concrete work shall conform to the requirements of SECTION 03300.

G. Cleanouts: Provide as indicated, pipe extension to grade with brass ferrule and brass countersunk cleanout plug.

1. Provide a 18-inch by 18-inch concrete collar, 6 inches thick around all exterior cleanouts

2.4 MITERED END SECTIONS:

A. Provide materials according to FDOT Standard Index No. 273, with 2.5 inch pipe grates on 6 inch centers.

PART III - EXECUTION

3.1 GENERAL:

A. General: All construction operations shall adhere to the requirements of the referenced FDOT Standard Specifications.

B. Conform to manufacturer's recommendations on the installation of HDPE and PVC storm sewers.

C. Pipe Distribution: Distribute material on the job no faster than it can be used to good advantage. Unload pipe which cannot be physically lifted by workers from the trucks, by a forklift, or other approved means. Do not drop pipe of any size from the bed of the truck to the ground.

D. Pipe Preparation and Handling: Inspect all pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

E. Use proper implements, tools, and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. Remove all damaged pipe from the job site. Do not drop or dump pipe into trenches under any circumstances.

3.2 LINE AND GRADE:

A. General: All sewer lines between structures shall be absolutely straight and true. No curvature shall be tolerated. Do not deviate from line or grade more than 1/2" for line and 1/4" for grade, provided that such variation does not result in a level or reverse sloping invert.

1. Establish line and grade for pipe by the use of lasers or by transferring the cut from offset stakes to batter boards set in the trench at maximum intervals of 25 feet. Maintain a minimum of three sets of batter boards with string line ahead of the pipe laying at all times.

B. Laying and Jointing Pipe: Pipe laying shall proceed upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined and the inside of the joint immediately before joining the pipe. Make assembly of the joint in accordance with the recommendations of the manufacturer of the type of joint used. Provide all special tools and appliances required for the jointing assembly.

1. After the joint has been made, check pipe for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. Apply sufficient pressure in making the joint to assure that the joint is "home" as defined in the standard installation instructions provided by the pipe manufacturer. To assure proper pipe alignment and joint makeup, place sufficient pipe zone material to secure the pipe from movement before the next joint is installed.

2. When pipe is laid within a movable trench shield, take necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.

3. Take the necessary precautions required to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, at the close of the day's work, or whenever the workers are absent from the job, close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the joints.

4. Plug or close off pipes which are stubbed off for structure construction or for construction by others, with temporary plugs.

5. Take all precautions necessary to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.

6. Where non-reinforced pipe is connected to manholes or concrete structures, take connection so that the standard pipe joint is located not more than 3 feet from the outside edge of the structure.

7. When cutting and/or machining the pipe is necessary, use only tools and methods recommended by the pipe manufacturer.

3.3 UNDERGROUND STRUCTURES:

A. Rock Base: Prior to setting precast concrete base section, remove water from the excavation. Place a minimum of 6" of rock base and thoroughly compact with a mechanical vibrating or power tamper.

B. Structure Joint Seals: Carefully inspect precast structure sections to be joined. Sections with chips or cracks in the tongue shall not be used. Joint seals shall be installed in strict conformance with the manufacturer's recommendations. Only pipe primer furnished by the joint seal manufacturer will be approved.

C. Precast Concrete Structures: Place precast concrete sections as shown on the drawings. Set top elevation of catch basins as indicated on the drawings. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set manhole tops 3 inches above finish surface, unless otherwise indicated.

1. Install frames and covers on top of manholes to positively prevent all infiltration of surface or groundwater into manholes.

2. Frames shall be set in a bed of mortar with the mortar carried over the flange of the

ring as shown in the Manhole Details on the drawings.

3. Provide rubber joint gasket complying with ASTM C-443.

4. Apply bituminous mastic coating at joints of sections.

D. Manhole Invert: Construct manhole inverts in conformance with details shown on the drawings and to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow. Trowel all mortar surfaces smooth.

3.4 BACKFILLING:

1. General: Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

   Place backfill and compact in accordance with provisions of SECTION 02200 - EARTHWORK.

3.5 CLEANING AND TESTING:

A. Prior to final acceptance, the storm sewer system shall be thoroughly cleaned and visually inspected in the presence of the Architect or his designated representative.

B. Following visual inspection, leakage testing may be required at the discretion of the Engineer and/or local authorities.

C. Acceptable methods of testing shall be water exfiltration in accordance with the local authority requirements.

   1. The permissible leakage rate shall be a maximum of 50 gallons per inch of pipe diameter per mile of pipe in a 24 hour period for PVC and HDPE pipe. The permissible leakage rate for RCP pipe shall be a maximum of 200 gallons per inch of pipe diameter per mile of pipe in a 24 hour period.

D. The Contractor shall furnish all necessary tools, supplies, labor and equipment for testing.

E. Visual inspection and testing shall be performed on the same day. Notify Engineer one week in advance.

END OF SECTION

PART 1 - GENERAL

1.01 Summary

A. This section includes the following areas of Work:

1. Fine Grading
2. Sodding of new lawn areas
3. Preparation of lawn areas
4. Fertilizing of lawn areas
5. Maintenance

B. Related Work Specified Elsewhere:

1. Trenching and backfilling for utilities

1.02 References

A. Applicable Standards:

1. American Society for testing and Materials (ASTM) - Equivalent AASHTO standards may be substituted as approved:

a. D977 - Emulsified Asphalt

1.03 Submittals

A. Certificates:

1. Fertilizer shall be accompanied by certificate from vendors certifying they meet requirements of these Specifications, stating botanical name, percentage by weight and percentage of purity.

PART 2 - PRODUCTS

2.01. Topsoil: Provide from off site borrow, or from project on-site excavation as approved by Engineer.

2.02. Sod: Provide strongly rooted sod, not less than 18 months old and free of weeds and undesirable native grasses. Provide only sod capable of growth and development when planted (viable, not dormant) and in strips not more than 18" wide x 4' long. Provide sod composed principally of the following:

See drawings for areas specified for each:

A. Argentine Bahia sod (Paspalum Notatum).

2.03 Fertilizer

A. Commercial fertilizer of neutral character, with some elements derived from organic sources, containing not less than 8% phosphoric acid, 8% potassium, and percentage of nitrogen required to provide less than 1.0 lb. of actual nitrogen per 1,000 square feet of lawn area. Provide nitrogen in form that will be available to the lawn during initial period of growth. The chemical designation shall be 12-8-8.

B. Deliver to site in labeled bags or containers.

C. Should commercial seed not be available with a minimum total germination percentage as specified herein, the contractor will increase the quantity of seed to achieve the quantities of pure live seed specified.

2.04 Water for Grassing

A. Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 8.5. Provide all water needed for grassing. Provide permanent or temporary piping valves, and temporary trucks to convey water from the source to the point of use. Provide any meters required and pay for water used if the water is taken from a public water system. Water shall be free of petroleum products, pesticides and any other deleterious constituents.

PART 3 - EXECUTION

3.01 Coordination of Work

A. Coordinate all work activities to provide for establishment of grass cover at the earliest possible time in the construction schedule to minimize erosion of topsoil.

3.02 Soil Preparation

A. Dispose of any existing sod, growth, rocks, or other obstructions which might interfere with tilling, seeding, sodding, or later maintenance operations. Remove stones over 1-1/2 inches in any dimensions and sticks, roots, rubbish, and other extraneous matter. Remove from site, do not stockpile.

B. Till to a depth of not less than 12 inches. Thoroughly loosen and pulverize topsoil.

C. Grade lawn areas to a smooth, even surface with loose, uniformity firm texture. Roll and rake, remove ridges and fill depressions to meet finish grades. Limit fine grading to areas which can be planted within immediate future.

D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry off before planting of lawns. Do not create a muddy soil condition.

E. Restore prepared areas to specified condition if eroded or otherwise disturbed after the fine grading and prior to planting.

F. Spread planting soil mixture to depth required to meet thickness, grades, and elevations indicated after light rolling and natural settlement. Do not spread if material is frozen or if subgrade is frozen.

G. Preparation of Unchanged Grades:

1. Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows:

a. Till to a depth of not less than 12 inches
b. Apply soil amendments and initial fertilizers
c. Remove high areas and fill in depressions
d. Till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter

H. Allow for a 3" sod thickness in areas to be added adjacent paving.

I. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of Owner's property: do not turn over into soil being prepared for lawn.

J. Place approximately ½ of the total amount of planting soil required. Work into the top of the loosened subgrade to create a transition layer and then place the remainder of the planting soil.

3.03 Sodding New Lawns

A. Prior to laying sod, contact owner for inspection of soil preparation work. Lay sod within 24 hours from time of stripping. Do not plant dormant sod or if ground is frozen.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger to offset joints in adjacent courses. Work form boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

C. Anchor sod on slopes with wood pegs as required to prevent slippage.

D. Water sod thoroughly with a fine spray immediately after planting.

3.04 Reconditioning Lawns

A. Recondition lawn areas damaged by Contractor's operations, including storage of materials or equipment and movement of vehicles. Also recondition lawn areas where settlement or washouts occur or where minor regarding is required. Recondition other existing lawn areas where indicated.

B. Provide fertilizer or sod, and soil amendments as specified for new lawns and as required to provide satisfactorily reconditioned lawn. Provide new planting soil as required to fill low spots and meet new finish grades.

C. Cultivate bare and compacted areas thoroughly to provide a good, deep planting bed.

D. Remove diseased or unsatisfactory lawn areas; do not bury into soil. Remove topsoil

containing foreign materials resulting from Contractor's operations including oil drippings, stone, gravel, and other construction materials. Replace with new topsoil.

E. Where substantial lawn remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before seeding or, if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.

F. Water newly planted areas and keep moist until new grass is established.

3.05 Protection

A. Erect barricades, warning signs and fencing to protect newly planted areas from traffic. Maintain barricade fencing and warning signs throughout maintenance period until substantial completion of project.

3.06 Maintenance

A. Mow sod to a height of 2 inches as soon as there is enough top growth to cut with mower. Remove no more than 40% of grass leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted.

B. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, re-grading, replanting as required to establish a smooth, acceptable lawn, free from eroded or bare areas.

C. Remove weeds by pulling or chemical treatment.

D. Perform maintenance until the date of substantial completion of project.

E. Apply second fertilizer application after first mowing and when grass is dry. Use fertilizer which will provide not less than 1.0 pound of actual nitrogen per 1,000 square feet of lawn area.

F. Replant bare areas using same materials specified for lawns.

G. Watering: Provide and maintain temporary piping, hoses, and lawn watering equipment as required to convey water from water sources and to keep lawn areas uniformly moist as required for proper growth.

H. Layout temporary lawn watering system and arrange watering schedule to avoid walking over muddy areas. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch (if any).

I. Maintain a balanced watering program. Maintain all grassed areas for a period of 90 days after the date of substantial completion and guarantee against all defects and faults of material and workmanship.

J. Apply water in sufficient quantities and as often as seasonal conditions require to keep the grassed areas moist.

K. Provide supplemental water and irrigation to sod areas when the rainfall is not adequate to maintain soil moisture necessary for growth of the grass. It is Contractor's responsibility to determine the quantities of water required and when to irrigate. This obligation shall remain in full force and effect until final acceptance of the work by Owner and shall be provided at no additional cost to Owner.

L. Owner, at his discretion, may relieve Contractor of this obligation at such time as Owner is able to provide irrigation. This action, however, does not relieve Contractor of the provisions and guarantees set forth in the Contract Documents.

3.07 Acceptance of Lawns

A. When lawn work is substantially complete, including maintenance, Engineer and Owner will, upon request, make an inspection to determine acceptability:

1. Lawn Work may be inspected for acceptance in parts agreeable to Owner, provided Work offered for inspection is complete, including maintenance.

B. Replant rejected Work and continue specified maintenance until re-inspected by Engineer and Owner and found to be acceptable.

C. Sodded lawns will be acceptable provided requirements, including maintenance, have been compiled with, and a healthy, well-rooted, even-colored, viable lawn is established, free of weeds, open joints, bare areas and surface irregularities.

3.08 Guarantee

A. Guarantee all grass areas to be alive and in satisfactory growth 30 days after substantial completion of planting.

B. Replace any grass that is dead or not in satisfactory growth, as determined by the owner or Owner's representative. Guarantee new sod or seed for an additional 30 days.

C. The term "Satisfactory Growth" as used in this section is defines as even plant growth in healthy conditions without bare spots larger then one square foot in seeded areas and without bare spots in sodded areas. Bare spots in sodded areas shall be resodded. All grassed and sodded areas shall be maintained until satisfactory growth has been demonstrated. In the event that the subsequent stand of grass is found contaminated with weeds or other obnoxious or undesirable growth, effectively eliminate such undesirable growth, at the Contractor's expense.

D. Replace sod with the same variety as initially specified.

3.09 Cleanup

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles prior to leaving site to avoid tracking soil onto surfacing of roads, walks, or other paved areas.

END OF SECTION

Division 3
Concrete

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this Section.

1.01 DESCRIPTION

A. Work Included: Labor, materials and equipment to design, fabricate, erect and remove formwork for cast-in-place concrete.

B. Related Work Specified Elsewhere:

1. Concrete Reinforcement: Section 03200

2. Concrete Accessories: Section 03250

3. Cast-In-Place Concrete: Section 03300

4. Structural Composite Precast Pre-tensioned Concrete: Section 03415

C. Work Installed but Furnished Under Another Section:

1. Expansion Joint Fillers: Section 03250

2. Waterstops: Section 03250

3. Anchors and Anchor Bolts for Connection of Structural Steel Work to Cast-In-Place Concrete Work: Section 05120

4. Steel Joist Bearing Plates, Anchors and Bridging Anchorages: Section 05210

5. Anchors, Bolts, Embedded Items, etc., for Securing Metal Fabrications to Cast-In-Place Concrete Work: Section 05500

1.02 QUALITY ASSURANCE

A. Reference Standards (Current Editions):

1. ACI 301: Specifications for Structural Concrete for Buildings.

2. ACI 318: Building Code Requirements for Reinforced Concrete.

3. Southern Building Code Congress International, Inc.: Standard Building Code.

4. ASTM Standards referenced herein.

B. Accessibility of Standards: Maintain one (1) copy of ACI 301, ACI 318 and Standard Building Code at the construction office, readily accessible for reference.

1.03 SUBMITTALS

A. Manufacturer's Data:

1. Manufacturer's specifications and installation instructions for:

a. Form Release Agent.

b. Slab Construction Joint Key.

c. Proprietary Forming Systems.

2. Manufacturer's written warranty that the form release agent will not stain concrete surfaces, will not adversely affect strength and texture of the concrete surfaces, and will not adversely affect the bond of subsequent surface applications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with reference standards.

B. Blockouts and Keyways: Wood or styrofoam.

C. Chamfer Strips: Wood.

D. Nailing Strips: Pressure treated wood.

E. Form Release Agent: Non-staining, rust preventive, guaranteed not to affect bond of subsequent surface applications to concrete.

F. Galvanized Corrugated Steel Permanent Deck Form:

1. Sheets: 28-gauge, 80 KSI steel.

2. Corrugations: 9/16" depth X 2-1/2" pitch.

3. Sheet Coverage: 30" nominal width.

4. Galvanizing: ASTM A525 Class G90.

G. Concrete Joist Forms: Removable steel forms, with end caps, or tapered end forms. Ceco or accepted substitute.

H. Anchor Bolt Templates: Steel or exterior grade plywood.

I. Slab Construction Joint Key: Permanent sheet metal tongue-and-groove edge form with metal stakes and accessories. Burke Keyed Kold Joint or accepted substitute.

PART 3 - EXECUTION

3.01 CONSTRUCTION, ERECTION AND REMOVAL

A. General: Comply with reference standards.

B. Material: Use proper form material to secure the finishes specified in other sections.

C. Chamfers: Install 3/4" chamfer strips in corners of exposed members, unless otherwise shown on the architectural drawings.

D. Footing Forms: Footings shall be formed. Earth forms are not acceptable.

E. Removal: Shoring shall remain in place until concrete has reached its specified 28-day compressive strength.

F. Reshoring: Formwork shall not be reshored without the express permission of the Architect.

G. Reuse: Formwork may be reused, if approval of the Architect is obtained. Reused forms must provide concrete finish equal to new formwork.

H. Galvanized Corrugated Steel Permanent Deck Form:

1. Install continuous over at least 3 spans, where possible.

2. Form orientation, laps, bearing length, etc., shall conform to the recommendations of the manufacturer.

3. Fasten to supports by welding through 16-gauge welding washers supplied by the manufacturer. Welds shall conform to manufacturer's recommendations, unless noted.

4. Weld pattern:

a. End Laps: Weld at each side lap, plus one intermediate weld (3 welds per sheet).

b. Intermediate Supports: Weld at side laps.

I. Joist Forms: Concrete joist forms shall be reasonably true to shape, and shall be installed in accordance with the manufacturer's recommendations. Use square end caps except where tapered end forms are shown on the drawings.

J. Anchor Bolts: Prepare and set templates for column anchor bolts, so that bolts are properly located and will not displace during placement of concrete. Drill bolt holes in templates in accordance with information shown on approved structural steel shop drawings.

K. Joint Keys: Install slab construction joint key in accordance with the manufacturer's instructions so that a combination edge form, construction joint, load transfer device and vibrating screed rail is provided.

L. Joint Fillers: Install expansion joint fillers as shown on the drawings.

M. Waterstops: Install waterstops as shown on the drawings. Make splices in strict accordance with the instructions of the manufacturer.

N. Embedded Items: Install embedded items and anchorages for connection of work of other sections in the formwork in accordance with approved shop drawings.

END OF SECTION 03100

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this section.

1.01 DESCRIPTION

A. Work Included: Labor, materials and equipment to complete concrete reinforcement shown on the drawing, or herein specified, and as required for a complete installation.

B. Related Work Specified Elsewhere.

1. Concrete Formwork: Section 03100

2. Cast-in-Place Concrete: Section 03300

1.02 QUALITY ASSURANCE

A. Reference Standards (Current Editions):

1. ACI 301: Specifications for Structural Concrete for Buildings.

2. ACI 318: Building Code Requirements for Reinforced Concrete.

3. Southern Building Code Congress International, Inc.: Standard Building Code.

4. CRSI: Reinforcing Bar Detailing.

5. ASTM Standards referenced herein.

B. Accessibility of Standards: Maintain one copy of ACI 301, ACI 318 and Standard Building Code at the construction office, readily accessible for reference.

1.03 SUBMITTALS

A. Placing drawings: Show all fabrication dimensions, and locations and instructions for placing of reinforcing steel and bar supports.

1. Drawings shall not contain reproductions of the contract drawings.

2. Each submitted drawing shall be complete. No changes or additions shall be made to drawings after submittal except those needed to comply with Contractor's checking or Engineer's review.

B. Manufacturer's Data:

1. Manufacturer's specifications and installation instructions for proprietary bar splicing systems.

2. Manufacturer's printed data for proposed fibrous concrete reinforcement materials, and batching and mixing instructions.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to the site in a timely manner, so that work on the project is uninterrupted.

B. Storage: Store materials for ease of inspection and identification. Keep items off the ground, using blocking or other supports. Protect materials from deterioration.

C. Handling: Handle steel items so as to prevent bending or distortion of material.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with ACI 301.

B. Deformed Bars: Comply with ASTM A615, Grade 60 with Supplement (SI), marked "S". Where bars are to be spliced or connected by welding, insure that bars are weldable type.

1. Provide zinc-coated bars where shown. Coating weight Class I.

2. Provide epoxy-coated bars where shown.

C. Welded Wire Fabric: Comply with ASTM A185. Furnish in flat sheets.

D. Butt Splice Devices: Comply with Section 12.14.3.3 or Section 12.14.3.4 of ACI 318.

E. Bar Supports: Wire, with plastic tips in contact with forming surfaces, where reinforcement is supported from formwork. Reinforcement supported from ground shall rest on precast concrete blocks at least 4 inches square and having a compressive strength not less than that of the concrete being placed.

F. Tie Wire: Black, soft-annealed wire, not smaller then 16-gauge.

2.02 FABRICATION

A. General: Comply with ACI 301.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Site Inspection: Inspect site prior to placement. Verify that conditions affecting placement are satisfactory. Do not start placement until unsatisfactory conditions are corrected.

B. Compliance with Standards: Comply with ACI 301. Install bar supports in conformance with CRSI – Reinforcing Bar Detailing.

C. Butt Splices: Butt splices for reinforcing bars shall be full welded or full mechanical type, complying with Section 12.14.3.3 or Section 12.14.3.4 of ACI 318.

D. Damaged Zinc Bar Coating: Repair in conformance with ACI 301.

E. Damaged Epoxy Bar Coating: Repair in conformance with ACI 301.

END OF SECTION 03200

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this section.

1.01 DESCRIPTION

A. Work Included: Labor, materials and equipment to furnish and install concrete accessories shown on the drawings, or herein specified, and as required for a complete installation.

B. Related Work Specified Elsewhere:

1. Concrete Formwork: Section 03100
2. Concrete Reinforcement: Section 03200
3. Cast-In-Place Concrete: Section 03300

C. Work Furnished But Installed Under Another Section:

1. Expansion Joint Fillers: Section 03100
2. Waterstops: Section 03100

1.02 QUALITY ASSURANCE

A. Reference Standards (Current Editions):

1. ACI 301: Specifications for Structural Concrete for Buildings.
2. ACI Publications referenced herein.
3. ASTM Standards referenced herein.
4. Corps of Engineers Specifications referenced herein.

B. Accessibility of Standards: Maintain one copy of ACI 301 at the construction office, readily accessible for reference.

1.03 SUBMITTALS

A. Manufacturer's Data: Manufacturer's specifications and installation instructions for:

1. Expansion joint fillers.
2. Waterstops.

B. Copies: Forward copies of submittals and data in accordance with Section 01340.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to the site in a timely manner, so that work on the project is uninterrupted.

B. Storage: Store materials for ease of inspection and identification. Keep items off the ground, using blocking or other supports. Protect materials from deterioration.

C. Handling: Handle metal items so as to prevent bending or distortion of material.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Expansion Joint Filler: Premolded asphalt-impregnated mineral fiberboard, conforming to ASTM D 1751.

B. Waterstops: Extruded virgin polyvinyl chloride, with molded fittings, conforming to Corps of Engineers Specification CRD-C-572. Type and size as shown on drawings.

C. Vapor Barrier: 6-mil polyethylene film, clear color, conforming to ASTM C171.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Site Inspection: Inspect site prior to placement. Verify that conditions affecting placement are satisfactory. Do not start placement until unsatisfactory conditions are corrected.

B. Vapor Barrier: Install vapor barrier under all footings and interior grade slabs. Place vapor barrier only on soil which has been compacted in accordance with Section 02200. Lap edges 6". At concrete edges, turn up to top of concrete.

C. Waterstops: Install waterstops where shown on drawings. Install and splice in strict accordance with ACI 301 and with manufacturer's recommendations.

END OF SECTION 03250

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this section.

1.01 DESCRIPTION

A. Work Included:

1. Labor, materials and equipment to complete cast-in-place concrete shown, except that specified as work of other sections.

2. Furnish and place grout under steel column bases and bearing plates of other structural members.

B. Related Work Specified Elsewhere:

1. Concrete Formwork: Section 03100

2. Concrete Reinforcement: Section 03200

3. Concrete Accessories: Section 03250

1.02 QUALITY ASSURANCE

A. Reference Standards (Current Editions):

1. ACI 301: Specifications for Structural Concrete for Buildings.

2. ACI Publications referenced herein.

3. ASTM Standards referenced herein.

B. Accessibility of Standards: Maintain one copy of ACI 301 at the construction office, readily accessible for reference.

C. Fibrous Concrete Reinforcement: Manufacturer shall provide the services of a qualified technical representative to instruct the concrete supplier in proper batching and mixing of fiber reinforced concrete.

1.03 SUBMITTALS

A. Concrete Mix Designs: Submit the tabulated proportioning for each concrete mix proposed for use.

B. Certification: Submit written certification by the manufacturer and testing laboratory as to compliance of admixtures with listed requirements, including chloride ion content. Highlight all evidence of compliance.

C. Fiber Reinforced Concrete Supplier's Certificate: Certificate stating that each batch of fiber reinforced concrete delivered to the project site contained the specified amount of the approved reinforcing fiber mixed in accordance with the manufacturer's instructions. Certificate shall be accompanied by a copy of each batch delivery ticket indicating the amount of reinforcing fiber added to that batch.

D. Manufacturer's Data: Submit manufacturer's published technical data for specified curing compounds, bonding compounds, epoxy compounds and non-shrink grout. Highlight all evidence of compliance.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with ACI 301.

B. Cement:

1. Domestic Portland Cement, Type I or Type II.

2. Blended Hydraulic Cement, conforming to ASTM C595, except that Types S and SA are not permitted.

C. Fine Aggregate: Clean sand conforming to Florida Department of Transportation Standard Specifications, Section 902.

D. Coarse Aggregate:

1. Normal weight concrete: Clean limestone, Size 57, except Size 8 for cell-fills and trim items.

E. Lightweight concrete: Conform to ASTM C 330.

F. Admixtures:

1. No calcium chloride, thiocyanates, nor admixture containing more than 0.05% chloride ions shall be used.

2. Water Reducing Admixture: Conform to ASTM C494, Type A.

3. Water Reducing, Retarding Admixture: Conform to ASTM C494, Type D.

4. High-Range Water Reducing Admixture (Superplasticizer): Conform to ASTM C494, Type F or G. Shall be a second or third generation type.

5. Non-Corrosive, Non-Chloride Accelerator: Conform to ASTM C494, Type C or E. Admixture manufacturer must have long term non-corrosive test data from an independent testing laboratory.

6. Air Entraining Admixture: Conform to ASTM C260.

7. Fly Ash: Type F or C. Conform to ASTM C618.

G. Fibrous Concrete Reinforcement: 100% virgin polypropylene collated, fibrillated fibers, 1 1/2 inches long, specifically manufactured for use as concrete reinforcement, and containing no reprocessed olefin materials. As manufactured by Fibermesh Company, Chattanooga, TN, or accepted substitute.

H. Curing Compounds:

1. Curing and Sealing Compound Shall be Ashford Formula manufactured by Curecrete Chemical Company, Inc. or approved equal

I. Bonding Compound: Polyvinyl acetate, rewettable type. "Euco-Weld" by Euclid Chemical Co., "Hibond" by Lambert Corp., "Weldcrete" by Larsen Co., or accepted substitute.

J. Epoxy Adhesive: 100% solids, 100% reactive compound suitable for use on dry or damp surfaces. "Euco Epoxy #620" by Euclid Chemical Co., "Epiweld 580 Hi-Mod Epoxy" by Lambert Corp., "Sikadur" by Sika Corp., "Allied Gold A-1000" by Rawl or accepted substitute.

K. Epoxy Mortar: 100% solids, solvent free. "#456 Epoxy Mortar System" by Euclid Chemical Co., "Epiweld 9-N-7" by Lambert Corp., "SikaTop 122" by Sika Corp. or accepted substitute.

L. Grout Under Bearing Plates: Conform to CRD-C-621-80, "Corps of Engineers Specification for Non-Shrink Grout." Non-metallic type. Must have a minimum compressive strength of 6000 psi in seven days. "Euco N-S Grout" by Euclid Chemical Co., "Vibropruf #11" by Lambert Corp., or accepted substitute.

2.02 MIXES

A. General: Comply with ACI 301.

B. Slump:

1. Concrete containing high range water reducing admixture (superplasticizer) shall have a maximum slump of 8 to 10 inches. Water content shall be such as to produce a slump of 2 to 3 inches without the admixture. Treated concrete shall be capable of maintaining its extended slump for at least 90 minutes.

2. Concrete in slabs which will be consolidated by vibrating screed shall have a maximum slump of 3 inches.

3. Pump-mix concrete not containing high range water reducing admixture shall have a maximum slump of 6 inches at the mixer.

4. All other concrete shall have a maximum slump of 4 inches.

C. Admixtures:

1. Concrete slabs placed at air temperatures below 50°F shall contain non-corrosive, non-chloride accelerator.

2. Where required to be air entrained, concrete shall contain air entraining admixture.

   a. Where concrete is to contain both air entraining and high range water reducing admixtures, the air entraining admixture shall be added only after the high range water reducing admixture is thoroughly blended into the concrete.

3. Fly ash may be used to replace pound for pound a maximum of 25% of the Portland Cement in a mix.

D. Water-Cement Ratio:

1. Conform with Section 3.4 of ACI 301.

2. Reinforced concrete requiring corrosion protection and in contact with brackish water or salt spray shall have a maximum water-cement ratio of 0.40.

3. All concrete required to be watertight shall have a maximum water-cement ratio of 0.45.

E. Mixing: All concrete shall be ready-mixed.

F. Lightweight Concrete: Dry weight shall not exceed 112 pcf. Proportion in accordance with manufacturers instructions.

G. Concrete Strengths: Required strengths are shown on the drawings.

H. Fibrous Concrete: Fibrous concrete shall contain 1 1/2 lbs. of reinforcement per cubic yard of concrete except as otherwise shown on the Structural Drawings. Batch and mix in strict accordance with recommendations of manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with ACI 301.

B. Site Inspection: Inspect site prior to placement. Verify that conditions affecting placement are satisfactory. Do not start placement until unsatisfactory conditions are corrected.

C. Age: No concrete in the project shall be placed for which more than 90 minutes have elapsed at time of placement since introduction of mixing water to the cement and aggregate or introduction of cement to the aggregate.

D. Hot or Cold Weather Placement: For concrete placed during hot or cold weather, observe procedures and precautionary measures in conformance with ACI 301.

E. Free-fall Placement: Maximum allowable free fall of concrete is 4 feet. Use a drop chute or elephant trunk in walls and columns directing the discharge so that concrete does not contact forms or reinforcement during its fall.

F. Underwater Placement: Deposit no concrete under water, except by special approval of the Architect.

G. Consolidate Concrete As Follows:

1. Use internal mechanical vibrators unless otherwise noted. Insert vibrator vertically to a depth of at least 4 inches into the previous layer. Allow vibrator to remain in one location for not longer than 10 seconds. Repeat procedure at intervals not to exceed 2 feet on centers. Use and type of vibrators shall be in strict conformance with ACI 309. Use lower frequency vibrators with "flowing" concrete.

2. For slabs on grade with thickness of 6" or less, use vibrating screed of low frequency (3000-6000 vibrations per minute), high amplitude type.

H. Finishing of Formed Surfaces:

1. Use rough form finish for all surfaces not exposed to public view.

2. Use smooth form finish for all surfaces exposed to public view.

I. Finishing of Slabs:

1. Slab surfaces shall be finished to a Class B tolerance. Depressions between high spots shall not exceed 1/4" under a 10-foot straightedge placed anywhere on the slab.

2. General information (slab on grade and elevated slabs): the requirements indicated are based on the latest FF/FL method per ASTM E1155. Ride for this work shall reflect these requirements and enforcement thereof can be expected.

3. Slab on grade:

a. Specified overall value: FF30/FL23
b. Minimum local value: FF25/FL20
c. Apply trowel finish to surfaces that are to receive resilient flooring, paint, or other thin film finish coating system.

4. Elevated slabs shall have a specified overall value of FF22 to FF27 and a minimum value of FF20 with no FL number defined. Slab finishes shall be finished to a Class B tolerance.

5. Finish slabs for surfaces as follows:

   a. Terrazzo or hard tile: Scratch finish.

   b. Soft tile: Troweled Finish.

   c. Exposed concrete: Broom finish.

   d. Carpet: Floated finish.

6. Ramps, stair steps and landings: Nonslip finish.

J. Curing:

1. Apply two applications of Ashford Formula immediately after final finishing in conformance with directions of manufacturer.

K. Concrete Strength: Where specified concrete strength of columns exceeds that of supported floor system, provide for adequate load transmission through the floor system in conformance with ACI 318, Section 10.13.

3.02 REPAIR OF DEFECTIVE AREAS

A. General: With prior approval of the Architect as to method and procedure, repairs of defective areas of concrete shall be as follows:

1. Structural repairs: Use epoxy adhesive and/or epoxy mortar in conformance with the manufacturer's directions.

2. Repair of other defective areas: Use bonding compound in conformance with ACI 301 and the manufacturer's directions.

3.03 GROUTING

A. General: Grout under bases and bearing plates of steel columns, beams and other structural members bearing on concrete, using an approved non-metallic, non-shrink grout in strict conformance with the manufacturer's directions.

3.04 FIELD QUALITY CONTROL

A. Testing:

1. Engage and pay for the services of a recognized engineering testing laboratory to conduct compressive strength tests of the concrete in accordance with ACI 301. Results of such tests shall be reported to the Architect on the same day that tests are made.

2. For the purpose of early form removal, if the Contractor desires strength tests to be made at an earlier age than the standard 28-days, he shall arrange, at his own expense, for the laboratory to perform additional testing. Two additional cylinders shall be prepared for each age report desired. The strength at that age shall be determined as the average of the two cylinder strengths.

3. When there is question as to quality of concrete in the structure, the Architect may order non-destructive testing or testing of specimens secured from the hardened concrete. Cost of such testing shall be borne by the Contractor.

4. If there remains a question as to adequacy of strength of structure, the Architect may direct load testing of the structure to determine its acceptability. Cost of such testing shall be borne by the Contractor.

B. Notification: Notify the Architect and the testing agency at least 24 hours before concrete is scheduled for placement. Place no structural or exposed concrete without approval of the Architect.

C. Supplier's Representative: During placement of concrete containing high range water reducing admixture (superplasticizer), a representative of the concrete admixture supplier shall be present at the jobsite.

END OF SECTION 03300

Division 4
Masonry

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this section.

1.01 DESCRIPTION

A. Work Included: Labor, materials and equipment to construct concrete unit masonry work as shown on the drawings or specified herein.

B. Related Work Specified Elsewhere:

1. Cast-In-Place Concrete: Section 03300

2. Caulking, Joint Fillers and Sealants: Division 7 Sections

C. Work Installed but Furnished Under Another Section:

1. Loose Steel Lintels for support of Masonry: Section 05120

2. Plates and Anchors for connection of Structural Steel: Section 05120

3. Steel Joist Bearing Plates, Anchors and Bridging Anchorages: Section 05210

4. Anchors, Embedded Items, etc., for Securing Metal Fabrications to Masonry: Section 05500

1.02 QUALITY ASSURANCE

A. Reference Standards: (Current Editions)

1. ACI 530.1: Specifications for Masonry Structures.

2. ACI Publications referenced herein.

3. ASTM Standards referenced herein.

B. Accessibility of Standards: Maintain one copy of ACI 530.1 at the construction office, readily accessible for reference.

C. Masonry Strength: Net area compressive strength of masonry (f'm) shall be as shown on Structural Drawings.

1.03 SUBMITTALS

A. General: Conform to ACI 530.1.

1. One Specimen of each type of masonry unit proposed for use (stretcher units, control joint units, etc.).

2. Results of tests of masonry units showing compliance with Specifications.

3. Results of mortar tests showing compliance with Specifications.

4. Producer's certificate showing that grout for the project conforms to Specifications.

5. Cold weather construction procedures.

6. Hot weather construction procedures.

7. Manufacturer's literature for submittal items.

8. Shop drawings showing details of steel reinforcement and masonry lintels.

   a. Drawings shall not contain reproductions of contract drawings.

   b. Each submitted drawing shall be complete. No changes or additions shall be made to drawings after submittal except those needed to comply with Contractor's checking, or Engineer's review.

9. One sample at least 6 inches long of each type of non-masonry joint material proposed for use.

10. Compressive strength of masonry determined by the unit strength method from tests on proposed masonry units and mortar, showing compliance with the Specifications.

11. One sample of masonry wall panels representative of quality, materials and color proposed for construction. Lay up sample at jobsite in location approved by Architect. Maintain sample in as-built condition until project is accepted by Owner. Minimum sample size 4'-0" long X 4'-0" high.

B. Copies: Except as noted, forward submittals in sufficient copies that the Architect may retain two copies of each submittal.

1.04 DELIVERY, STORAGE AND HANDLING

A. General: Comply with ACI 530.1.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with ACI 530.1.

B. Concrete Masonry Units:

1. Units for exterior walls and bearing partitions shall conform to ASTM C90, Type II, two cell, hollow, load bearing units of 8-inch by 16-inch nominal face size and bed dimension as shown on the drawings. Units shall be normal weight unless otherwise noted, and shall have no end flanges. Average compressive strength for the net area shall be as shown on Structural Drawings.

2. Units for non-bearing partitions shall conform to ASTM C129, Type II, two cell, hollow, non-load bearing units of 8-inch by 16-inch nominal face size and bed dimension as shown on the drawings. Units shall be normal weight unless otherwise noted.

3. Solid units shall conform to ASTM C90, Type II, and shall be normal weight unless otherwise noted. Nominal size shall be 2-2/3" X 4" X 8", except as noted.

4. Units shall be free from substances that would cause staining or pop-outs and shall be of fine, even texture with straight, true edges.

5. Obtain units from one manufacturer to insure even color and texture.

6. Provide special units required by the drawings, including corner, pilaster, sash and jamb units.

C. Mortar:

1. Mortar shall conform to ASTM C270, and shall contain no admixtures.

2. Mortar shall conform to Type M or S, except Type N may be used for non-bearing partitions. Color of mortar shall match color of masonry units.

D. Lintels: Masonry lintels shall be precast concrete, U-type, of thickness to match supported wall. End bearings shall contain openings for installation of vertical bars and grout. As manufactured by Power Concrete Products, Co., Orlando, FL, or accepted substitute. Length shall provide for at least 8-inches of bearing on masonry at each end.

E. Grout:

1. Grout shall conform to ASTM C476, and shall contain no admixtures.

2. Grout shall be fine or coarse, as best suits the application.

3. At placement, grout slump shall be between 8 inches and 11 inches.

F. Reinforcement:

1. Reinforcing bars shall conform to ASTM A615, Grade 60.

2. Joint reinforcement shall be galvanized, single width truss type, fabricated with a single pair of deformed 9-gage side rods and continuous 9-gage cross rods spaced not more than 16 inches on center. Furnish complete with prefabricated corners and tees. Width shall be 2-inches narrower than wall. Where wall is used to back-up face brick, furnish with 3/16-inch diameter adjustable wall tie eye sections spaced at 24-inches on center, complete with rectangular pintles. Length as required to span insulation air space plus 3-inches into face brick. Dur-O-Wal, or accepted substitute.

G. Accessories:

1. Galvanized 24-gage dove-tailed anchor slots with anchors at 16-inches o.c. Heckmann Building Products, or accepted substitute.

2. Galvanized 16-gage metal ties for use with the anchor slots provided. Type and size as required. Heckmann Building Products, or accepted substitute.

3. Miscellaneous anchors and attachment members required for anchorage of this work and work of other trades requiring attachment to masonry, which are not specifically provided under separate sections.

4. Control joint gaskets shall be factory extruded preformed polyvinyl chloride shear keys. Dur-O-Wal "Regular Rapid Poly-Joint", or accepted substitute.

5. Cleaning agent shall be a mild, non-caustic detergent solution. 801 Super Real Clean by Superior Mfg., Co., or accepted substitute.

PART 3 - EXECUTION

3.01 MASONRY, REINFORCEMENT, METAL ACCESSORIES AND GROUT

A. General: Conform to ACI 530.1.

B. Wetting Units: Do not wet masonry units before placing in wall.

C. Bond: Construct masonry in running bond pattern with head joints in successive courses horizontally offset one-half unit length.

D. Lintels: Install precast concrete lintels so that length of bearing at each end is at least 8-inches. Fill with pea-gravel concrete (f'c=3000 psi) if recommended by manufacturer. Before installing lintels, fill wall cells under bearings with grout.

E. Reinforcing Bars: Lap bars 48 diameters at splices. Center vertical reinforcement in cells, unless otherwise noted.

F. Joint Reinforcement: Place reinforcement in horizontal joints at 16 inches o.c. measured vertically. Lap reinforcement at least 8 inches at splices. Install prefabricated corners and tees at wall intersections.

G. Bed and Head Joints: Joints shall be 3/8" thick. Cut off mortar flush with block face, and tool joints slightly concave. Rake out mortar in preparation for application of caulking or sealants where shown.

H. Grout Vibration: Mechanical vibration shall be performed using a low velocity vibrator with a 3/4-inch head. Activate vibrator for one to two seconds in each grouted cell of hollow masonry. Do not over-vibrate.

I. Wall Control Joints: Install where shown, but not to exceed horizontal spacing of 24'-0" o.c.

J. Filled Cells: At vertical cells to be filled with grout, lay masonry units with full bed joints around cells.

K. Build-in items furnished by Others for anchorage or support of their work.

3.02 REPAIR, POINTING AND CLEANING

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

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

C. Cleaning: Clean exposed masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.

3.03 FIELD QUALITY CONTROL

A. Inspections and Testing:

1. The Owner will engage an independent engineering testing laboratory to conduct tests of masonry prisms and grout for compliance with Specification requirements.

2. Engage an independent engineering testing laboratory to conduct tests of masonry prisms and grout for compliance with Specification requirements.

3. Coordinate and cooperate with testing laboratory to expedite this work.

4. Results of inspections and tests will be reported to the Architect on the same day as completed.

5. Results of inspections and tests shall be reported to the Architect on the same day as completed.

6. Prism Testing:

   a. Conform to ACI 530.1.

   b. Prior to construction, perform two tests on samples of materials to be used in construction to determine masonry strengths at 7 days and at 28 days, and to verify adequacy of strength for the project.

   c. During construction, perform tests on materials at site to verify that specified strengths are being provided. Tests may be made at 7 days and strengths determined by comparison with tests made prior to construction. Make two separate unscheduled tests during construction of each story of masonry.

7. Grout Testing:

   a. Test grout in conformance with ACI 530.1.

END OF SECTION 04810

Division 5
Metals

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this Section.

1.01 DESCRIPTION

A. Work Included:

1. Fabricate, deliver and erect, unless otherwise specified, all items of structural steel, as defined in the AISC "Code of Standard Practice", and as shown on the drawings.

a. Architecturally exposed structural steel items are specifically designated on the drawings.

2. Fabricate and deliver the following items of structural steel, which will be installed as work of other sections:

a. Anchors and anchor bolts for connection of structural steel to concrete or masonry.

b. Loose lintels for support of masonry.

B. Related Work Specified Elsewhere:

1. Concrete Formwork: Section 03100

2. Steel Joists: Section 05210

3. Metal Decking: Section 05310

4. Metal Fabrications: Section 05500

1.02 QUALITY ASSURANCE

A. Reference Standards (Current Editions):

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".

2. AISC "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design".

3. RCSC "Specification For Structural Joints Using ASTM A325 or A490 Bolts".

4. SSPC/AISC "Guide to the Shop Painting of Structural Steel".

5. ASTM A123 "Zinc (Hot Galvanized) Coating on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip."

6. AISC "Specification For Architecturally Exposed Structural Steel".

B. Source Quality Control: Secure mill test certificates for all rolled structural steel furnished.

C. Welding: Ensure that welding on the project is performed only by welders holding certificates issued by a recognized engineering testing laboratory during the previous twelve month period attesting to their qualifications to perform the required welding, and that the certificates are in their possession whenever they perform welding on the project.

1.03 SUBMITTALS

A. Shop Drawings: Submit shop drawings showing complete information for fabrication and erection of all structural steel items.

1. Drawings shall not contain reproductions of the contract documents.

2. Each submitted drawing shall be complete. No changes or additions shall be made to drawings after submittal except those needed to comply with Contractor's checking or Engineer's review.

B. Mill Test Certificates: Submit certificates for all rolled items of structural steel furnished.

C. Copies: Forward submittals in sufficient copies that Architect may retain two sets of each submittal.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to the site in a timely manner, so that work on the project is uninterrupted.

B. Storage: Store materials for ease of inspection and identification. Keep steel members off the ground, using pallets, platforms or other supports. Protect materials and finishes from deterioration.

C. Handling: Handle steel items in such a manner as to prevent bending or distortion of material or assemblies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with reference standards.

B. General: Comply with reference standards. Note special requirements for architecturally exposed structural steel items.

C. Angles, Plates and Bars: ASTM A36, except as noted.

D. Rolled Steel Shapes all wide-flange and WT: ASTM A992 (ASTM A572, Grade 50 is acceptable as substitute for A992).

E. Structural Tubing: ASTM A500, Grade B.

F. Steel Pipe: ASTM A53 Type E or S, Grade B.

G. High-Strength Steel Bolts: ASTM A325, with suitable nuts and washers.

H. Other Bolts: ASTM A307, Grade A, Hex, with matching nuts and washers.

I. Welded Headed Anchors: Carbon steel, as manufactured by Nelson, KSM or Blue Arc.

J. Welding Electrodes: E70 Series.

j. Structural Steel Primer paint: Provide primers compatible with the final coating systems.

   a. Exterior: Zinc-rich urethane primer
   b. Interior: Alkyd-phenolic primer
   c. Galvanized: Polyamide-epoxy or modified alkyd-phenolic coasting

k. Galvanizing Repair Paint: Use a high zinc dust content paint for regalvanizing welds in galvanized steel, compatible with intended coasting system; manufactured by ZRC Products Company, Tnemec, or Southern Coatings.

l. Galvanizing: Provide a hot dip zinc coating for those items shown or specified to be galvanized, as follows:

   a. ASTM A153 for galvanizing iron and steel hardware
   b. ASTM A123 for galvanizing rolled, and pressed, and forged steel shapes, plates, bars and strip 1/8" thick and heavier
   c. ASTM A386 for galvanizing assembled steel products

2.02 FABRICATION

A. General: Comply with reference standards.

B. General: Comply with reference standards. Note special requirements for architecturally exposed structural steel items.

C. Connections:

   1. Use welded or high-strength bolted shop connections, unless otherwise noted.

   2. Return all fillet welds 1/2" at each end.

3. Make high-strength bolted connections bearing type, with bolt threads in shear planes and bolts fully tensioned, unless otherwise noted.

4. Frame beam connections with double angles or single plates, unless otherwise noted. Develop the end reactions shown on the drawings. If not shown, develop the end reaction due to the maximum allowable uniform load for the given length of beam, assuming full lateral support.

5. One-sided or eccentric connections are not permitted, unless specifically shown.

D. Cuts: Provide 1" radius at corners of re-entrant cuts, where possible.

E. Grinding: Grind all cut edges to remove burrs.

F. Camber: Fabricate beams with residual camber up.

G. Welded Headed Anchors: Install using manufacturer's automatic welding equipment.

H. Lintels: Exterior wall lintels exposed to view shall be hot-dip galvanized after fabrication. Conform to ASTM A123.

PART 3 - EXECUTION

3.01 ERECTION

A. General: Comply with reference standards.

B. General: Comply with reference standards. Note special requirements for architecturally exposed structural steel items.

C. Site Inspection: Inspect site prior to erection. Verify that conditions affecting erection are satisfactory. Do not start erection until unsatisfactory conditions are corrected.

D. Field Connections: High-strength bolted bearing type, with bolt threads in shear planes and bolts fully tensioned by the "Turn-of-Nut" method, unless otherwise noted.

E. Bolts: Anchor bolts and other bolts connecting structural steel to other work shall conform to ASTM A307, except as noted.

F. Cutting: Do not field-cut steel without written approval of the Architect.

G. Field Painting:

1. Remove loose weld slag and clean all connections, defective paint and rusted areas.

2. Spot prime with same paint and to same thickness as shop coat.

H. Galvanizing Repair: Repair damaged galvanized finishes by grinding to bright metal and coating with zinc rich primer. Comply with manufacturer's directions.

3.02 FIELD QUALITY CONTROL

A. Testing Agency: The Owner will engage an independent engineering testing laboratory to inspect and test high strength bolted and welded connections during fabrication and erection and to submit reports of findings. Welding inspectors shall be qualified as AWS Certified Welding Inspectors in accordance with AWS QC1. The following will be performed as a minimum.

B. Testing Agency: Engage and pay for the services of a recognized engineering testing laboratory to inspect and test high strength bolted and welded connections during fabrication and erection and to submit reports of findings. Welding inspectors shall be qualified by AWS Certified Welding Inspectors in accordance with AWS QC1. The following shall be performed as a minimum.

1. Verification that welding is being performed only by welders holding proper certificates of qualifications in accordance with AWS D1.1 for the types and positions of welds they are making.

2. Visual inspection of all bolted connections in accordance with RCSC Specifications.

3. Visual inspection of all welded connections.

4. Interpreting and reporting of results of inspections and tests, including extent of deviations, to the Engineer within 24 hours of completion of inspection or test.

5. Reinspection or retesting of corrections of all deficiencies found.

C. Cooperation: Provide access for testing agency to perform testing and inspection during fabrication and erection. Cooperate fully to expedite this work.

D. Correction of Deficiencies: Correct all deficiencies found during inspections and testing, and pay for reinspections and retesting to verify adequacy of corrective measures.

END OF SECTION 05120

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this Section.

1.01 DESCRIPTION

A. Work Included:

1. Fabricate, deliver and erect steel joists as shown on the drawings, with suitable bridging.

2. Fabricate and deliver joist bearing plates, seats, anchors, and bridging anchorages. These will be installed as work of other sections.

B. Related Work Specified Elsewhere:

1. Concrete Formwork: Section 03100

2. Structural Steel: Section 05120

3. Steel Joist Girders: Section 05215

4. Metal Decking: Section 05300

5. Metal Fabrications: Section 05500

1.02 QUALITY ASSURANCE

A. Reference Standards (Current Editions):

1. SJI "Standard Specifications for Open Web Steel Joists, K-Series".

2. SJI "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series".

3. SJI "Recommended Code of Standard Practice for Steel Joists and Joist Girders".

4. AISC "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design".

5. SSPC/AISC "Guide to the Shop Painting of Structural Steel".

B. Fabricator Qualifications: Fabricator shall be a member company of the Steel Joist Institute.

C. Specialty Engineer: Fabricator shall furnish the services of a Specialty Engineer, who shall be a Florida Registered Structural Engineer. Specialty Engineer shall supervise the custom designing of joists and bridging to fit dimensions, load requirements and conditions shown on the drawings. He shall also supervise the preparation of shop drawings for the joist systems.

1.03 SUBMITTALS

A. Shop Drawings:

1. Prepare shop drawings showing complete information for fabrication and erection of steel joists. Identify the specific project , list the design criteria and show all necessary joist location information and details.

2. Submit prints of shop drawings in sufficient quantity that Architect may retain two (2) sets of each submittal.

3. Shop drawings shall bear the signature and impressed seal of the Specialty Engineer.

4. Drawings shall not contain reproductions of the contract drawings.

5. Each submittal drawing shall be complete. No changes or additions shall be made to drawings after submittal except those needed to comply with Contractor's checking or Engineer's review.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to the site in a timely manner, so that work on the project is uninterrupted.

B. Storage: Store materials for ease of inspection and identification. Keep steel members off the ground, using pallets, platforms or other supports. Protect materials and finishes from deterioration.

C. Handling: Handle steel items in such a manner as to prevent bending or distortion of material or assemblies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with reference standards.

B. Welded Headed Anchors: As manufactured by Nelson, KSM or Blue Arc.

2.02 FABRICATION

A. General: Comply with reference standards, except as otherwise specified.

B. Joist Components: Use only hot-rolled steel shapes and round bars.

C. Ceiling Extensions: Extend bottom chords as required for support of ceilings.

D. Camber: Camber joists the amounts shown in the tables of the reference standards.

E. Open Web Joist Bottom Chords: Use double angles.

F. Joist Bearings: For joists which will slope longitudinally more than 1/4 inch in 12 inches after erection, provide ends with level bearings.

G. Bridging Members: Use hot-rolled angles.

H. Welded Headed Anchors: Install using manufacturer's automatic welding equipment.

I. Shop Painting: Use red oxide conforming to SSPC 15-68T.

PART 3 - EXECUTION

3.01 ERECTION

A. General: Comply with reference standards, and with details shown on the drawings, unless otherwise specified.

B. Site Inspection: Inspect site prior to erection. Verify that conditions affecting erection are satisfactory. Do not start erection until unsatisfactory conditions are corrected.

C. Open Web Joist Bridging: Use horizontal bridging. Provide at least 1" of 1/8" fillet weld at each connection.

D. Field Painting:

1. After erection, remove loose weld slag and clean all connections, defective paint and rusted areas.

2. Spot-prime joists with same material as shop coat.

3. Paint bridging and bridging anchors with same material as joist shop coat.

END OF SECTION 05210

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this Section.

1.01 DESCRIPTION

A. Work Included: Fabricate, deliver and erect metal floor and roof decking, as shown on the drawings, or herein specified.

B. Related Work Specified Elsewhere:

1. Cast-in-place Concrete: Section 03300

2. Structural Steel: Section 05120

3. Steel Joists: Section 05210

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a member company of the Steel Deck Institute (SDI).

B. Reference Standards (Current Editions):

1. SDI "Specifications And Commentary for Steel Roof Deck."

2. SDI "Specifications And Commentary For Composite Steel Floor Deck".

3. AISI "Light Gage Cold-Formed Steel Design Manual".

4. SDI "Diaphragm Design Manual"

1.03 SUBMITTALS

A. Manufacturer's Data: Manufacturer's specifications and installation instructions for each type of deck to be furnished.

B. Shop Drawings: Erection drawings of all decking showing positioning of sheets and erection details.

1. Drawings shall not contain reproductions of the contract drawings.

2. Each submitted drawing shall be complete. No changes or additions shall be made to drawings after submittal except those needed to comply with Contractor's checking or Engineer's review.

3. Forward submittals in sufficient copies that Architect may retain two (2) sets of each submittal.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Roof Deck:

1. Conform to reference standards.

2. Type: See Structural Drawings.

3. Shop Finish: Galvanized. Conform to ASTM A525, Class G90.

4. Ridge and Valley Plates: 20-gage, supplied by deck manufacturer. Finish same as deck sheets.

B. Welding Electrodes: E70 Series.

C. Weld Washers: As supplied by deck manufacturer.

PART 3 - EXECUTION

3.01 ERECTION

A. Site Inspection: Inspect site prior to erection. Verify that conditions affecting erection are satisfactory. Do not start erection until unsatisfactory conditions are corrected.

B. Steel Roof Deck:

1. Conform to reference standards.

2. Install continuous over at least 2 spans. For single spans, use double sheets.

3. Attachment: See Structural Drawings.

4. Install ridge and valley plates wherever slope exceeds 1/2-inch per foot.

END OF SECTION 05310

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this Section.

1.01 DESCRIPTION

A. Work Included: Labor, materials and equipment to design and complete load bearing lightgage metal stud systems as shown on the drawings, or herein specified.

1.02 QUALITY ASSURANCE

A. Reference Standards (Current Editions)

1. ASTM Standards referenced herein.

2. AISI "Specification for the Design of Cold-Formed Steel Structural Members".

3. AWS "Code for Welding in Building Construction, D1.0".

B. Specialty Engineer: Furnish the services of a Specialty Engineer who shall be a Florida Registered Structural Engineer. Specialty Engineer shall supervise the custom designing of load bearing stud systems to fit the dimensions, load requirements and conditions shown on the drawings, and shall supervise the preparation of shop drawings for the systems.

C. Fabrication and Erection: Systems shall be fabricated and erected by personnel experienced in lightgage steel construction.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product information and installation instructions for each item of lightgage framing and accessories.

B. Shop Drawings:

1. Submit placing drawings for framing members showing size and gage designations, number, type, location and spacing. Indicate supplemental strapping, bracing, splices, accessories, and details required for proper installation. Drawings shall be signed and sealed by the Specialty Engineer.

2. Drawings shall not contain reproductions of the contract drawings.

3. Each submitted drawing shall be complete. No changes or additions shall be made to drawings after submittal except those needed to comply with contractor's checking or Engineer's review.

C. Design Calculations: Submit complete design calculations for load bearing stud systems. Computer printouts may be substituted for manual calculations, if they are accompanied by identified design assumptions, input data and output data sufficient to permit their proper evaluation. Calculations shall be signed and sealed by the Specialty Engineer, as an indication that he understands the intent of the Structural Engineer of record, that he has used the specified criteria, and that he has accepted responsibility for the results.

1.04 DELIVERY, STORAGE AND HANDLING

A. Components: Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.

PART 2 - PRODUCTS

2.01 METAL FRAMING

A. System Components: Manufacturer's standard C-shaped load bearing steel studs of type, size, shape and gage as shown. With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, bracing and accessories as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system.

B. Materials and Finishes:

1. Fabricate metal framing components of corrosion resistant steel sheet conforming to ASTM A-446, and having yield strengths of 40,000 PSI for studs and 33,000 PSI for runners.

2. Provide galvanized finish to metal framing components complying with ASTM A-525 for minimum G 60 coating.

C. Cold Galvanizing Compound: "ZRC Cold Galvanizing Compound", by ZRC Chemical Products, or accepted substitute.

2.02 FABRICATION

A. General: Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.

B. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting or screw fasteners, as standard with manufacturer.

1. Wire tying of framing components is not permitted.

C. Fabrication Tolerances: Fabricate units to a maximum allowable tolerance variation from plumb, level and true to line of 1/8 inch in 10 feet.

PART 3 - EXECUTION

3.01 INSTALLATION

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

B. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24" O.C. spacing for nail or power-driven fasteners, nor 16" O.C. for other types of attachment. Provide fasteners at corners and ends of tracks.

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

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

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

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

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

2. Frame both sides of expansion and control joints, as shown for wall system, with a separate stud. Do not bridge the joint with components of stud system.

3. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 4'-6" O.C. Weld at each intersection.

G. Field Painting: Touch up shop applied protective coatings damaged during handling and installation. Use compatible primer for prime coated surface. Use cold galvanizing compound for galvanized surfaces, applied in strict accordance with manufacturer's instructions.

END OF SECTION 05400

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Steel framing and supports for overhead doors.
   2. Steel framing and supports for countertops.
   3. Steel framing and supports for mechanical and electrical equipment.
   4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   5. Shelf angles.
   6. Steel weld plates and angles for casting into concrete not specified in other Sections.
   7. Structural-steel shapes for door frames.
   8. Metal bollards.
   9. Supports for TV mounting brackets.

B. Products furnished, but not installed, under this Section include the following:

   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.03 SUBMITTALS

A. Product Data: For the following:
   1. Paint products.
   2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.
   3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

1.04 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1.06 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.03 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1 for use with Type 304, and Alloy Group 2 for use with Type 316.

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Machine Screws: ASME B18.6.3.

F. Plain Washers: Round, ASME B18.22.1.

G. Lock Washers: Helical, spring type, ASME B18.21.1.

H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 for use with Type 304, and Alloy Group 2 for use with Type 316 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.04 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

C. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.05 PAINT

A. Shop Primers: Provide primers compatible with the final coating systems.

1. Exterior: Zinc-rich urethane primer.
2. Interior: Alkyd-phenolic primer.
3. Galvanized: Polyamide-epoxy or modified alkyd-phenolic coating.

2.06 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.07 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

C. Galvanize miscellaneous framing and supports in exterior walls, non-conditioned spaces and elsewhere as indicated.

D. Prime remaining framing and supports.

2.08 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels in exterior walls, non-conditioned spaces and elsewhere as indicated.

D. Prime remaining loose steel lintels.

2.09 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles in exterior walls, non-conditioned spaces and elsewhere as indicated.

D. Prime remaining shelf angles.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates located in exterior walls, in nonconditioned spaces and elsewhere as indicated, after fabrication.

C. Prime remaining plates.

2.11 STRUCTURAL-STEEL DOOR FRAMES

A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together. Plug-weld built-up members and continuously weld exposed joints.

1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

B. Galvanize steel frames located in exterior wall and when either side is exposed to non-conditioned space.

C. Prime remaining frames.

2.12 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize miscellaneous steel trim located in exterior walls, non-conditioned spaces and elsewhere as indicated.

D. Prime plates remaining miscellaneous steel trim.

2.13 METAL BOLLARDS

A. Fabricate metal bollards from galvanized Schedule 40 steel.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

A Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
3. Galvanized Items: Solvent clean.

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

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

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.03 INSTALLING PIPE BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.04 ADJUSTING AND CLEANING

A Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05521
PIPE RAILINGS AND
PROTECTIVE GUARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Steel pipe railings.
2. Protective guards at Apparatus Bay.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain railings and guards through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings and guards by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings and guards without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.07 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.02 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Castings: Either gray or malleable iron, unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

2.03 FASTENERS

A. General: Provide the following:

1. Steel Railings and Guards: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring items to other types of construction indicated and capable of withstanding design loads.

2.04 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 Section: "Painting."

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating.

2.05 FABRICATION

A. General: Fabricate railings and guards to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings and guards in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings and guards with welded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form changes in direction as follows:

1. As detailed or by bending or flush bends.

J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails and guards, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing and guard members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings and guards to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings or guards. Coordinate anchorage devices with supporting structure.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in the same piece are not acceptable.

C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings and guards.

2.07 STEEL AND IRON FINISHES

A. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements of recommended SSPC surface preparation specifications and environmental exposure conditions of installed railings and guards.

C. Apply shop primer to prepared surfaces of railings and guards, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings and guards accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and guards and for properly transferring loads to in-place construction.

3.03 RAILING AND GUARD CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing and guard components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.04 ANCHORING RAILING AND GUARD ENDS

A. Anchor railing and guard ends to concrete and masonry with round flanges connected to ends and anchored to wall construction with anchors and bolts.

3.05 ATTACHING HANDRAILS AND GUARDS TO WALLS

A. Attach handrails and guards to wall with wall brackets as indicated, and to provide 1-1/2-inch clearance from inside face of handrail and finished wall surface.

B. Fabricate protective guards bent to fit flat against the wall or column at both ends and to fit around ducts, pipes and other items, with 2-inch clearance between item and protective guard. Drill each end for two 3/4-inch anchor bolts.

C. Use type of bracket indicated, or if not indicated, with flange tapped for concealed anchorage to threaded hanger bolt or with predrilled hole for exposed bolt anchorage.

D. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

E. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For steel-framed gypsum board partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.06 PROTECTION

A. Protect finishes of railings and guards from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

Division 6
Wood and Plastics

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Wood blocking.
2. Plywood backing panels.

1.03 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. RIS - Redwood Inspection Service.
4. SPIB - Southern Pine Inspection Bureau.
5. WCLIB - West Coast Lumber Inspection Bureau.
6. WWPA - Western Wood Products Association.

1.04 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:

a. Ammoniacal, or amine, copper quat (ACQ).
b. Ammoniacal copper citrate (CC).
c. Copper azole, Type A (CBA-A).

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches above grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated lumber and plywood are indicated, use materials impregnated with fire-retardant chemicals by a pressure process or other means acceptable to authorities having jurisdiction to produce products with the following fire-test-response characteristics:

1. Flame-spread index of not greater than 25 when tested according to ASTM E 84.
2. Flame-spread index of not greater than 25 when tested according to ASTM E 84 with test continued for a period of 30 minutes with no evidence of significant progressive combustion. Flame front shall not progress more than 10-1/2 feet (3.2 m) beyond centerline of burner at any time during test.

B. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.

C. Interior, Low-Hygroscopic-Type, Fire-Retardant Treatment: Formulation that results in treated material with an apparent moisture content of not more than 28 percent when tested according to ASTM D 3201 at 92 percent relative humidity.

D. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber and plywood from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

E. Kiln-dry material after treatment to levels required for untreated material. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

2.04 DIMENSION LUMBER

A. Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

2.05 MISCELLANEOUS LUMBER

A. Provide lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Mixed southern pine; SPIB.
2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
3. Eastern softwoods; NELMA.
4. Northern species; NLGA.
5. Western woods; WCLIB or WWPA.

C. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.06 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4 inch thick.

2.07 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material (interior locations): Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material (exterior locations): Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 2306.1, "Fastening Schedule," in the Standard Building Code.

E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

F. Blocking and Nailer Installation:

1. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
2. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

G. Plywood Backing Panels: Nail or screw to supports.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2 Plastic-laminate cabinets.
3. Plastic-laminate countertops.
4. Shop finishing interior woodwork.

1.03 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated, including] [cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples for Verification: For the following:

1. Exposed cabinet hardware and accessories, two of each type and finish.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm experienced in production of architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for specified grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide AWI Quality Certification Program certificate indicating that woodwork complies with requirements of grades specified.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.07 PROJECT CONDITIONS

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

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.08 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 PRODUCT MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering high pressure decorative laminates which may be incorporated into the Work include, but are not limited to, the following:

1. Formica Corp.
2. International Paper; Decorative Products Div.
3. Laminart.
4. Pioneer Plastics Corp.
5. Westinghouse Electric Corp.; Specialty Products Div.
6. Wilsonart International; Div. of Premark International, Inc.

2.02 MATERIALS

A. Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Softwood Plywood: DOC PS 1, Medium Density Overlay.
3. Hardwood Plywood: HPVA HP-1.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

D. Adhesive for Bonding Plastic Laminate: As recommended by manufacturer and fabricator.

2.03 CABINET HARDWARE AND ACCESSORIES

A. Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Provide Type 2 (institutional) stainless steel complying with Satin Stainless Steel: BHMA 630.

D. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

E. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings and nylon roller, BHMA A156.9, B05091, and rated for the following loads:

1. Box Drawer Slides: 75 lbf.

2.04 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.05 FABRICATION, GENERAL

A. Interior Woodwork: Provide interior woodwork complying with the referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Factory cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of water resistant coating.
2. Provide a continuous preservative pressure treated wood base for all cabinetwork. Refer to Division 6 Section: Rough Carpentry for acceptable preservative materials and processes.
3. Provide plywood substrates for floor based cabinetwork in Kitchen areas and in cabinets within 24 inches of sinks, water heaters and dishwashers.

2.06 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Grade: Custom.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

E. Wood Species and Cut: Red oak, plain sliced.

2.07 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.

B. Grade: Custom.

C. AWI Type of Cabinet Construction: Flush overlay.

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
    a. Provide materials for Architect's selections from laminate manufacturer's full range of colors and finishes.
    b. Horizontal Surfaces Other than Tops: GP-50, 0.050-inch (1.270-mm) nominal thickness.
    c. Postformed Surfaces: PF-42, 0.042-inch (1.067-mm) nominal thickness.
    d. Vertical Surfaces: GP-28, 0.028-inch (0.711-mm) nominal thickness.
    e. Edges: GP-50, 0.050-inch (1.270-mm) nominal thickness.

E. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other than Drawer Bodies: High-pressure decorative laminate, Grade GP-28, except as otherwise indicated.
2. Cabinet lining: FL-20 (.020 in. nominal thickness).
3. Panel Backing: BK 20 (.020 in. nominal thickness).
4. Drawer Sides and Backs: Shop finished solid hardwood lumber, or thermoset decorative overlay.
5. Drawer Bottoms: Shop finished solid hardwood lumber, or thermoset decorative overlay.

F. Cabinet Wood Base: Provide preservative pressure treated continuous wood base for all base cabinets.

2.08 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.

B. Grade: Custom.

C. High-pressure decorative laminate complying with the following:

1. Grade: GP-50, 0.050-inch nominal thickness.
2. Grade: PF-42, 0.042-inch nominal thickness.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Provide materials for Architect's selections from manufacturer's full range of colors and finishes.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

2.09 SHOP FINISHING

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:

1. Grade: Custom.
2. AWI Finish System TR-4: Conversion varnish, or
3. AWI Finish System TR-5: Catalyzed vinyl lacquer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

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

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

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

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Except when hanging cleats are approved, fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c.

G. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

Division 7
Thermal and Moisture Protection

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Two-component, unmodified latex-rubber waterproofing.

1.03 PERFORMANCE REQUIREMENTS

A. Provide waterproofing membrane that prevents the passage of water.

1.04 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

D. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

E. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.

1. Do not apply waterproofing in rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.08 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer and Installer agreeing to repair or replace waterproofing that does not comply with requirements or that does not remain watertight within specified warranty period.

1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate that exceed 1/16 inch (1.6 mm) in width.
2. Warranty Period: Five years after date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Two-Component, Unmodified Latex-Rubber Waterproofing:

a. W. R. Grace & Co.; Procor, or approved equal.

2.02 WATERPROOFING MATERIALS

A. Provide waterproofing materials recommended by manufacturer to be compatible with one another and able to develop bond to substrate under conditions of service and application, as demonstrated by waterproofing manufacturer based on testing and field experience.

1. Produce waterproofing materials suitable for application to vertical, horizontal, and sloped substrates, as applicable.
2. Provide waterproofing materials with not less than 90 percent solids.

B. Cold Fluid-Applied Waterproofing: Comply with ASTM C 836, with manufacturer's written physical requirements, and as follows:

1. Two-component, unmodified latex-rubber waterproofing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage or overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

3.03 PREPARATION AT TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves according to ASTM C 898 and manufacturer's written instructions.

B. Prime substrate, unless otherwise instructed by waterproofing manufacturer.

C. Apply a double thickness of waterproofing and embed a joint reinforcing strip in preparation coat when recommended by waterproofing manufacturer.

1. Provide sealant cants around penetrations and at inside corners of deck-to-wall butt joints when recommended by waterproofing manufacturer.

3.04 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 898 and waterproofing manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

1. Comply with ASTM C 1193 for joint-sealant installation.
2. Apply bond breaker between sealant and preparation strip.
3. Prime substrate and apply a single thickness of preparation strip extending a minimum of 3 inches (75 mm) along each side of joint. Apply a double thickness of waterproofing and embed a joint reinforcing strip in preparation coat.

3.05 WATERPROOFING APPLICATION

A. Apply waterproofing according to ASTM C 898 and manufacturer's written instructions.

B. Start installing waterproofing in presence of manufacturer's technical representative.

C. Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.

1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases, with an average dry film thickness of 60 mils (1.5 mm) and a minimum dry film thickness of 50 mils (1.3 mm) at any point.
2. Apply waterproofing to prepared wall terminations and vertical surfaces.
3. Verify wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).

3.06 CURING, PROTECTING, AND CLEANING

A. Cure waterproofing according to manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Concealed and exposed building insulation except insulation for roof decks under metal roofing and under exterior metal wall siding panels.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.01 INSULATING MATERIALS

A. Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Faced Mineral-Fiber Blanket Insulation: ASTM C665, Type II (kraft-faced), Class C, Category 1. In addition to where indicated for other installations, install paper side up, above ceiling materials in conditioned spaces. Minimum R value =19.

C. Unfaced, Mineral-Fiber Blanket Insulation: Thermal insulation combining fibers of glass, slag wool, or rock wool with thermosetting resins to comply with ASTM C 665, Type I (blankets without membrane facing).

D. Exterior Wall Thermal Insulation System (except under exterior metal wall siding):

1. Insulation Board: Rigid extruded closed cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process using HCFCs as blowing agents, complying with ASTM C 578, Type IV (1.60 lb/cu. ft.), or Type X, (1.30 lb/cu. ft.). Insulation under exterior metal wall siding is specified in Division 7 Section 07610: "Metal Roofing and Wall Siding."

a. Thermal Resistance: Minimum R-Value of insulation based on minimum aged R Value of 5.0 per inch (per 5 year testing).
b. Water absorption: Max. 0.1 % by volume (ASTM C 272).
c. Surface Burning Characteristics: Flame spread: 5; Smoke developed: 165.
d. Minimum total thickness: 2 inches

2.02 AUXILIARY INSULATING MATERIALS AND FASTENERS

A. Adhesive for Bonding Board Type Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates and as recommended by insulation manufacturer.

1. Acceptable Manufacturers / Products:

a. ChemRex, Inc. - "Contech Brands PL300 Foam Board Adhesive."
b. ChemRex, Inc. - "Contech Brands Premium Foam Board Adhesive."
c. Dacar Products, Inc. - "Foamgrab PS" or approved equal.

B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

2. Spindle: Copper-coated, low carbon steel, fully annealed, 0.105 inch in diameter, length to suit depth of insulation indicated.

C. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulations, including removing projections capable of puncturing or interfering with insulation attachment.

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness. At ceiling areas comply with the following:

1. Above gypsum board:
    a. Friction fit between framing members at areas indicated.
    b. Do not block air passages at outside air vents.

c. Maintain minimum clearances at heat-producing devices such as recessed lighting fixtures, ballasts, and HVAC equipment in accord with fixture/equipment manufacturer recommendations and as directed by Architect. Provide baffles or similar restraining devices to maintain clearances.

2. Above acoustic tile ceilings:

a. Size batts to match tile panels.
b. Cover entire space as indicated with side and end joints firmly abutted.
c. Maintain clearances as indicated or specified.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

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

C. Install mineral-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.
3. For metal-framed 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.
4. Set faced units with facing to exterior side of construction. Do not obstruct ventilation spaces, except for firestopping and smoke sealing. Tape joints and ruptures in facing, and seal each continuous area of insulation to surrounding construction.

D. Z-Furring Members:

1. Erect board insulation vertically and hold in place with Z-furring members spaced maximum 24 inches o.c., except maximum 16 inches o.c. when supporting shelving, wall cabinets, or other wall mounted equipment.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

E. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

3.05 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes factory formed custom-fabricated, field assembled, standing-seam, sheet metal roofing.

B. Roof system includes, but is not limited to, metal pans and support framing, rigid insulation, waterproofing underlayment, soffit panels, trim, closures, gutters and downspouts, fasteners and accessories.

1. Metal standing seam roof system is to be installed over structural metal roof deck and roof framing specified in other Sections.
2. Soffit panels are to be installed over cold formed metal framing specified in other Sections.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide specified sheet metal roofing and wall systems capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of components including supports, or permanent damage to fasteners and anchors.

1. Wind loads shall be determined by the more restrictive of the following using the appropriate factors and coefficients. Wind load pressures shall be computed and applied using the design wind speed indicated.

   a. ASCE 7-98
   b. Florida Building Code – Design Wind Speed 130 mph

B. Thermal Movements: Provide sheet metal systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal roofing thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Infiltration: Provide sheet metal systems that do not allow water infiltration to building interior, with metal flashing and connections of sheet metal lapped to allow moisture to run off the material.

1.04 SUBMITTALS

A. Product Data: For each product indicated. Include details of construction relative to materials, dimensions of individual components and profiles, and finishes. Include data for roof insulation and waterproofing underlayment.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, wall panel and soffit system, including plans, elevations, and keyed references to termination points. Distinguish between shop- and field-assembled work. Include the following:

1. Details for forming sheet metal roofing, and soffits, including seams and dimensions.
2. Details for joining and securing sheet metal systems, including layout of fasteners, clips, and other attachments. Include pattern of seams.
3. Details of termination points and assemblies, including fixed points.
4. Details of expansion joints, including showing direction of expansion and contraction.
5. Details of roof penetrations.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Details of the following accessory items, at a scale of not less than 1-1/2 inches per 12 inches:

    a. Flashing, trim and related accessories.
    b. Roof curbs.
    c. Gutters and downspouts

C. Engineering calculations: Provide calculations for the systems to be installed that bear the seal and signature of Structural Engineer registered in the State of Florida.

D. Coordination Drawings: Roof plans drawn to scale and indicating coordinating penetrations and roof-mounted items. Show the following:

1. Sheet metal roofing, and attachments.
2. Roof purlins and rafters.
3. Metal roof deck, roof insulation and waterproofing underlayment.
4. Roof-mounted items including roof equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.

E. Samples for Initial Selection: For each type of sheet metal roofing required along with Samples of manufacturer's full range of factory-applied color finishes available.

1. Include similar Samples of trim and accessories involving color selection.

F. Samples for Verification: For each product and type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Roofing: 12 inches long by actual panel width of each, including color finish and finished seam. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Roof Insulation.
4. Waterproofing underlayment.
5. Accessories: 12-inch- long Samples for each type of accessory.

G. Qualification Data: For installer and fabricator.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sheet metal roofing portable roll-forming equipment. Include reports for structural performance.

I. Warranties: Sample of Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of sheet metal roofing.

B. Custom-Fabricated Sheet Metal Roofing Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.

C. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockup of typical roof eave, including fascia, and soffit as shown on Drawings; approximately 48 inches square by full thickness, including attachments, waterproof roof underlayment, roof insulation and accessories.

E. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to sheet metal roofing including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, sheet metal roofing and wall panel Installer, and manufacturer's representative. Installer, and installers whose work interfaces with or affects roofing and siding work,

including installers of roof insulation, underlayment, roof accessories, roof-mounted equipment, sheathing and waterproofing membrane.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to roofing and siding installation
4. Examine metal deck and roof insulation conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of metal deck and structural framing during and after roofing.
6. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal roofing.
7. Examine support conditions for compliance with requirements, including alignment between and attachment to substrates and supports.
8. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
9. Review temporary protection requirements for roofing and siding during and after installation.
10. Review roof observation and repair procedures after roofing and siding installation.
11. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, underlayment, sheet metal roofing pans, related roofing and materials so as not to be damaged or deformed. Package sheet metal roofing and wall panel materials for protection during transportation and handling.

B. Unload, store, and erect materials in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roofing to ensure dryness. Do not store sheet metal roofing in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

1.07 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section "Roof Accessories."

B. Coordinate sheet metal roofing with rain drainage work, gutters, downspouts, flashing, trim, and construction of metal decks, insulation, underlayment, sheathing, and other adjoining work to provide leakproof, secure, and noncorrosive installations.

1.08 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Installer's Warranty: Installer's warranty, on warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of custom-fabricated metal roofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Loose parts.
c. Wrinkling or buckling.
d. Failure to remain weathertight, including uncontrolled water leakage.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
f. Galvanic action between metal roofing and dissimilar materials.

2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ROOFING SHEET METALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Surface: Smooth, flat finish.

3. Thickness: Minimum 0.0217 inch, unless otherwise indicated.
4. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings:
    a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
        1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:
            a) Humidity Resistance: 2000 hours.
        2.) Color: 'Bemo' – Surrey Beige with Orange Peel Finish
5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.02 ROOF UNDERLAYMENT MATERIAL

A. Self-Adhering, High-Temperature Sheet: 40 mils thick minimum, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
    1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
    2. Low Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
    3. Products:
        a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "HR" High Performance Roofing Underlayment.
        b. Grace, W. R. & Co.; Vycor Ultra.
        c. Henry Company; Perma-Seal PE.
        d. Metal-Fab Manufacturing, LLC; MetShield.
        e. TC MiraDRI; WIP 300HT.

B. Slip Sheet: Building paper, minimum 5 lb/100 sq. ft., rosin sized.

2.03 INSULATION MATERIALS

A. Provide insulating materials under roofing that comply with requirements and with referenced standards.
    1. Preformed Units: Sizes to fit applications and thicknesses indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: Rigid, closed cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process using HCFCs as blowing agents, complying with ASTM C 578, Type VI, 1.8-lb/cu. ft. minimum density.

1. Minimum total thickness: As indicated on Drawings.(Provide in two layers, of equal thickness.
2. Approved Manufacturers: Extruded-Polystyrene Board Insulation:

   a. Amoco Foam Products Company.
   b. DiversiFoam Products.
   c. Dow Chemical Co.
   d. UC Industries, Inc.; Owens-Corning Co.

2.04 METAL ROOFING ACCESSORIES AND RELATED COMPONENTS

A. Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated.

1. Closures: Provide closures at eaves, ridges and terminations, fabricated of same metal as sheet metal roofing.
2. Clips: Minimum 0.0625-inch- thick, stainless-steel panel clips designed to withstand negative-load requirements.
3. Cleats: Mechanically seamed cleats formed from the following material:

   a. Metallic-Coated Steel Roofing: Minimum 0.0250-inch- thick, stainless-steel or nylon-coated aluminum sheet.

4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. Closures: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from minimum 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent sheet metal roofing.

C. Gutters: Formed from minimum 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced maximum 36 inches o.c., fabricated from same metal as gutters. Provide bronze,

copper, or aluminum wire ball strainers at outlets. Finish gutters to match sheet metal roofing

D. Downspouts: Formed from minimum 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10-foot- long sections, complete with formed elbows and offsets. Finish downspouts to match sheet metal roofing.

E. Roof Pipe Flashing: Premolded, EPDM pipe collar (sleeves) with flexible aluminum ring bonded to base.

2.08 FABRICATION

A. Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate metal roofing, soffit panels and accessories at the shop to greatest extent possible.

1. Standing-Seam Roofing: Form standing-seam pans with finished seam height of 1-1/2 inches .

B. Fabricate metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.

1. Lay out metal roofing so cross seams, when required, are made in direction of flow with higher pans overlapping lower pans. Stagger cross seams.
2. Fold and cleat eaves and transverse seams in the shop.
3. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required for leakproof construction.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant (concealed within joints).

D. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.

F. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to

design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.09 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, sheet metal roofing and wall panel supports, and other conditions affecting performance of work.

1. Examine metal roof deck to verify that it is properly supported by framing or blocking and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made flashings, and penetrations through sheet metal roofing.

B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before sheet metal roofing installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Install flashings, fasciae, trim, accessories and other sheet metal to comply with roofing manufacturer's requirements.

3.03 INSULATION INSTALLATION

A. Install roof insulation with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt boards together.

1. Secure insulation system to deck below with piercing or self-drilling, self-tapping fasteners. Engage fasteners by driving them through insulation into top flange of steel deck. Use driving method prescribed by fastener manufacturer. Insulation joints parallel to ribs of deck shall occur on solid bearing surfaces only, not over open ribs.

B. Cut insulation to fit tight against blocking or penetrations.

3.04 ROOF UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on insulation under sheet metal roofing. Apply over entire roof in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

B. Apply slip sheet over underlayment before installing sheet metal roofing.

3.05 METAL ROOFING, AND SOFFIT PANEL INSTALLATION

A. Install sheet metal roofing and wall siding perpendicular to supports. Anchor roofing, siding and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required for complete roofing and siding systems and as recommended by fabricator.

1. Field cutting of sheet metal by torch is not permitted.

2. Rigidly fasten eave end of sheet metal roofing and allow ridge end free movement due to thermal expansion and contraction. Predrill roofing.
3. Provide metal closures at indicated or required locations.
4. Flash and seal roofing and siding with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install ridge caps as sheet metal roofing work proceeds.
7. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.
8. Lap metal flashing over roofing and siding to allow moisture to run over and off the material.

B. Fasteners: Use fasteners of sizes that will not penetrate completely through substrate.

1. Steel Roofing, and Soffit Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing and siding, or manufacturers of dissimilar metals.

D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

E. Eave Edging and Fascia: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

F. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges, unless otherwise indicated.

1. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
2. Secure cleats not more than 12 inches o.c.

G. Seal joints as shown and as required for leakproof construction. When required at roof, provide low-slope transverse seams using cleats where backup of moisture may occur.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust

setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Provide expansion cleats in roof panels that exceed 30 feet in length.

I. Standing-Seam Roofing: Attach standing-seam metal roof pans to framing with cleats, securely fastened at spacing required by design.

1. Install roof pans reaching from eave to ridge before moving to adjacent pans.
2. Lock each pan to adjacent pan. Before pans are locked, apply continuous bead of sealant to top flange of lower pan. Crimp standing seams by folding over twice so cleat and pan edges are completely engaged.
3. Loose-lock pans at eave edges to continuous cleats and flanges on back edges of gutters.

J. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Securely install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

3.06 ACCESSORY INSTALLATION

A. Install accessories with positive anchorage to building and weathertight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete roofing and siding system assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using

manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspout to direct water away from building or, when indicated, tie downspouts to underground drainage system indicated.

E. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing and siding. Fasten and seal to sheet metal as recommended by manufacturer.

3.09 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet on slope and location lines; wall siding 1/4 inch in 20 feet nonaccumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.10 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films, if any, as roofing and siding is installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

C. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.11 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner.>
2. Address: <Insert address.>
3. Building Name/Type: <Insert information.>
4. Address: <Insert address.>
5. Area of Work: <Insert information.>
6. Acceptance Date: <Insert date.>
7. Warranty Period: <Insert time.>
8. Expiration Date: <Insert date.>

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speeds exceeding 3 second durations of 130 mph;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing and Siding Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing and siding failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature.>
2. Name: <Insert name.>
3. Title: <Insert title.>

END OF SECTION

SECTION 07842
FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes firestopping and smokesealing for the following:

1. Through-penetrations of fire-resistance-rated construction including both empty openings and openings containing cables, pipes, ducts, conduits, structural members, and other penetrating items.
2. Membrane-penetrations of fire-resistance-rated construction including both empty openings and openings containing cables, pipes, ducts, conduits, structural members, and other penetrating items.
3. Joints in fire-resistance-rated construction, including floor-to-floor, wall-to-wall, floor-to-wall and head-of-wall joint systems.
4. Openings of, and annular spaces of, through- and membrane-penetrations in smoke barriers and other compartmentalized areas.
5. Construction, control and expansion joints of, and perimeters of, smoke barriers and other compartmentalized areas.

1.03 REFERENCES

A. ASTM E-814 "Test Method for Fire Tests of Through-Penetration Fire Stops".

B. UL 2079 "Standard for Tests for Fire Resistance of Building Joint Systems".

C. FM 4991 "Standard for Approval of Firestop Contractors"

1.04 DEFINITIONS

A. Firestopping: The combination of materials utilized to restore the integrity of an assembly identified with an hourly rating.

B. Smokesealing: The combination of materials utilized to restore the integrity of an assembly identified as a smoke barrier.

C. Through-Penetration: The incident in which a penetrating item passes entirely through any assembly identified either with an hourly rating or as a smoke barrier; i.e. breaching both sides of the assembly.

D. Membrane-Penetration: The incident in which a penetrating item passes into or exits from any assembly identified either with an hourly rating or as a smoke barrier; i.e. entering into or exiting from only one side of the assembly.

E. Joint: The abutment of or gap between two or more assemblies. Either one or both of the assemblies may be identified either with an hourly rating or as a smoke barrier. The assemblies may be either parallel or perpendicular to each other. These include floor-to-floor, wall-to-wall, floor-to-wall, head-of-wall, or any other linear breach of the assembly(ies).

1.05 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide systems that are produced and installed to resist the spread of fire and the passage of smoke and other gases according to requirements indicated, and to restore integrity of assembly.

1. For systems subject to movement, provide products that will remain flexible to allow for such movement without affecting the integrity of the system when exposed to movement.
2. For systems exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
3. For systems for items subject to binding, eg fire or smoke dampers, provide non-intumescent type products.

B. F-Rated Penetration Firestop Systems: Provide penetration firestop systems with F ratings determined per ASTM E 814, not less than that of the construction penetrated.

C. T-Rated Penetration Firestop Systems: Provide penetration firestop systems with T ratings, in addition to F ratings, determined per ASTM E 814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas.

D. Joint Firestop Systems: Provide joint firestop systems with fire-resistance ratings determined per UL 2079, not less than that of the construction in which the joint occurs.

1. Where movement is required or can be anticipated, joint firestopping system must be listed as a dynamic joint, with movement capabilities equal to those of the in-service conditions.

E. Materials offered for horizontal applications shall be capable of self-supporting any penetrating item and shall maintain their integrity when tested in horizontal applications.

1.06 SUBMITTALS

A. Schedule identifying conditions to be firestopped and smokesealed. Include type of construction, orientation, type and size of penetrant, type and size of joint, and methods to accomplish firestopping and smokesealing.

1. One axis of schedule shall identify each assembly to be firestopped or smokesealed and its' rating (i.e., 1 hour cmu wall). Second axis of schedule shall identify each penetrant or joint to be firestopped or smokesealed (i.e., 4" cast iron pipe – insulated). Intersection point between both axes of schedule shall identify design designations from qualified testing and inspecting agency proposed to accomplish firestopping and smokesealing (i.e., C-AJ-5102).

B. Product data and copies of listings or test reports. Cross reference each to schedule.

1. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular condition, submit illustration approved by manufacturer's fire protection engineer with modifications marked and signed engineering opinion letter stating basis for modifications.

C. Qualification data for firm and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, and dates (month/year); names and phone numbers of Architects and Owners; products installed at each listed project; and other information specified.

1. Include letter from manufacturers of products specified, wherein manufacturer recognizes as trained or approved, or certifies, firm and persons for installation of that manufacturer's products.
2. Copy of Factory Mutual's Approved Firestop Contractor certificate, if applicable.

D. Identification label.

E. Certification affidavit.

1.07 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics:

1. Firestopping tests performed by a qualified nationally recognized independent testing and inspecting agency performing testing and follow-up inspection services for firestopping that is recognized by the Council of American Building Officials and is acceptable to authorities having jurisdiction.
2. Penetration firestopping identical to that tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the firestopping surrounding the penetrating items in the test assembly.

3. Joint firestopping identical to that tested per UL 2079 under conditions where all components of each joint system, including splices, are exposed to a positive furnace pressure differential. For tests of floor-to-floor, floor-to-wall and head-of-wall joint systems, the average furnace pressure shall be measured at 12 inches below the exposed horizontal surface of the test assembly. For tests of wall-to-wall joint systems, the average furnace pressure shall be measured at the elevation of the midheight of the exposed vertical surface of the test assembly. After the initial 10 minutes of fire exposure, the furnace pressure for the respective joint systems shall not be less than 0.01 inch of water for an aggregate time period exceeding 10 percent of the fire exposure for fire tests of 1 hour or less duration, 7.5 percent of the fire exposure for fire tests longer than 1 hour but not longer than 2 hours and 5 percent of the fire exposure for fire tests exceeding 2 hours.

B. References to specific design designations of firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed alternate systems equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

C. Installer Qualifications: A single experienced Installer who is trained, certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements and who has specialized in installing firestopping systems similar in material, design, and extent to those indicated for this Project. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1. All firestopping and smokesealing products, regardless of the Section in which their use is specified or drawing on which their use is indicated, are to be installed by a single installer.

D. Technical Advice: Provide technical advice from material manufacturer's lab and technical department on materials and assemblies as required. For through- or membrane-penetrations and assemblies proposed but not yet tested provide an Engineering Opinion, in writing on manufacturer's letterhead signed by a qualified person and bearing his title, with copies to the Architect. Engineering Opinions shall be based on approval tests from recognized independent testing agency.

E. Pre-Installation Conference: Prior to preparation for and installation of materials to be used as firestops and smokeseals convene a pre-installation conference at project site with the Contractor, installer, affected subcontractor(s), material supplier(s), and Architect. Review Contract Document requirements, submittals, status of coordinating work, availability of materials and installation facilities, proposed installation schedule, safety and handling requirements, requirements for inspections and testing or certifications, proposed installation procedures and protection requirements for construction period extending beyond installation. Record discussion; furnish copy of recorded discussions to each participant.

F. Field-Constructed Mockup: Prior to installing firestopping and smokesealing, erect mockups for each different system to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final installations.

1. Locate mockups on site in locations indicated or, if not indicated, as directed by Architect.
2. Identify mockups as specified under the "Field Quality Control" article.
3. Notify Architect 1 week in advance of the dates and times when mockups will be erected.
4. Obtain Architect's acceptance of mockups before start of final unit of Work.
5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.

    a. When directed, demolish and remove mockups from Project site.
    b. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

G. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that systems are installed per specified requirements.

1. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate systems.

1.08 CERTIFICATIONS

A. Contractor shall provide the following notarized affidavit jointly signed by corporate officers, with titles noted, of both the Contractor and installer

"we the undersigned certify that firestops and smokeseals have been installed in accordance with Contract Document requirements and manufacturer's instructions, and that materials used meet firestopping and smokesealing requirements of the Contract Documents".

B. Manufacturer shall provide the following certification, executed by the appropriate person, with title and department noted:

"Products provided by (manufacturer) for the (name of project) are composed of the same ingredients and formulation or are of the same components and identical construction as products that have been tested by (the testing agency) for various fire resistive and other performance ratings, and when properly applied or installed in accordance with (manufacturer) instructions will perform in a manner consistent with results obtained in the tests conducted by (the testing agency)".

1.09 SEQUENCING AND SCHEDULING

A. Schedule installation of penetration firestopping and smokesealing after completion of penetrant installation but prior to covering or concealing of openings. Schedule installation of joint firestopping and smokesealing after completion of adjacent assemblies, but prior to covering or concealing of joints.

B. Do not cover up those firestopping and smokesealing installations that will become concealed behind other construction until authorities having jurisdiction have examined each installation.

1.10 PRECEDENCES

A. Order of precedences: Firestopping, smokesealing, acoustical/sound rating, other requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. A/D Fire Protection Systems, Inc.
2. Bio Fireshield / The Rectorseal Corporation.
3. Hilti, Inc.
4. Grace / International Protective Coatings Corp.
5. Isolatek International.
6. Nelson Firestop Products / O - Z Gedney.
7. NMP Corp.
8. Specified Technologies Inc.
9. Thermal Ceramics.
10. 3M Fire Protection Products.
11. Tremco Inc.
12. Unifrax.

2.02 MATERIALS

A. Firestopping and Smokesealing: Provide systems composed of components that are compatible with each other, the substrates forming openings or joints, and the items, if any, penetrating the system under conditions of service and application, as demonstrated by system manufacturer based on testing and field experience. Provide systems of one or more of the following types:

1. Ceramic-Fiber Mastic Coating and Sealant: Single-component formulation of ceramic fibers and inorganic binders.

2. Collar: Factory-manufactured device consisting of a metal restricting collar housing a molded intumescent insert.
3. Endothermic Latex Compound Sealant: Single-component, endothermic, latex formulation.
4. Intumescent Latex Mastic Sealant: Single-component, intumescent, latex formulation.
5. Intumescent Polyurethane Foam Block: Pliable soft foam shaped block, intumescent formulation.
6. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
7. Intumescent Wrap Strip: Flexible elastomeric strip, intumescent. May be used in conjunction with a surface mounted restricting collar.
8. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.
9. Pillow/Bag: Re-usable, heat-expanding pillow/bag composed of a glass-fiber cloth or plastic case filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
10. Silicone Sealant: Single-component, moisture-curing, silicone-based, neutral-curing elastomeric sealant, self-leveling and nonsag as appropriate.

B. Identification: Provide pressure-sensitive, self-adhesive, preprinted vinyl identification labels for firestopping and smokesealing systems, minimum 2 inch by 3 inch . Identification shall include:

1. Condition:

    a. For penetration firestops, "Rated Penetration Firestop System - Do Not Disturb".
    b. For joint firestops, "Rated Joint Firestop System - Do Not Disturb".
    c. For smokeseals, "Smokeseal System - Do Not Disturb".
    d. For all, "Notify Building Management of any damage".

2. System designation issued by the qualified testing and inspecting agency, and the name of the qualified testing and inspecting agency.
3. System manufacturer's name.
4. Contractor's name, address, and phone number.
5. Installer's name, address, and phone number.
6. Date of installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordination: Sequence work to avoid need for removal of firestopping and smokesealing by work of other trades.

B. Preparation: Clean out openings and joints immediately prior to installing firestopping and smokesealing. Prime substrates where recommended by manufacturer.

C. Install forming/damming materials and other accessories of types required to support firestopping during application and in the position needed to produce the cross-sectional shapes and depths required to restore fire-resistance-rated construction. After installing firestopping and smokesealing, remove combustible forming materials and other accessories not listed as permanent components of system.

D. Install firestopping by proven techniques to restore fire-resistance-rated construction.

E. Install materials in both fire rated and smoke barrier assemblies with sufficient pressure to properly fill and seal openings to ensure an effective cold smokeseal.

3.02 FIELD QUALITY CONTROL

A. After installation, identify firestopping and smokesealing systems at locations where each is installed. Attach labels permanently to surfaces of adjacent construction on both sides of each system installation where labels will be visible to anyone seeking to disturb the installation or adjacent construction.

B. Inspect completed firestopping and smokesealing for compliance with requirements, and issue written letter to Architect and Owner stating such.

C. Do not proceed to cover or enclose firestopping and smokesealing with other construction until reports of examinations are issued.

D. Where deficiencies are found, repair or replace firestopping and smokesealing so that it complies with requirements.

3.03 CLEANING AND PROTECTION

A. Clean off excess materials adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of systems and of products in which opening and joint occurs.

B. Protect firestopping and smokesealing during and after installation from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping and smokesealing immediately and install new materials to produce systems complying with specified requirements.

3.04 PENETRATION AND JOINT FIRESTOP SCHEDULE

A. A combination of multiple details may be necessary to address a specific job condition, such as multiple or differing penetrants through a single opening or a head-of-wall joint with a penetration of the wall or horizontal assembly.

B. The following basic system references are not intended to be exhaustive or exclusive. System numbers are from UL for convenience only.

C. Blank Opening:

1. CMU: CAJ0004, CAJ0009, CAJ0011, CAJ0012, CAJ0014, CAJ0015, CAJ0033, CAJ0040, CAJ0041, CAJ0043, CAJ0050, CAJ0051, CAJ0053, CAJ0054, CAJ0055, CBJ0009.
2. GWB: WL0001, WL0005.

D. Metallic Pipe, Conduit or Tubing:

1. CMU: CAJ1001, CAJ1003, CAJ1031, CAJ1044, CAJ1079, CAJ1205, CAJ1213, CAJ1224, CAJ1226, CAJ1234, CAJ1235, CAJ1262.
2. GWB: WL1001, WL1029, WL1030, WL1049, WL1054, WL1085, WL1089, WL1090, WL1091, WL1094, WL1105, WL1113, WL1115.

E. Flexible Metal Conduit:

1. CMU: CAJ1052, CAJ1079, CAJ1176, CAJ1242.
2. GWB: WL1017, WL1046, WL1049.

F. Metal Pipe, Conduit or Tubing, With Cables:

1. CMU: CAJ3015, CAJ3016, CAJ3089, CAJ3093, CAJ3128, CAJ8001, CAJ8046.
2. GWB: WL3005, WL3025, WL3032, WL3065, WL3088, WL8008.

G. Non-Metallic Pipe, Conduit or Tubing – Plastics:

1. CMU: CAJ2001, CAJ2082, CAJ2088, CAJ2109, CAJ2124, CAJ2149, CAJ2163, CAJ2171, FA2024, WJ2040.
2. GWB: WL2002, WL2038, WL2059, WL2070, WL2071, WL2078, WL2083, WL2133.

H. Non-Metallic Pipe, Conduit or Tubing – Glass:

1. CMU: CAJ1032, CAJ2079, CAJ2118, CAJ2144.
2. GWB: WL2112, WL2114.

I. Electrical Cables – No Sleeve:

1. CMU: CAJ3003, CAJ3016, CAJ3030, CAJ3035, CAJ3043, CAJ3068, CAJ3083, CAJ3095, CAJ3103, CAJ3116.
2. GWB: WL3011, WL3026, WL3030, WL3044, WL3060, WL3064, WL3065, WL3076, WL3087.

J. Electrical Cables – Metal Sleeve:

1. CMU: CAJ3002, CAJ3030, CAJ3095, CAJ3116, CAJ3128, WJ3030.
2. GWB: WL3005, WL3025, WL3032, WL3065, WL3072, WL3088, WL3106.

K. Electrical Cables – Non-Metallic Sleeve:

1. CMU: CAJ2162, CAJ2163, CAJ3030, CBJ3003.
2. GWB: Submit.

L. Cable Trays:

1. CMU: CAJ4010, CAJ4023, CAJ4027, CAJ4029, CAJ4032, CAJ4035, CAJ4037, CAJ4038, CAJ8049, WJ4012.
2. GWB: WL4001, WL4003, WL4004, WL4008, WL4010, WL4011, WL4012, WL4017.

M. Insulated Metallic Pipe, Conduit or Tubing:

1. CMU: CAJ5001, CAJ5058, CAJ5080, CAJ5082, CAJ5088, CAJ5089, CAJ5091, CAJ5099, CBJ5008.
2. GWB: WL5014, WL5029, WL5033, WL5039, WL5040, WL5050, WL5060, WL5065, WL5066, WL8007.

N. Insulated Non-Metallic Pipe, Conduit or Tubing – Plastics:

1. CMU: CAJ5022, CAJ5042, CAJ5106.
2. GWB: WL2002, WL5054.

O. Insulated Non-Metallic Pipe, Conduit or Tubing – Glass:

1. CMU: CAJ5103.
2. GWB: WL5051.

P. Miscellaneous Electrical Penetrants:

1. CMU: CAJ6011, CAJ8001, CAJ8055.
2. GWB: WL8002, WL8003, CLIV, UL Report 94NK15324.

Q. Miscellaneous Mechanical Penetrants:

1. CMU: CAJ7005, CAJ7008, CAJ7009, CAJ7010, CAJ7013, CAJ7016, CAJ7027, CAJ7030, CAJ7036, WJ7001, WJ7002, WJ7003.
2. GWB: WL7003, WL7006, WL7007, WL7008, WL7009, WL7010, WL7011, WL7022.

R. Multiple Mixed Penetrants:

1. CMU: CAJ1140, CAJ3123, CAJ4010, CAJ8001, CAJ8012, CAJ8013, CAJ8042, CAJ8046, CAJ8049, CAJ8052, CAJ8053, CAJ8055, CAJ8056, CAJ8057, CAJ8059, WJ8004.
2. GWB: CAJ8003, WL1031, WL1127, WL4017, WL8002, WL8003, WL8004, WL8007, WL8008, WL8010, WL8013.

S. Floor-to-Floor Joints, Dynamic:

1. Concrete: FFD1001, FFD1004, FFD1005.

T. Wall-to-Wall Joints, Dynamic:

1. Concrete, Masonry: WWD1002, WWD1004.
2. Frame: Submit.

U. Floor-to-Wall Joints, Dynamic:

1. Concrete-Concrete/Masonry: FWD0002, FWD1001, FWD1003, FWD1004.
2. Concrete-Frame: Submit.

V. Head-of-Wall Joints, Dynamic:

1. Concrete/Masonry – Concrete: HWD0006, HWD0007, HWD0008, HWD0017, HWD0022, HWD1001.
2. Frame – Concrete: HWD0003, HWD0010, HWD0011, HWD0015, HWD0016, HWD0019, HWD0020.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes, but is not limited to, sealants for the following applications and those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

    a. Construction joints (control and expansion) in cast-in-place concrete.
    b. Joints between plant-precast architectural concrete units.
    c. Control and expansion joints in concrete unit masonry and brick in veneer.
    d. Joints between different materials listed above.
    e. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    f. Control and expansion joints in ceiling and overhead surfaces.
    g. Other joints as indicated or required.

2. Exterior joints in the following horizontal traffic surfaces:

    a. Isolation and contraction joints in cast-in-place concrete slabs.
    b. Tile control and expansion joints.
    c. Joints between different materials listed above.
    d. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Tile control and expansion joints.
    d. Vertical joints on exposed surfaces of interior unit masonry, concrete walls and partitions.
    e. Perimeter joints between interior wall surfaces and frames of interior doors.

f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
g. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated.

1.03 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

D. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.03 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Multicomponent Nonsag Neutral-Curing Silicone Sealant:

1. Products:

a. Dow Corning Corporation; 756 H.P.
b. Other approved equivalent.

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, and ceramic tile.

E. Single-Component Neutral-Curing Silicone Sealant:

1. Products:

    a. Dow Corning Corporation; 799.
    b. GE Silicones; UltraGlaze SSG4000.
    c. GE Silicones; UltraGlaze SSG4000AC.
    d. Polymeric Systems Inc.; PSI-631.
    e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
    f. Tremco; Proglaze SG.
    g. Tremco; Spectrem 2.
    h. Tremco; Tremsil 600.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and ceramic tile.

F. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

1. Products:

    a. Pecora Corporation; 898.
    b. Tremco; Tremsil 600 White.
    c. Or approved equal.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and ceramic tile.

2.04 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Products:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
c. Or approved equal.

2.05 PREFORMED JOINT SEALANTS

A. Preformed Silicone-Sealant System: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. Products:

a. Dow Corning Corporation; 123 Silicone Seal.
b. GE Silicones; UltraSpan US1100.
c. Pecora Corporation; Sil-Span.
d. Tremco; Spectrem Ez Seal.

B. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:

1. Products:

a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
b. illbruck Sealant Systems, Inc.; Wilseal 600.
c. Polytite Manufacturing Corporation; Polytite B.
d. Polytite Manufacturing Corporation; Polytite Standard.
e. Sandell Manufacturing Co., Inc.; Polyseal.

2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.

a. Density: Manufacturer's standard.

2.06 PREFORMED TAPE SEALANTS

A. Back-Bedding Mastic Tape Sealant: Preformed, butyl-based elastomeric tape sealant with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Tape Sealant: Closed-cell, PVC foam tape sealant; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for applications in which tape acts as the primary sealant.
2. Type 2, for applications in which tape is used in combination with a full bead of liquid sealant.

2.07 JOINT-SEALANT BACKING

A. Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330. Provide any type approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.08 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or joint-sealant-substrate tests prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

    1. Do not leave gaps between ends of sealant backings.
    2. Do not stretch, twist, puncture, or tear sealant backings.
    3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

    1. Place sealants so they directly contact and fully wet joint substrates.
    2. Completely fill recesses in each joint configuration.
    3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

G. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

H. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.04 FIELD QUALITY CONTROL

A. EXAMINATION / INSPECTION

1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
2. Inspect tested joints and report on the following:

   a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.

b. Whether sealants filled joint cavities and are free from voids.
c. Whether sealant dimensions and configurations comply with specified requirements.

3. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements. Costs for retests and resultant required work will be paid for by Contractor.

3.05 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

Division 8
Doors and Windows

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Standard steel doors and frames.
2. Sidelight and borrowed light frames
3. Fire-rated door and frame assemblies.
4. Fire-rated window frames.
5. Vision lites in doors.
6. Louvers in doors and door frame transoms.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide exterior metal doors and frames capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of components and supports, or permanent damage to fasteners and anchors.

1. Wind loads shall be determined by the more restrictive of the following using the appropriate factors and coefficients. Wind load pressures shall be computed and applied using the design wind speed indicated by Wind Information located on Drawings.

a. ASCE 7-98.
b. Florida Building Code

1.04 DEFINITIONS

A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.05 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:

1. Elevations of each door design.
2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Coordination of glazing frames and stops with glass and glazing requirements.

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

D. Engineering calculations: Provide calculations for exterior doors, indicating compliance with performance requirements for systems to be installed, that bear the seal and signature of Structural Engineer registered in the State of Florida.

1.06 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

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

1. Test Pressure: Test at atmospheric pressure.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
3. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

C. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

1.08 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of steel doors that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: 7 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Doors and Frames:

a. Amweld Building Products, Inc.
b. Ceco Door Products; a United Dominion Company.
c. Curries Company.
d. Pioneer Industries Inc.
e. Republic Builders Products.
f. Steelcraft; a division of Ingersoll-Rand.

2.02 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A 526, commercial quality, or ASTM A 642, drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60) coating designation, mill phosphatized.

D. Insulating Material: From the following:

1. Exterior: Polyurethane insulation, polystyrene insulation or mineral fiberboard.
2. Sound Doors: Sound attenuating core, of minimum 9 lbs./sq. ft. density.

2.03 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior and Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).
2. Insulate exterior doors.

C. Door Construction: Vertical steel stiffeners.

D. Sound Doors: Provide hardware for doors with an STC rating as part of the tested assembly. Architect will select where multiple items have been tested or approved.

E. Door Louvers (Interior): Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.

1. Sightproof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

F. Door Louvers (Exterior): Provide louvers for exterior doors of welded inverted vee or y type construction providing 50% free area. Reinforce rectangular louver exceeding 18" in width at it's midpoint by a vertical rectangular steel bar at least 1/4" x 1-1/2". Vanes of no less than 12 gage metallic coated sheet and spaced so that no rigid flat instrument can be passed through them. Provide insert screens and/or flattened expanded metal not less than 12 gage on louvers in exterior locations.

G. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.04 FRAMES

A. Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Standard frames of minimum 16 gage for frames less than 42 in. wide, minimum 14 gage for frames over 42 in. wide steel sheet for:

1. Level 3 steel doors.

C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames. Only push-in type are acceptable.

D. Plaster Guards: Provide 0.016-inch- thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

E. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, metallic-coated steel sheet.

1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.05 FABRICATION

A. Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from galvanized steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, galvanized steel channels with channel webs placed even with top and bottom edges. Insulate exterior doors.

C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:

1. Cold-rolled steel sheet unless otherwise indicated.

D. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

E. Clearances for Fire-Rated Doors: As required by NFPA 80.

F. Single-Acting, Door-Edge Profile: Square edge, unless beveled edge is indicated.

G. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

H. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

I. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

J. Sound-Rated (Acoustical) Assemblies: Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested according to ASTM E 1408, and classified according to ASTM E 413.

1. Unless otherwise indicated, provide acoustical assemblies with STC sound ratings of 33 or better.
2. Provide hardware for doors with an STC rating as part of the tested assembly. Architect will select where multiple items have been tested or approved.

K. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

L. Frame Construction: Fabricate frames to shape shown.

1. Fabricate frames with mitered or coped and continuously back welded corners and seamless face joints.
2. Provide welded frames with temporary spreader bars.

M. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

N. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

O. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- thick steel sheet.

1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

P. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.06 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Exterior Installations: Install doors and frames in exterior walls to provide installations that comply with requirements of "Performance Requirements " Article.

C. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
2. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
3. Install fire-rated frames according to NFPA 80.
4. For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.

D. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
2. Smoke-Control Doors: Install to comply with NFPA 105.

3.02 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Solid-core doors with stain-grade wood-veneer faces.
2. Bi-fold and sliding doors, when scheduled.
3. Factory finishing flush wood doors.
4. Factory fitting flush wood doors to frames and factory machining for hardware.
5. Vision lites for flush wood doors.
6. Louvers for flush wood doors.

1.03 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

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

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Louver blade and frame sections, 6 inches long, for each material and finish specified.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors," or AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

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

1. Test Pressure: Test at positive pressure.
2. Oversize, Fire-Rated Wood Doors: When they occur, for door assemblies exceeding sizes of tested assemblies, provide oversize fire door label or certificate of inspection, from a testing and inspecting agency acceptable to authorities having jurisdiction, stating that doors comply with requirements of design, materials, and construction.
3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

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

1.06 PROJECT CONDITIONS

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

1.07 WARRANTY

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

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Flush Wood Doors:

a. Algoma Hardwoods Inc.
b. Buell Door Company.
c. Eagle Plywood & Door Manufacturing, Inc.
d. Eggers Industries; Architectural Door Division.
e. Ideal Wood Products, Inc.
f. IPIK Door Company.
g. Lambton Doors.
h. Marshfield Door Systems, Inc.
i. Oshkosh Architectural Door Co.
j. Vancouver Door Company, Inc.
k. No substitutions.

2.02 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

1. Grade: Custom, with Grade A faces.
2. Species and Cut: Red oak, plain sliced.
3. Match between Veneer Leaves: Slip match.
4. Assembly of Veneer Leaves on Door Faces: Balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

6. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by 10 feet or more.
7. Stiles: Same species as faces or a compatible species.

2.03 SOLID-CORE DOORS

A. Interior Veneer-Faced Doors:

1. Core: Minimum 32 psf density particle board.
2. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

B. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
4. Pairs: Furnish intumescent seals when required by codes, for pairs of fire-rated doors.

2.04 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

1. Blade Type: Vision-proof, inverted V.
2. Metal and Finish: Extruded aluminum with Class II, clear anodic finish complying with AA-C22A31.

B. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.

C. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.05 FABRICATION

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

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

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

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

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

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Louvers: Factory install louvers in prepared openings.

2.06 FACTORY FINISHING

A. Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.

B. Finish doors at factory.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: Manufacturer's standard finish with performance comparable to AWI System TR-6 catalyzed polyurethane, unless directed or approved otherwise.
3. Staining: Match Architect's sample.
4. Effect and sheen: As selected by Architect

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Finish Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

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

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.03 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Non-rated and fire-rated wall access doors and frames.
2. Non-rated and fire-rated ceiling access doors and frames.

1.03 SUBMITTALS

A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

B. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.05 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Access Doors:

a. Acudor Products, Inc.
b. J. L. Industries, Inc.
c. Karp Associates, Inc.
d. Larsen's Manufacturing Company.
e. Milcor Limited Partnership.

2.02 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), with Class C coating and phosphate treatment to prepare surface for painting; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M for uncoated base metal.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

E. Plaster Bead: Casing bead formed from 0.0299-inch zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.03 PAINT

A. Shop Primer for Metallic-Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.04 ACCESS DOORS AND FRAMES

A. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from steel or metallic-coated steel sheet.

1. Locations: Where indicated.
2. Fire-Resistance Rating: As indicated or required for conditions.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch- thick sheet metal with drywall bead or plaster bead.
6. Hinges: Continuous piano hinge.
7. Automatic Closer: Spring type.
8. Latch: Self-latching bolt operated by key with interior release.

B. Flush Access Doors and Trimless Frames: Fabricated from steel or metallic-coated steel sheet.

1. Locations: As indicated.
2. Door: Minimum 0.060-inch- thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- thick sheet metal with drywall bead or plaster bead as required.
4. Hinges: Continuous piano hinge.
5. Latch: Screwdriver-operated cam latch.

2.05 FABRICATION

A. Provide access door assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. For trimless frames with drywall bead for installation in gypsum board assembly, provide edge trim for gypsum board securely attached to perimeter of frames.
2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
3. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction and to attach masonry anchors in masonry construction.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.07 METALLIC-COATED STEEL FINISHES

A. Galvanizing of Steel Shapes and Plates: Hot-dip galvanize items indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pretreating.

2.08 STEEL FINISHES

A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.01 PREPARATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

3.03 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes electrically operated sectional overhead doors.

1.03 DEFINITIONS

A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of components, including supports; or permanent damage to fasteners and anchors.

1. Wind loads shall be determined by the more restrictive of the following using the appropriate factors and coefficients. Wind load pressures shall be computed and applied using the design wind speed indicated by Wind Information located on Drawings.

a. ASCE 7-98.
b. Florida Building Code
c. Wind speed 130 mph.

2. Air Infiltration: Maximum rate not more than indicated, when tested according to ASTM E 283.

a. Maximum Rate: 0.08 cfm at 15 mph.

B. Operation-Cycle Requirements: Provide sectional overhead door components and operators capable of operating for not less than 100,000 cycles.

1.05 SUBMITTALS

A. Product Data: For each type and size of sectional overhead door and accessory. Include the following:

1. Summary of forces and loads on walls and jambs.

2. Motors: Show nameplate data and ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Frame: 6 inches long.
2. Panel: 6 inches square.

E. Qualification Data: For Installer.

F. Engineering calculations: Provide calculations indicating compliance with performance requirements, for doors to be installed, that bear the seal and signature of Structural Engineer registered in the State of Florida.

G. Operation and Maintenance / Training Manual: For Owner' personnel.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer.

1. Obtain operators and controls from sectional overhead door manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of sectional overhead doors and accessories and are based on the specific system indicated. Other manufacturers' systems with equal performance and dimensional characteristics may be considered. Refer to Division 1 Section "Product Requirements."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sectional Door Panel: Furnish one (1) panel for each type and size of sectional door installed in the Project.

1.08 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of sectional overhead doors that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Failure of system to meet performance requirements.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Failure of operating components to function normally.

C. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Steel Doors with non-insulated Steel Panels:
   a. Clopay Building Products Company; Model '524 W5' Basis of Design
   b. Overhead Door Corp.
   c. Ideal Door Corp.
   d. Wayne-Dalton Corp.

2.02 STEEL DOOR SECTIONS

A. Construct door sections including face sheets and frames from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, G90 coating designation.

1. Minimum Base-Metal (Uncoated) Thickness for Section Faces: Minimum 0.053 inch, (18 ga.)
2. Exterior-Section Face: Flat.

B. Fabricate door panels from a single sheet to provide sections not more than 24 inches high. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.

C. Enclose open sections with channel end stiles formed from not less than 0.064-inch-thick galvanized steel sheet and weld end stiles to door section in place. Provide intermediate stiles formed from not less than 0.064-inch- thick galvanized steel sheet, cut to door section profile, and welded in place.

1. Stile Spacing: Not more than 48 inches apart.

D. Reinforce bottom section with a continuous channel or angle complying with bottom-section profile and allowing installation of astragal.

E. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.

F. Provide reinforcement for hardware attachment.

H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

I. Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants.

2. Apply manufacturer's standard primer and baked enamel finish to interior- and exterior-door faces after forming, according to coating manufacturer's written instructions for application, thermosetting, and minimum dry film thickness.

a. Color and Gloss: Custom color to match Architect's selection.

2.03 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's heavy duty 3" galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653/A 653M for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced at 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

1. Provide tracks configured for the following lift types:

a. High lift.

B. Track Reinforcement and Supports: Galvanized steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

1. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

a. Repair galvanized coating on tracks according to ASTM A 780.

C. Weatherseals: Replaceable, adjustable, continuous, compressible full weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of overhead door.

1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
2. Provide continuous flexible seals at door jambs for a weathertight installation.

2.04 HARDWARE

A. Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty galvanized steel hinges of not less than 0.0747-inch- thick, uncoated steel at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.

C. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch- wide track.

1. Tire Material: Case-hardened steel.

D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

E. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

1. Locking Bars: Full-disc cremone type, both jamb sides operable from inside only.
2. Lock cylinder is specified in Division 8 Section "Door Hardware."

F. Chain Lock Keeper: Suitable for padlock.

G. Provide safety interlock switch on power operated doors, to disengage power supply when door is locked.

2.05 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from oil-tempered-steel wire complying with ASTM A 229/A 229M, Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 7 to 1. Provide springs calibrated for a minimum of 100,000 cycles.

B. Cable Drums: Cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.

C. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either cable breaks.

D. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level shaft and prevent sag.

E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.06 ELECTRIC DOOR OPERATORS

A. Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, photoelectric sensor, timer, control devices, integral gearing for locking door, and accessories required for proper operation.

B. Comply with NFPA 70.

C. Disconnect Device: Hand-operated disconnect device or mechanism for automatically engaging chain-and-sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect device and operator so they are accessible from floor

level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70, Class 2 control circuit, maximum 24-V, ac or dc.

F. Design Basis Door-Operator: Heavy Industrial duty "Model GH - LiftMaster" as manufactured by The Chamberlain Group, Inc. Elmhurst, Illinois, with remote control as specified below. Provide unit consisting of electric motor and the following:

1. Worm Gear Reduction type with quick release for manual operation.

G. Electric Motors: High-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.

1. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
2. Provide totally enclosed, nonventilated or fan-cooled motor, fitted with plugged drain, and controller with NEMA ICS 6, Type 1 enclosure.
3. Motor Starter, Controls, and Enclosure: Motor starter shall be an across the line, mechanically interlocked, magnetic reversing contactor.

H. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Pressure-Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

   a. Provide pneumatically actuated automatic bottom bar.

      1) Self-Monitoring Type: Four-wire configured device.

2. Photoelectric Sensor: Provide manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

I. Limit Switches: Adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

J. Design Basis Radio Control: "Multi-Code Model 1099" Radio Receiver, as manufactured by Stanley, with four (4) radio control units and a manual override button.

1. Provide waterproof multifunction remote control / receiver.

K. Timer: Interlocked with motor control close relay and set to automatically close door at a pre-programmed time. Timer to be interfaced with Photoelectric Sensor and activated when beam is broken.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install door, track, and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

B. Install doors to comply with requirements of Article "Performance Requirements. "

C. Fasten vertical track assembly to framing, spaced not less than 24 inches apart. Hang horizontal track from structural overhead framing with angle or channel hangers fastened to framing by welding or bolting or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.02 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup services.

B. Complete installation and startup checks according to manufacturer's written instructions.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.03 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and with weathertight fit around entire perimeter.

B. Touch-up Painting: Immediately after welding galvanized track to track supports, clean field welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.04 DEMONSTRATION

A. Start-Up Services: Engage a factory-authorized service representative to perform start-up services and to train Owner's maintenance personnel to adjust, operate, and

maintain sectional overhead doors. Refer to Division 1 Section "Demonstration and Training."

1. Test door closing and opening components for proper functioning.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and replacing component devices.
3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
1. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
2. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Exterior aluminum entrance, storefront and window systems.

1.03 PERFORMANCE REQUIREMENTS

A. Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Wind and structural loads.
2. Thermal movements.
3. Dimensional tolerances of building frame and other adjacent construction.
4. Failure includes the following:

   a. Air infiltration and water penetration exceeding specified limits.
   b. Deflection exceeding specified limits.
   c. Thermal stresses transferred to building structure.
   d. Noise or vibration created by wind and thermal and structural movements.
   e. Loosening or weakening of fasteners, attachments, and other components.
   f. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
   g. Sealant failure.
   h. Failure of operating units to function properly.

B. Sealant Compatibility: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. Provide sealant that fails cohesively before sealant releases from substrate when tested for adhesive compatibility with each substrate and joint condition required.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

C. Wind loads shall be determined by the more restrictive of the following using the appropriate factors and coefficients. Wind load pressures shall be computed and applied using the design wind speed indicated by Wind Information located on Drawings.

1. ASCE 7-98
2. Florida Building Code

D. Static-Pressure Test Performance: Provide systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

1. Test Pressure: 150 percent of inward and outward wind-load design pressures.
2. Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.

E. Dead Loads: Provide system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.

F. Live Loads: Provide systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads required without failure of materials or permanent deformation.

G. Air Infiltration: Provide systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft..

H. Water Penetration: Provide systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 10 lbf/sq. ft.. Water leakage is defined as follows:

1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

I. Thermal Movements: Provide systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

J. Structural-Support Movement: Provide systems that accommodate structural movements including, but not limited to, sway and deflection.

K. Dimensional Tolerances: Provide systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.04 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: For entrance,storefront and window systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work. Include engineering data as required by Article "Quality Assurance."

1. For entrance systems, include coordination with hardware schedule and indicate operating hardware types, quantities, and locations.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

E. Qualification Data: For Installer.

F. Engineering calculations: Provide calculations indicating compliance with performance requirements for systems to be installed, that bear the seal and signature of Structural Engineer registered in the State of Florida.

G. Preconstruction Sealant Test Reports: Submit compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants. Include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

H. Field Test Reports: Indicate and interpret test results for compliance with aluminum systems' performance requirements.

I. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing systems similar to those required for this Project and who is acceptable to manufacturer.

1. Engineering Data Responsibility: Prepare data for aluminum systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of system through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 "Product Requirements," Article - Substitutions.

1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by aluminum-framed systems.

1. Test a minimum of five samples of each metal, glazing, and other material.
2. Prepare samples using techniques and primers required for installed systems.
3. For materials that fail tests, determine corrective measures required to prepare each material to ensure compatibility with and adhesion of sealants, including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

E. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.07 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Failure of system to meet performance requirements.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Failure of operating components to function normally.
5. Water leakage through fixed glazing and frame areas.

C. Warranty Period: 3 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. International Aluminum Corporation; U.S. Aluminum. (Design Basis).
2. Arch Aluminum & Glass Co., Inc.
3. Butler Manufacturing Company; Vistawall Architectural Products.
4. EFCO Corporation.
5. Kawneer Company, Inc.
6. YKK AP America Inc.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.03 FRAMING SYSTEM AND RELATED COMPONENTS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

B. Storefront and Window Framing System: Design Basis:

1. EFCO - 2 ½" x 5" Storefront Framing – System 525 (NT)

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

F. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

G. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.04 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.05 DOORS

A. Doors: Provide manufacturer's standard 1-3/4-inch- thick glazed doors for manual swing, with minimum 0.125-inch- thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.

1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
2. Stile Design: Design Basis - United States Aluminum. Series 550 Wide Stile with ADA bottom rail.

2.06 HARDWARE

A. Hardware, as furnished by Division 8 Section "Finish Hardware," for aluminum entrances of this Section, is to be installed by aluminum door manufacturer as part of the work of this Section.

2.07 FABRICATION

A. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

I. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2.08 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Install storefront components and systems in exterior walls to comply with requirements of "Performance Requirements " Article.

C. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

D. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Section 07920: "Joint Sealants."

F. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

G. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

1. Install concealed and surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible. Refer to Section 08710: "Finish Hardware."

H. Install glazing to comply with requirements of Section 08800: "Glazing," unless otherwise indicated.

I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

J. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing indicated.

B. Structural-Silicone-Sealant Adhesion Test: Test installed structural silicone sealant according to field adhesion test method described in AAMA CW #13, "Structural Sealant Glazing Systems (A Design Guide)". Test a minimum of 2 areas.

C. Water-Resistance Test: After completing the installation, test aluminum system according to ASTM E1105 requirements, expanded to test the joint between the aluminum system and adjacent construction.

D. Number of Test Specimens:

1. Windows: One for the first 100 or fraction, plus one additional test for each additional 100 or fraction.

E. Requirements:

1. Water Infiltration: No uncontrolled water shall be present

F. Retesting:

1. Should any of the specimens fail the field test, the specimens may be modified or repaired, and retested.
2. Should any of the specimens fail the second field test, the specimens may be additionally modified or repaired, and retested.
3. All modifications and repairs made to the specimens shall be recorded, and the same modifications and repairs made to all the aluminum systems and adjacent construction on the project.
4. Should the second test fail, the Architect may require two additional windows or bays and their adjacent construction to be tested.

G. Rejection: Failure of any of the specimens to meet the test requirements of the third test shall be cause for rejection of all aluminum systems and adjacent construction on the project.

3.04 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.05 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

B. The work in this Section shall include furnishing of all items of finish hardware as hereinafter specified or obviously necessary to complete the building, except those items that are specifically excluded from this Section of the specification.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Hollow Metal Doors and Frames.
B. Aluminum Doors and Frames.
C. Wood Doors and Frames.

1.04 DESCRIPTION OF WORK

A. Furnish labor and material to complete hardware work indicated, as specified herein, or as may be required by actual conditions at building.
B. Include all necessary screws, bolts, expansion shields, other devices, if necessary, as required for proper hardware application. The hardware supplier shall assume all responsibility for correct quantities.
C. All hardware shall meet the requirements of Federal, Sate and Local codes having jurisdiction over this project, notwithstanding any real or apparent conflict therewith in these specifications.

D. Fire-Rated Openings:

1. Provide hardware for fire-rated openings in compliance with A.I.A. (NBFU) Pamphlet No.80, NFPA Standards No.101, UBC 702 (1997) and UL10C. This requirement takes precedence over other requirements for such hardware. Provide only hardware that has been tested and listed by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.

2. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label indicating Fire Door to be equipped with fire exit hardware and provide UL label on exit device indicating "Fire Exit Hardware".

E. FASTENERS:

1. Hardware as furnished shall conform to published templates generally prepared for machine screw installation.
2. Furnish each item complete with all screws required for installation. Typically, all exposed screw installation.
3. Insofar as practical, concealed type fasteners for hardware units that have exposed screws shall be furnished with Phillips flat head screws, finished to match adjacent hardware.
4. Door closers and exit devices to be installed with closed head through bolts (sex bolts).

1.05 QUALITY ASSURANCE

A. The finish hardware supplier shall prepare and submit to the architect six (6) copies of a complete schedule identifying each door and each set number, following the numbering system and not creating any separate system himself. He shall submit the schedule for review, make corrections as directed and resubmit the corrected schedule for final approval. Approval of schedule will not relieve contractor of the responsibility for furnishing all necessary hardware, including the responsibility for furnishing correct quantities.

B. No manufacturing orders shall be placed until detailed schedule has been submitted to the architect and written approval received.

C. After hardware schedule has been approved, furnish templates required by manufacturing contractors for making proper provisions in their work for accurate fitting, finishing hardware setting. Furnish templates in ample time to facilitate progress of work.

D. Hardware supplier shall have an office and warehouse facilities to accommodate the materials used on this project. The supplier must be an authorized distributor of the products specified.

1.06 DELIVERY, STORAGE AND HANDLING

A. Wrap/protect finished hardware items for shipment. Deliver to manufacturing contractors the hardware items required by them for their application; deliver balance of hardware to job, store in designated location. Each item shall be clearly marked with it's intended location.

1.07 WARRANTY

A. The material furnished shall be warranted for one (1) year after installation, or longer, as the individual manufacturer's warranty permits.

B. Overhead door closers shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship, for a period of ten (10) years commencing on the Date of Final Completion and Acceptance. In the event of failure, the manufacturer is to promptly repair or replace the defective closer with no additional cost to the owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. To the greatest extent possible, obtain each kind of hardware item from only one manufacturer.

B. All numbers and symbols used herein have been taken from the current catalogs of the following manufacturers.

PRODUCT	**SPECIFIED MANUFACTURER**	**ACCEPTABLE SUBSTITUTE**
1) Hinges	Stanley	Hager, McKinney
2) Locks & Latches	Yale	No Substitution
3) Cylinders, Keys, Keying	Yale	No Substitution
4) Exit Devices	Von Duprin	No Substitution
5) Door Closers	LCN	Corbin-Russwin
6) OH Stops/Holders	Glynn Johnson	Rixson
7) Wall Stops, Floor Stops, Flush bolts	Ives / Trimco	Glynn Johnson, Rockwood
8) Kick Plates/Pulls	Trimco	Ives, Rockwood
9) Lock Guards	Don-Jo	Ives, Glynn Johnson
10) Thresholds, Weatherstrip	Pemko	Reese, National Guard
11) Key Cabinet	Key Control	Telkee, Lund

C. If material manufactured by other than that specified or listed herewith as an equal is to be bid upon, permission must be requested from the architect seven (7) days prior to bidding. If substitution is allowed, it will be so noted by addendum.

2.02 HINGES

C. Exterior Butts shall be Stainless Steel. Butts on all out swinging doors shall be furnished with non-removable pins (NRP).

D. Interior Butts shall be as listed.

E. Doors 5' or less in height shall have two (2) butts. Furnish one (1) additional butt for each 2'6" in height or fraction thereof.

F. All hinges shall be the ball bearing type.

2.03 CYLINDERS AND KEYING

A. All locks and cylinders shall be removable core, six (6) pin, Yale, keyed to the existing Yale system.

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

C. Key Material: Provide keys of nickle silver only.

D. Key Quantity: Furnish three (3) change keys for each lock; five (5) master keys for each master key system; five (5) grand master keys for each grand master key system; and twelve (12) construction master keys.

1. Deliver all permanent keys and key blanks to the Owner's representative.

E. Visual Key Control: Stamp the key set symbol on the key bow ONLY of all the cut keys.

2.04 LOCKSETS

A. Locksets shall be mortise type with two piece hinged, anti-friction, 3/4 " throw stainless steel latchbolt; YALE 8800 series, CRR design.

B.

1. Acceptable Substitutions:

   a) No substitution. Owner preference.

   b) Locks & Latches shall comply with NFPA 101, 2003 Ed. SEC. 7.2.1.5

2.05 EXIT DEVICES

A. All devices shall be Von Duprin 99 Series in types and functions specified. All devices must be listed under "Panic Hardware" in accident equipment list of Underwriters Laboratories. All labeled doors with "Fire Exit Hardware" must have labels attached and be in strict accordance with Underwriters Laboratories. Where lockable lever trim is specified, use Von Duprin 994L Break Away Trim.

1. Acceptable Substitutions:

   a) No substitution. Owner preference..

2.06 DOOR CLOSERS

A. All closers shall be LCN 4041 EDA series having non-ferrous covers, forged steel arms, separate valves for adjusting back check, closing and latching cycles and adjustable spring to provide up to 50% increase in spring power. Closers shall be furnished with parallel arm mounted on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing wherever wall conditions permit. Furnish with non-hold open arms unless otherwise indicated.

B. Door closer cylinders shall be of high strength cast iron construction to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory.

C. It will be the Hardware Supplier's responsibility to furnish the correct arms and brackets required to mount the closers on the proper side of the opening.

1. Acceptable Substitutions:

   a) Corbin-Russwin DC2210 series.

2.07 TRIM AND PLATES

A. Kick plates, mop plates and armor plates shall be .050 gauge with US32D finish. Kick

plates to be 8" high, mop plates to be 4" high. All plates shall be two (2) inches less full width of door.

B. Push plates, pull plates, door pulls and miscellaneous door trim shall be shown in the hardware schedule.

2.08 DOOR STOPS

A. Door stops shall be furnished for all doors to prevent damage to doors or hardware from striking adjacent walls or fixtures. Furnish floor or wall stops as required and/or as specified in the hardware schedule.

2.09 THRESHOLDS AND WEATHERSTRIP

A. Thresholds and weatherstrip shall be as listed in the hardware schedule.

2.10 DOOR SILENCERS

A. Furnish rubber door silencers equal to Glynn Johnson GJ64 for all new interior hollow metal frames, two (2) per pair and three (3) per single door frame.

2.11 KEY CONTROL SYSTEM

A. Furnish a complete key control system, sufficient for number of keys in project plus 150%.

2.12 HARDWARE FINISHES

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

B. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

1. Butts - Exterior	US32D - stainless steel
2. Butts - Interior	US26D - on brass or steel as indicated in schedule
3. Locks	US26D

4.	Push/Pull/Kick Plates	US32D
5.	Closers	AL - sprayed aluminum
6.	Door Stops & Miscellaneous	US26D or US32D
7.	Overhead Holders	US32D or US26D
8.	Thresholds & Weatherstripping	A - clear aluminum
9.	Latch Guards	US32D - stainless steel

PART 3 - EXECUTION

3.01 DELIVERIES

A. General: Stockpile all items sufficiently in advance to ensure their availability and make all necessary deliveries in a timely manner to ensure orderly progress of the total work.

3.02 INSTALLATION

A. All hardware shall be applied and installed in accordance with the Finish Hardware Schedule. Care should be exercised not to mar or damage adjacent work.

B. Contractor to provide a secure lock-up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items that are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses both before and after installation.

C. No hardware is to be installed until the hardware manufacturers have provided a pre-installation class. This is to insure proper installation of the specified products.

3.03 ADJUSTING AND CLEANING

A. Contractor shall adjust all hardware in strict compliance with manufacturer's instructions. Prior to turning project over to Owner, contractor shall clean and make any final adjustments to the finish hardware.

3.04 PROTECTION

A. Contractor shall protect the hardware, as it is stored on construction site in a covered and dry place.

B. Contractor shall protect exposed hardware installed on doors during the construction phase.

3.05 HARDWARE SCHEDULE

A. The following schedule is furnished for whatever assistance it may afford the contractor. Do not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware group, provide door or item with hardware the same as required for similar purposes. Quantities listed are for each pair of doors or for each single door.

HW 1

DOORS: 100, 131, 131C
EACH TO HAVE:

3	HINGES	FBB199 4.5 X 4.5 NRP	US32D
1	LOCK	CRE8822FL	US26D
1	LATCH GUARD	CLP110	US32D
1	CLOSER	PA4041 CUSH x110 DEGREE STOPxTBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	STOP	BUILT INTO CLOSER ARM	
1	THRESHOLD	2548A X LAR	AL
1	SET WEATHERSTRIP	S88D (HEAD & JAMBS)	
1	SILL SWEEP	3452CNB	
1	DOOR SHOE	314CN X LAR	
1	RAIN DRIP	346C X (OPENING + 4")	

HW 2

DOORS: 100A
EACH TO HAVE:

3	HINGES	FBB179 4.5 X 4.5	US26D
1	LOCK	CRE8807FL	US26D
1	CLOSER	PA4041 EDA X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	FLOOR STOP	FS436	US26D
3	SILENCERS	SR64	

HW 3

DOORS: 102
EACH TO HAVE:

3	HINGES	FBB179 4.5 X 4.5	US26D
1	PRIVACY LOCK	CRE8802FL	US26D
1	CLOSER	4041 X DEL X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	FLOOR STOP	FS436	US26D
3	SILENCERS	SR64	

HW 4

DOORS: 102A, 128, 129
EACH TO HAVE:

3	HINGES	FBB179 4.5 X 4.5	US26D
1	LOCK	CRR8822FL	US26D
	(NOTE: KEY ON TOILET ROOM SIDE OF DRS 102A & 122A)		
1	CLOSER	4041 X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	FLOOR STOP	FS436 (OMIT @ DR 128)	US26D
1	CONCEALED O.H.STOP	104S X 90 DEGREE (DR 128 ONLY)	US32D
3	SILENCERS	SR64	

HW 5

DOORS: 114A, 130A
EACH TO HAVE:

3	HINGES	FBB168 4.5 X 4.5	US26D
1	EXIT DEVICE	98L X 996L-BE X 03 X SNB	US26D
	(NOTE: BLANK ESCUTCHEON OUTSIDE LEVER ALWAYS FREE)		
1	CLOSER	PA4041 EDA X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	FLOOR STOP	FS444	US26D
1	THRESHOLD	2748A X LAR	AL
1	SET PERIMETER SEAL	2891AS (HEAD & JAMBS)	
1	AUTO DOOR BOTTOM	420ASL	
1	SILL SWEEP	315CN X LAR	

HW 6

DOORS: 114, 130

EACH TO HAVE:

3	HINGES	FBB199 4.5 X 4.5 NRP	US26D
1	EXIT DEVICE	98L-F X 996L X 03 X SNB	US26D
1	CYLINDER	1193	US26D
1	CLOSER	PA4040 X S CUSH X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	SPRING STOP	BUILT INTO CLOSER ARM	
1	THRESHOLD	2748A X LAR	AL
1	SET PERIMETER SEAL	2891AS (HEAD & JAMBS)	
1	AUTO DOOR BOTTOM	420ASL	
1	SILL SWEEP	315CN X LAR	

HW 7

DOORS: 108A
EACH TO HAVE:

3	HINGES	FBB191 4.5 X 4.5 NRP	US32D
1	COMBINATION LOCK	MPM X 17	US26D
1	CYLINDER	2196	US26D
1	LATCH GUARD	CLP110	US32D
1	CLOSER	PA4040 X S CUSH X TBMS AL	
1	KICK PLATE	10 X 2" LDW	US32D
1	SPRING STOP	BUILT INTO CLOSER ARM	
1	THRESHOLD	2548A X LAR	AL
1	SET WEATHERSTRIP	S88D (HEAD & JAMBS)	
1	SILL SWEEP	3452CNB	
1	DOOR SHOE	314CN X LAR	
1	RAIN DRIP	346C X (OPENING + 4")	

HW 8

DOORS: 104
EACH TO HAVE:

1	CYLINDER	1193	US26D

NOTES: BALANCE OF HARDWARE BY DOOR SUPPLIER.

HARDWARE SUPPLIER MUST VERIFY TYPE AND FINISH OF CYLINDER REQUIRED WITH DOOR SUPPLIER.

HW 9

DOORS: 103, 103A, 108, 116, 116A, 121, 121A, 121B
EACH TO HAVE:

3	HINGES	FBB179 4.5 X 4.5	US26D
1	PUSH PLATE	1001-3 4 X 16	US32D
1	DOOR PULL	1017-3 4 X 16	US32D
1	CLOSER	4041 OR PA4041 X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	FLOOR STOP	FS436	US26D
3	SILENCERS	SR64	

HW 10

DOORS: 123, 124
EACH TO HAVE:

3	HINGES	FBB179 4.5 X 4.5	US26D
1	PRIVACY LOCK	CRE8802FL	US26D
1	KICK PLATE	10 X 2" LDW	US32D
1	FLOOR STOP	FS438	US26D
3	SILENCERS	SR64	

HW 11

DOORS: 110
EACH TO HAVE:

3	HINGES	FBB179 4.5 X 4.5	US26D
1	LOCK	CRE8808FL	US26D
1	PERMANENT CORE	20-740	US26D
1	CLOSER	PA4041 X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
3	SILENCERS	SR64	

NOTE: NO STOP REQUIRED.

HW 12

DOORS: 126, 127
EACH TO HAVE:

3	HINGES	FBB179 4.5 X 4.5	US26D
1	LOCK	CRE8805FL	US26D
1	WALL STOP	WS407CVX	US32D
3	SILENCERS	SR64	

HW 13

DOORS: 133
EACH TO HAVE:

6	HINGES	FBB191 4.5 X 4.5 NRP	US32D
1	LOCK	CRE8805FL x Knurled OS	US26D
2	FLUSH BOLTS	FB458 - 12"	US26D
1	CLOSER	PA4041 CUSH X TBMS (ACTIVE LEAF)	AL
2	KICK PLATES	10 X 1" LDW	US32D
1	OVERHEAD STOP	904S (INACTIVE LEAF)	US32D
1	THRESHOLD	176A X LAR	AL
1	SET WEATHERSTRIP	S88D (HEAD & JAMBS)	
2	DOOR SHOES	314CN X LAR	
1	ASTRAGAL	BY DOOR SUPPLIER	
2	SILL SWEEPS	3452CNB	

HW 14

DOORS: 134
EACH TO HAVE:

3	HINGES	FBB191 4.5 X 4.5 NRP	US32D
1	LOCK	CRE8805FL x Knurled OS	US26D
1	CLOSER	PA4040 CUSH X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	STOP	BUILT INTO CLOSER ARM	
1	THRESHOLD	176A X LAR	
1	SET WEATHERSTRIP	S88D (HEAD & JAMBS)	
1	DOOR SHOE	314CN	
1	SILL SWEEP	3452CNB	

HW 15

DOORS: 132, 136
EACH TO HAVE:

3	HINGES	FBB191 4.5 X 4.5 NRP	US32D
1	LOCK	CRE8808FL	US26D
1	CLOSER	PA1461 CUSH X TBMS	AL
1	KICK PLATE	10 X 2" LDW	US32D
1	STOP	BUILT INTO CLOSER ARM	
1	THRESHOLD	176A X LAR	AL
1	SET WEATHERSTRIP	S88D (HEAD & JAMBS)	
1	DOOR SHOE	314CN	
1	SILL SWEEP	3452CNB	

HW 16

DOORS: 138
EACH TO HAVE:

6	HINGES	FBB191 4.5 X 4.5 NRP	US32D
1	LOCK	CRE8808FL	US26D
2	FLUSH BOLTS	FB458 - 12"	US26D
2	KICK PLATES	10 X 2" LDW	US32D
1	THRESHOLD	176A X LAR	AL
1	SET WEATHERSTRIP	S88D (HEAD & JAMBS)	
2	DOOR SHOES	314CN	
1	ASTRAGAL	BY DOOR SUPPLIER	
2	SILL SWEEPS	3452CNB	

HW 17

DOORS: 125
EACH TO HAVE:

6	HINGES	F179 4 X 4	US26D
1	SET BI-FOLD TRACK & HDWR	BFC125N-00-72	
1	FLOOR GUIDE TRACK	BF125-91	
2	GUIDE ROLLERS	BF125-71	
2	DOOR PULLS	4484 - 4" X 2" SCREWS	US26D

HW 18

CHAIN LINK GATES: 139A, 139B
EACH TO HAVE:

1 PADLOCK 424

NOTE: BALANCE OF HARDWARE BY GATE MANUFACTURER.

HW 19

DOORS: 131A, 131B
EACH TO HAVE:

NOTE: ALL HARDWARE BY DOOR SUPPLIER.

HW 20

MISCELLANEOUS:

1 KEY CABINET RWC50S

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed storefront framing.
4. Glazed entrances.
5. Interior borrowed lites.

1.03 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

1.04 PERFORMANCE REQUIREMENTS

A. Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

a. Specified Design Wind Loads: Wind loads shall be determined by the more restrictive of the following using the appropriate factors and coefficients. Wind load pressures shall be computed and applied using the design wind speed indicated by Wind Information located on Drawings.

1) ASCE 7-98, "Minimum Design Loads for Buildings and Other Structures," Section 6.4.2, "Analytic Procedure".
2) Florida Building Code.

b. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

1) For monolithic-glass lites heat treated to resist wind loads.

c. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm, unless required otherwise.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.

1.05 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch square Samples for glass.

1. Clear and tinted float glass.
2. Fire rated glass.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

1. Calculations: Provide calculations for determining glass thicknesses, indicating compliance with "Performance Requirements" Article, that bear the seal and signature of Structural Engineer registered in the State of Florida.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Clear Glass: Obtain clear and tinted float glass from one primary-glass manufacturer.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and industry organizations, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards. As a minimum comply with:

1. Federal Standard 16 CFR 1201: Federal Safety Standard for Architectural Glazing Materials.
2. FGMA: Glazing Manual.

D. Safety Glass: Products complying with requirements of 16 CFR Part 1201 for Category II materials.

1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
2. Glass in Hazardous Locations (per FBC 2406.3) shall be safety glazing as required in FBC Section 2406 – Safety Glazing.

E. Fire-Resistive Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 2074, labeled and listed by testing and inspecting agency acceptable to authorities having jurisdiction.

F. Fire-Resistive Glazing Products for Window Assemblies: Products identical to those tested per ASTM E 2010, labeled and listed by testing and inspecting agency acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.09 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Visteon Glass Division.
2. AFG Industries Inc.
3. Guardian Industries Corp.
4. Pilkington Libby Owens Ford.
5. PPG Industries.

B. Rated Glazing – Subject to requirements, provide fire-resistive glazing from one of the following manufacturers:

1. Flachglas-AG.
2. Nippon Electric Glass.
3. SAFTI.
4. Vetrotech Ltd. / Saint-Gobain.

C. Impact Resistant Laminated Exterior Glass: One sheet of 1/4 inch thick clear float glass and one sheet of 1/4 inch thick tinted float glass, both strengthened in accordance with ASTM C158, Kind CS, and/or ASTM C1048, Kind HS, both permanently laminated together with a clear 0.090 inch thick interlayer material in accordance with ASTM C1172, Kind LCS, LHS.

1. Provide PPG Solarban 60 (3); Solexia Float Glass.
   a. Shade Coefficient: 0.42.
   b. Shg. C : 0.37.
   c. Visible Light: 60%
   d. Winter Value: 0.29.
   e. Summer Value: 0.28
2. Nominal Thickness: 9/16 inch.

2.02 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select).

B. Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).

1. Thickness: 1/4-inch.

C. Tinted Float Glass: Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select).

1. Color: DESIGN BASIS - PPG "Solex" (light green tint) with visible light transmittance of 77 % and shading coefficient (minimum) of 0.69-0.71 for 1/4" thick glass.
2. Thickness: 1/4-inch.

2.03 HEAT-TREATED FLOAT GLASS

A. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated or required.

2.04 FIRE-RATED GLAZING PRODUCTS

A. Monolithic Ceramic Glazing Material: Proprietary product in the form of clear flat sheets of 3/16-inch (5-mm) nominal thickness weighting 2.5 lb/sq. ft. (12.2 kg/sq. m), and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which the glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Polished on both surfaces, transparent.

B. Laminated Ceramic Glazing Material: Proprietary product in the form of two lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch (8-mm) nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft. (19.5 kg/sq. m); and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which the glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Polished on both surfaces, transparent.

C. Laminated Glass with Intumescent Interlayers: Proprietary product in the form of multiple lites of Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Kind FT (fully tempered) float glass laminated with intumescent interlayers; and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which the glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.05 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape

and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.06 ELASTOMERIC GLAZING SEALANTS

A. Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.

B. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements for Type, Grade, Class and Uses.

1. Glazing Joints - Non-Structural: One-part silicone sealant, non-sag, Class A.

a.	Elongation Capacity	±50%
b.	Service Temperature Range	-40 to 180° F
c.	Shore A Hardness Range	20 to 35

2. Glazing Joints - Structural: One-part silicone sealant, non-sag, Class A; capable of autobonding.

a.	Elongation Capacity	±25%
b.	Service Temperature Range	-40 to 180° F
c.	Shore A Hardness Range	20 to 35

C. Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

2.07 MISCELLANEOUS GLAZING MATERIALS

A. Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.08 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

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

3.03 GLAZING INSTALLATION

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

C. Glazing channel dimensions: Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

D. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

F. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

H. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

I. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.05 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.06 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

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

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

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

3.07 GLAZING SCHEDULE

GLASS TYPE	LOCATION	REMARKS
Heat-treated; Kind - FT (fully tempered). Clear or tinted.	Use at all locations required by codes.	See Note 1.
Heat-treated; Kind - HS (heat strengthened). Clear.	Use at all interior glazing, unless noted or required otherwise.	See Note 1.
Heat-treated; Kind - HS (heat strengthened). Tinted.	Use at exterior aluminum storefront, framed windows and aluminum entrances, unless noted or required otherwise.	See Note 1.

Note 1: Refer to Part 2 Articles for glass type product requirements.

END OF SECTION

Division 9
Finishes

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior portland cement plasterwork (stucco) on metal lath plaster bases and accessories.

B. Related Sections include the following:

1. Division 4 Section "Simulated Stone" for stone veneer installed over stucco scratch coat.
2. Division 7 Section "Joint Sealants" for sealants.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Provide drawings and details.

C. Material Certificates: Submit certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.5 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.

1. Diamond-Mesh Lath: Flat and self furring:

a. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).

2. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm).

a. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).

B. Paper Backing: FS UU-B-790, Type I Grade D, Style 2 vapor-permeable paper.

1. Provide paper-backed lath at all exterior locations.

2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Zinc and Zinc-Coated (Galvanized) Accessories:

1. External-Corner Reinforcement: Expanded, large-mesh, diamond-metal lath fabricated from zinc-alloy and specially formed to reinforce external corners of portland cement plaster on exterior exposures while allowing full plaster encasement.
2. Cornerbeads: Fabricated from zinc.

a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.

3. Casing Beads: Fabricated from zinc; square-edged style; with expanded flanges.
4. Control Joints: Fabricated from zinc; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

5. Expansion Joints: Fabricated from zinc; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
6. Two-Piece Expansion Joints: Fabricated from zinc; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4-to-5/8-inch (6.34-to-16-mm) wide; with perforated flanges.

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of not fewer than three exposed threads.

E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

F. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), unperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.1 mm) thick, in width to suit steel stud size.

2.4 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type II.

B. Masonry Cement: ASTM C 91, Type N.

C. Portland and Masonry Cement Mixes Cement Color: Gray.

D. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

E. Sand Aggregate: ASTM C 897.

F. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.

1. Color for Finish Coats: Gray.

2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. ft. (16 kg of fiber/cu. m) of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
b. Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 3 to 5 parts aggregate per part of cementitious material (sum of separate volumes of each component material).

2. Masonry Cement Mixes:

a. Scratch Coat: 1 part masonry cement and 2-1/2 to 4 parts aggregate.
b. Brown Coat: 1 part masonry cement and 3 to 5 parts aggregate.

3. Portland and Masonry Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
b. Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material (sum of separate volumes of each component material).

C. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters, comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

3.3 INSTALLING METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C 1063.

1. On Solid Surfaces, Not Otherwise Furred: Install self-furring diamond-mesh lath.

3.4 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:

1. Install lath-type external-corner reinforcement at exterior locations.
2. Install cornerbead at interior and exterior locations.

C. Control Joints: Install control joints at locations indicated on Drawings and as follows:

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:

a. Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
b. Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).

2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

D. Caulk accessory joints at splices, and abutting or terminating points prior to application of stucco.

3.5 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
2. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where

full grouting is indicated or required for fire-resistance rating, grout at least 6 inches (152 mm) at each jamb anchor.

3. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Plaster Finish Coats: Apply to provide finish to match Architect's sample.

3.6 CUTTING AND PATCHING

A. Cut, patch, replace, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Interior gypsum wallboard.
2. Tile backing panels.
3. Impact-resistant wallboard.
4. Non-load-bearing steel framing.
5. Sound attenuation blankets for STC rated gypsum board installations.

1.03 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products," UL's "Fire Resistance Directory," or GA-600, "Fire Resistance Design Manual."

B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

1.08 PRECEDENCES

A. Firestopping requirements take precedence over acoustical or other requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Framing and Furring:
    a. Clark Steel Framing Systems.
    b. Dale Industries, Inc. - Dale/Incor.
    c. Dietrich Industries, Inc.
    d. MarinoWare; Division of Ware Ind.
    e. National Gypsum Company.
    f. Unimast, Inc.

2. Gypsum Board and Related Products:
    a. American Gypsum Co.
    b. G-P Gypsum Corp.
    c. National Gypsum Company.
    d. United States Gypsum Co.

2.02 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch- diameter wire.

C. Hanger Attachments to Concrete: As follows:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.

D. Hangers: Optional as follows, except where indicated or required otherwise:

1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
2. Rod Hangers: ASTM A 510, mild carbon steel.
    a. Protective Coating: ASTM A 153/A 153M, hot-dip galvanized.
3. Flat Hangers: Commercial-steel sheet, ASTM A 653/A 653M, G40, hot-dip galvanized.
4. Angle Hangers: ASTM A 653/A 653M, G60, hot-dip galvanized commercial-steel sheet.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.

1. Depth: As indicated or required for conditions.

F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.

1. Cold Rolled Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange, 3/4 inch deep.
2. Steel Studs: ASTM C 645.
    a. Minimum Base Metal Thickness: 0.0312 inch at locations receiving tile. Other conditions as recommended by manufacturer.
    b. Depth: As indicated.
3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    a. Minimum Base Metal Thickness: 0.0312 inch at locations receiving tile. Other conditions as recommended by manufacturer.

G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
    b. Chicago Metallic Corporation; Drywall Furring 640 or Drywall Furring 660 System.
    c. USG Interiors, Inc.; Drywall Suspension System.

2.03 STEEL PARTITION AND SOFFIT FRAMING

A. Components, General: As follows:

1. Comply with ASTM C 754 for conditions indicated.
2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.

B. Steel Studs and Runners: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0312 inch at locations receiving tile, hung cabinets, fire doors, and doors over 48 inches wide. Other conditions as recommended by manufacturer.
2. Depth: As indicated.

C. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base Metal Thickness: 0.0312 inch thickness, unless indicated otherwise

E. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.

1. Depth: 1-1/2 inches, unless indicated otherwise.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0312 inch at locations receiving tile, hung cabinets, fire doors, and doors over 48 inches wide. Other conditions as recommended by manufacturer.
2. Depth: As indicated.

G. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.04 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.

1. Regular Type:

a. Thickness: 5/8 inch, unless indicated otherwise.
b. Long Edges: Tapered.

2. Type X:

a. Thickness: 5/8 inch.
b. Long Edges: Tapered.

C. Sag-Resistant Gypsum Wallboard: ASTM C 36, manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

D. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M.

1. Core: Regular or fire-resistive and in thicknesses as required by installations.

E. Proprietary Abuse-Resistant Gypsum Wallboard: ASTM C 36, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels.

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

a. National Gypsum Company; Gold Bond Hi-Abuse Wallboard.
b. United States Gypsum Co.; SHEETROCK Brand Abuse-Resistant Gypsum Panels.

2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Location: As indicated or scheduled.

2.05 TILE BACKING PANELS

A. Panel Material and Size: Provide tile backing board selected from products below. Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Water-Resistant Backing Board: Glass-Mat type or other Architect approved; Unless approved otherwise comply with ASTM C 1178/C 1178M.

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

a. "Dens-Shield Tile Backer" as manufactured by G-P Gypsum Corp.

C. Cementitious Backer Units: ANSI A118.9.

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

a. Custom Building Products; Wonderboard.
b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
c. United States Gypsum Co.; DUROCK Cement Board.

2. Thickness: 5/8 inch, unless indicated or required otherwise.

2.06 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead: Use at outside corners, unless otherwise indicated.
b. LC-Bead (J-Bead): Use at exposed panel edges.
c. Expansion (Control) Joint: Use where indicated.

2.07 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels: As recommended by manufacturer.

2.08 ACOUSTICAL SEALANT

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

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
c. Or approved equal.

2. Acoustical Sealant for Concealed Joints:

a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
b. Pecora Corp.; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.09 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.10 FIRESTOPS AND SMOKESEALS

A. Firestop and smokeseal devices and systems are the work of Division 7 Section "Firestopping".

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

3.03 STEEL FRAMING INSTALLATION

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Coordinate installations of support framing specified in Section 05500 for TV mounting brackets, specified elsewhere in Section 11135, with wall and ceiling framing.

D. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.

1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.

    a. Use deep-leg deflection track where indicated.

E. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

F. Space studs and furring at not over 16 inches at locations receiving tile, wall hung cabinets, and wall hung shelving.

3.04 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure other type hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

C. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.

D. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.05 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt-felt or foam-gasket isolation strip between studs and wall.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at, or 6 inches above, suspended ceilings as required. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs 1/2 inch short of full height to provide perimeter relief.

2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

D. Install steel studs and furring at the following spacings:

1. Single-Layer and Multilayer Construction: As required by conditions
2. Cementitious Backer Units: 16 inches o.c., unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install two studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above. Where required.

G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

3.06 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install sag resistant ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install regular, water resistant, Type X, and abuse-resistant type panels at locations required and specified. Install gypsum panels with face side out where applicable. Unless manufacturer requires otherwise, butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints with space between edges of adjoining gypsum panels.

I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed.

K. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

1. Sealing of perimeters and penetrations in sound walls which are identified as also being fire-rated or smoke-resistant is the work of Division 7 Section "Firestopping". Fire and smoke requirements take precedence.

L. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches o.c. for vertical applications.

M. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

N. Identify rated (and smoke) walls above ceiling with the note: "Fire (and smoke) barrier - protect all openings", complying with requirements of local jurisdictions.

3.07 PANEL APPLICATION METHODS

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of board.

B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

E. Multilayer Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

F. Tile Backing Panels:

1. Install at all tile areas and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.
2. Install glass-mat type or cementitious type backer units at areas to receive tile that are subject to wetting such as showers, tubs, and where otherwise indicated.

    a. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.08 INSTALLING TRIM ACCESSORIES

A. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings or as otherwise required by conditions. Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.09 FINISHING GYPSUM BOARD ASSEMBLIES

A. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for indicated locations or as otherwise directed.

1. Level 1: Use at the following locations. Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: Use at the following locations. Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
3. Level 3: Use for surfaces to receive medium or heavy textured finishes before painting or applying heavy wallcoverings where lighting conditions are not critical. Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges.
4. Level 4: Use for surfaces receiving light textured finish wallcovering and flat paints. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
5. Level 5: Use for surfaces receiving gloss and semi-gloss enamels and surfaces subject to severe lighting. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface.

3.10 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect one week in advance of the date and the time when the Project, or part of the Project, will be ready for an above-ceiling observation.
2. Prior to notifying Architect, complete the following in areas to receive gypsum board ceilings:

    a. Installation of 80 percent of lighting fixtures, powered for operation.
    b. Installation, insulation, and leak and pressure testing of water piping systems.

c. Installation of air duct systems.
d. Installation of air devices.
e. Installation of mechanical system control air tubing.
f. Installation of ceiling support framing.
g. Firestopping of penetrations and joints in fire rated assemblies.
h. Smoke sealing of penetrations and joints in smoke resistant assemblies.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Porcelain floor tile.
2. Ceramic mosaic tile.
3. Ceramic wall tile.
4. Waterproof membrane installations.
5. Marble for window sills.
6. Tile base, accessories and , metal trim installed as part of tile installations.

1.03 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.
2. Ramp Surfaces: Minimum 0.8.

1.04 SUBMITTALS

A. Product Data: For each type of tile, adhesive, mortar, grout, and other products specified.

B. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.
2. Full-size units of each type of trim and accessory for each color required.
3. Stone thresholds and marble in 6-inch lengths.

C. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

D. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.

F. Tile Test Reports: Indicate and interpret test results for compliance of special-purpose tile with specified requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:

1. Joint sealants.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Section 01310: "Project Management and Coordination," Article - Project Meetings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish 1 unopened box of each primary size and color installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers and products that may be incorporated into the Work include, but are not limited to, those indicated for each tile type Design Basis, included in this Section.

2.02 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

2.03 TILE PRODUCTS

A. Porcelain Ceramic Floor Tile, and Base: Provide tile complying with the following requirements:

1. Tile (Design Basis): Dal Tile; 'Porcealto Graniti' ' CD07 Verde Alghero'- All scheduled areas except showers.

a. Standard: ANSI / TCA - A137.1.

1.) Manufacturer / Product: As selected by Architect.
2.) Type / Size: Unglazed porcelain. Floor - 12 in. x 12 in.; Base: 4 in. x 12 in. and coordinating running trim pieces.
3.) Color: As selected by Architect from manufacturer's full range of colors.
4.) Provide one (2) colors.
5.) Installation Method: Thinset method.

B. Ceramic Mosaic Unglazed Floor Tile: Provide tile complying with the following requirements:

1. Tile (Design Basis): Dal-Tile; 'Keystones' D050 – 'Mottled Medium Brown' for Showers, floor and walls.

a. Standard: ANSI / TCA - A137.1.

1.) Manufacturer / Product: As selected by Architect.
2.) Size: 2 in. x 2 in. x 1/4 in.
3.) Shape: square.
4.) Edge: modified square.
5.) Surface Finish: unglazed.
6.) Moisture absorption: 0 to 0.5 percent.
7.) Color: As indicated or selected by Architect from manufacturer's full range of colors; minimum four (4) colors to be used.
8.) Mounted sheet size: 12 in. x 24 in.
9.) Installation Method: Thinset method.

C. Ceramic Wall Tile: Provide tile complying with the following requirements:

1. Tile (Design Basis): Dal-Tile; Series- 'Semi-Gloss'. All scheduled wall areas, except showers. Wall field tile: 0135, 'Almond'. Wall accent tile: 1452, 'Cypress'. Wall accent tile: K-180, 'Chamois'.

2.

a. Standard: ANSI / TCA - A137.1.

1.) Manufacturer / Product: As selected by Architect.
2.) Size: 4 1/4 in. x 4 1/4 in.
3.) Shape: square.

4.) Edge: modified square.
5.) Surface Finish: glazed porcelain.
6.) Moisture absorption: 0 to 0.5 percent.
7.) Color: As indicated or selected by Architect from manufacturer's full range of colors; minimum four (4) colors to be used.
8.) Installation Method: Thinset method.

D. Base: For shower areas.

1. Length: 2 inches.
2. Height: 2 inches.
3. Top Edge: square.
4. Internal corner: Coved.
5. External corner: bullnosed.
6. Surface Finish: Matte.
7. Moisture absorption: 0 to 0.5 percent.
8. Color: Unless indicated or scheduled otherwise, match floor tile.

2.04 SETTING AND GROUTING PRODUCTS

A. Setting And Grouting Materials For All Areas Except Shower, Restroom And Kitchen Areas:

1. Adhesive Manufacturers and Type: as recommended by tile manufacturer; Kind: Organic adhesive - ANSI/TCA A 136.1, Type 2; thinset bond type.
2. Mortar and Grout Manufacturers: Design Basis - TEC Product Cementitious with latex.
3. Mortar Materials: ANSI / TCA A 118.1 and ANSI A 118.4; Portland Cement, sand, latex additive and water. Color Admixture - Manufacturer's recommended type; color as selected; submit full color range for selection by Architect.
4. Grout Materials:
   a. Grout: Cementitious type with latex additive, in accordance with ANSI A 118.6 and A 108.10 and compatible with setting materials. Provide sanded grout, unless approved otherwise.
   b. Color Additive: Manufacturer's recommended type; color as selected; submit full color range for selection by Architect.

   NOTE - Grouting process is not completed until the grout residue (or grout haze) is completely removed from the tile surface.

B. Setting And Grouting Materials For Shower, Restroom, Kitchen Areas and Computer Training Area:

1. Setting / Adhesive Materials: Epoxy adhesive - ANSI A 118.3, thinset bond type.
2. Acceptable Adhesive Manufacturers:
   a. American Olean Tile Co., Inc.; Product - A020000 Epoxy Adhesive.
   b. Atlas Minerals & Chemicals, Inc.; Product - Epoxy Adhesive.

c. Summitville Tiles Inc.; Product - 5300 Epoxy Adhesive.

3. Grouting Materials: Chemical-resistant, water-cleanable, ceramic tile-setting and -grouting epoxy, complying with ANSI A118.3 and compatible with setting materials.

2.05 WINDOW SILLS

A. Marble Window Sills: Provide marble window sills complying with recommendations and requirements of MIA and with a minimum abrasive-hardness value of 10 per ASTM C 241. Provide matched marble from a single quarry for each type, variety, color and quantity reuired.

1. Selection: Unless scheduled or directed otherwise, provide "White Cherokee" as produced by Georgia Marble Co., Dimension Stone Group, Nelson, Georgia.

2.06 WATERPROOFING FOR TILE INSTALLATIONS

A. Waterproofing System for Porcelain Tile Installations:

1. Membrane: One part elastomeric and seamless membrane of at least 30 mils or 1 /32 in. providing a positive barrier to moisture / water, irrigation and penetration.
2. Acceptable manufacturers / Products:

a. Hydroment; Product - Ultraset.
b. Ardex; Product - 8-19
c. Laticrete; Product - 9235

B. Waterproofing System for Ceramic Tile Floor Installations:

1. Membrane: Either 0.030 in. polyethylene film polyester facing both sides, or latex rubber system with glass fiber fabric reinforcing.

2.07 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Tile and Carpet Joiners: 'Schluter-Schiene' profiles, as indicated or selected by Architect.

2.08 MIXES

A. Mix and proportion pre-mix setting bed, grout materials, and adhesives in accordance with manufacturer's written instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other

packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:

1. Petroleum paraffin wax or grout release.

3.03 INSTALLATION

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Do not use tile pieces less than 1/2 of full unit width. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots, when used, to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated or required by referenced standards, during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.

2. Prepare joints and apply sealants to comply with requirements of Section 07920: "Joint Sealants."

H. Grout tile to comply with the specified standards and manufacturer's requirements.

I. Install tile at restroom showers and similar wall areas subject to wetting, over wall board selected from specified tile backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated. Refer to Division 9 Section: "Gypsum Board Assemblies."

3.04 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.05 TILE INSTALLATION

A. Unless indicated or required otherwise, install tile to comply with TCA installation methods and ANSI A108 series of tile installation standards.

B. Joint Widths: Install tile on floors with joint widths as recommended by material manufacturer for tile type selected.

C. Joint Widths: Install tile on walls with 1/16 inch joint widths, unless recommended otherwise by material manufacturer for tile type selected.

D. Stone Thresholds, if any: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.

E. Installation Method for Porcelain Floor Tile: TCA F 113 or F 115 (for use where epoxy materials are indicated), thin set method.

F. Installation Method for Ceramic Mosaic Floor Tile: TCA F 122, thin set.

G. Installation Method for Ceramic Wall Tile: TCA W 242 or W 244 (for use over cementitious backer units), thin set.

3.06 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.

2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. When used, remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.

1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

1.03 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. 12 inch- square samples of each acoustical panel type, pattern, and color.
2. Set of 12-inch- long samples of exposed suspension system members, including moldings, for each color and system type required.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Test Reports: Indicate compliance of acoustical panel ceilings and components with requirements based on comprehensive testing of current products.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Ceiling Units: Obtain each acoustical ceiling panel from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Suspension System: Obtain each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
2. Products are identified with appropriate markings of applicable testing and inspecting agency.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Section 01310: Article - "Project Management and Coordination."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.07 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following manufacturers:

B. Suspension Grid System:

1. Armstrong World Industries Inc.
2. Chicago Metallic Corporation.
3. USG Interiors Inc.
4. Substitutions submitted in compliance with Section 01600.

C. Acoustical Panels:

1. Armstrong World Industries Inc.
2. USG Interiors Inc.
3. Celotex Corporation.
4. Substitutions submitted in compliance with Section 01600.

D. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated as Design Basis, or those producing acceptable equivalent products, for each designation in the Acoustical Panel Ceiling Schedule at the end of Part 3.

2.02 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.03 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Metal Suspension System Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3.

C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

F. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

G. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

H. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

A. Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, for fire-resistance ratings, and to retain panels tight to grid system within 15 feet of an exterior door. Space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.
5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.04 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Conduct an above-ceiling observation prior to installation of acoustical panel ceilings and report any deficiencies in the Work observed. Do not proceed with installation of acoustical panels to ceiling suspension system until deficiencies have been corrected.

1. Notify Architect one week in advance of the date and the time when the Project, or part of the Project, will be ready for an above-ceiling observation.
2. Prior to notifying Architect, complete the following in areas to receive acoustical panel ceilings:
    a. Installation of 80 percent of lighting fixtures, powered for operation.
    b. Installation, insulation, and leak and pressure testing of water piping systems.
    c. Installation of air duct systems.
    d. Installation of air devices.
    e. Installation of mechanical system control air tubing.
    f. Installation of ceiling suspension system.
    g. Firestopping of penetrations and joints in fire rated assemblies.
    h. Smoke sealing of penetrations and joints in smoke resistant assemblies.

3.05 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.06 ACOUSTICAL PANEL CEILING AND SUSPENSION SYSTEM SCHEDULE

A. Suspension System for Acoustical Panel Ceilings: Provide acoustical panel ceiling suspension system complying with the following:

1. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized-Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, 15/16-inch- (24-mm-) wide, aluminum caps on flanges; other characteristics as follows:

   a. Structural Classification: Intermediate-duty system.
   b. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
   c. Face Design: Flush face.
   d. Finish: Manufacturer's standard baked polyester paint in white color.

2. Products: Provide products selected from the following.
   a. Prelude; Armstrong.
   b. Series 200 "H" Hot Dipped; Chicago Metallic Corp.
   c. DX24 hot dipped grid; USG Interiors.

B. Acoustical Panels: Where scheduled or indicated, provide acoustical panels complying with the following:

1. Ceiling Designation CA1 Product Design Basis:

   a. Armstrong # 1728 –with characteristics and requirements as follow:
   b. Classification: Panels fitting ASTM E 1264, Class A, fiber base with factory applied finish.
   c. Light reflectance: 75 percent minimum.
   d. NRC Rating: .70.
   e. Color: White.
   f. Edge Detail: Square.
   g. Size: 24 by 24 inches.
   h. Thickness: 5/8 inch.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Rubber floor tile.
2. Resilient wall base.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.

D. Maintenance Data: For resilient products to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.06 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Close spaces to traffic during floor covering installation and for 48 hours after floor covering installation..

C. Install resilient products after other finishing operations, including painting, have been completed.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.

2.02 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range of standard colors; Group 1.

2.03 RUBBER FLOOR TILE

A. Rubber Floor Tile: ASTM F 1344.

1. AFCO-USA, American Floor Products Company, Inc.
2. Burke Mercer Flooring Products.
3. Dodge-Regupol Inc., distributed by Gerbert Limited.
4. Endura.
5. Johnsonite.

6. Mondo Rubber International, Inc.
7. Musson, R. C. Rubber Co.
8. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
9. Pirelli Rubber Flooring.
10. R.C.A. Rubber Company (The).
11. Roppe Corporation.

B. Class: I-A (homogeneous rubber tile, solid color).

C. Wearing Surface: Molded pattern.

1. Molded-Pattern Figure: Raised discs.

D. Thickness: 0.125 inch.

E. Size: 24 by 24 inches.

F. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.04 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.

1. AFCO-USA, American Floor Products Company, Inc.
2. Armstrong World Industries, Inc.
3. Azrock Commercial Flooring, DOMCO.
4. Burke Mercer Flooring Products.
5. Endura.
6. Johnsonite.
7. Marley Flexco (USA), Inc.
8. Mondo Rubber International, Inc.
9. Musson, R. C. Rubber Co.
10. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
11. Pirelli Rubber Flooring.
12. Roppe Corporation.

B. Style: Cove (with top-set toe).

C. Minimum Thickness: 0.125 inch

D. Height: Unless indicated or scheduled otherwise, 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Inside and Outside Corners: Premolded.

G. Surface: Smooth.

2.05 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as recommended by manufacturer.
b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.04 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

3.06 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Field applied painting and finishing of exposed interior and exterior surfaces indicated on Drawings or specified.
2. Surface preparation, if not prepared under other specifications sections.

B. Related Sections:

1. Factory Primed and Prefinished Products: Check all specifications sections to determine items furnished factory primed or prefinished.

1.03 WORK NOT TO BE PAINTED

A. Prefinished Products:

1. Acoustical ceiling panels and suspension system.
2. Plastic laminate.
3. Ceramic tile.
4. Toilet compartments and accessories.
5. Glass.
6. Mirrors.
7. Stainless steel, brass, copper, chrome, anodized and prefinished aluminum, and ornamental metals, except as otherwise indicated or specified.

B. Work indicated to remain unfinished.

C. Surfaces specified or scheduled to receive other finishes.

D. Operating mechanisms (e.g., valve and damper operators, linkages, sensing devices, motor and fan shafts, and other similar operating mechanisms).

E. Required labels (e.g., Underwriters' Laboratories, Inc., Factory Mutual, and other code required labels, and equipment names, identification, performance rating, or nomenclature plates) and operating instructions.

F. Finished mechanical and electrical equipment (i.e., light fixtures, switchgear, fire sprinkler heads, and other similar equipment), except as specified in this Section.

G. Concealed surfaces in inaccessible areas (i.e., foundation spaces, furred areas, utility tunnels, pipe chases, duct shafts, elevator shafts), unless indicated or directed otherwise.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. D 16 - Standard Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
2. D 523 - Standard Test Method for Specular Gloss.
3. D 2016 - Standard Test Methods for Moisture Content of Wood.

1.05 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this Section.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain materials for each type finish system required from one source, and from a single primary manufacturer, as standard products of manufacturer, with primers and undercoat materials produced by the manufacturer of finish coats. Use only thinners recommended by coating manufacturer and only within recommended limits.

B. Applicator: Company specializing in commercial painting and finishing with 5 years documented experience.

1.07 SUBMITTALS

A. Color and Texture Samples: Before starting work, secure instructions and prepare duplicate 12 inch square stepped color and texture samples of each color and finish required, complete with primers and block fillers.

B. Materials List - for each product include:

1. Manufacturer's name.
2. Product brand names, types, numbers, colors, sheens, and grades.
3. Label analysis.
4. Cross reference of coatings to specific finish systems and applications.
5. Installation substrates and locations where products are to be installed, including number of coats for each product.

C. Product Data: Manufacturer's specifications and technical data for all products, including substrate preparation and installation instructions, required minimum wet film thickness for installation, and applicable Material Safety Data Sheets.

D. Manufacturer's Certification for Hazardous Materials and VOC Compliance: Provide certification from manufacturer that all products supplied are free of lead, chromates, and mercury per current government standards and that all products supplied shall not exceed the maximum allowable Volatile Organic Compounds (VOC) of 3.5 lbs. per gallon (420 grams per liter). Local restrictions may be more stringent.

1.08 PROTECTION

A. Protect surfaces, objects, adjacent work and finishes, and storage areas from damage. Provide drop cloths, shields, masking, coverings, and other protections required.

1. Coordinate work with other trades. Remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings, fastenings, light fixtures and other finished items which are not to be job site finished.

a. Carefully clean and store removed items. Do not use cleaning agents detrimental to permanent finishes.
b. Reinstall removed items after completion of job site finishing in each area.

B. Place waste, cloths, and other material which may constitute a fire hazard in closed metal containers.

1.09 DELIVERY, STORAGE AND HANDLING

A. Procedures: Comply with requirements of Section 01600.

B. Deliver products to site in original, sealed containers bearing legible labels indicating manufacturer; type of finish material (generic classification or binder type); brand name, brand code or stock number; color name and number; label analysis; date of manufacture; shelf life; coverage rates; drying time; and instructions for surface preparation, mixing, reducing (where applicable), application, and cleanup.

C. Store in dry, well ventilated space at minimum 45 degrees F. and maximum 90 degrees F. ambient temperatures, unless otherwise allowed or required by manufacturer's instructions.

D. Take precautions to avoid freezing and danger of fire and spontaneous combustion.

E. Keep storage areas clean.

1.10 ENVIRONMENTAL CONDITIONS

A. Lighting: Maintain 80 foot candies minimum on surfaces being finished.

B. Ventilation and Heating: Provide as required to maintain following surface and ambient temperatures for 24 hours before, during, and 48 hours after application of finishes, unless otherwise allowed or required by manufacturer's instructions:

1. Latex Paints: Minimum 45 degrees F. for interiors; minimum 50 degrees F. for exterior.
2. Varnish and All Other Solvent Thinned Coatings: Between 45 degrees F. and 95 degrees F. for interior or exterior.

C. Do not apply coatings to damp or wet surfaces, during rain or snow, when relative humidity is above 85%, or at temperatures less than 5 degrees F. above dew point, unless otherwise allowed by manufacturer's instructions.

1.11 RECORD DOCUMENTS

A. Provide to Architect, along with close out documents two bound catalogs to include the location, product, and color for all finishes applied under this Section. The catalog is to contain all as built information, both interior and exterior, along with actual samples of each color used (size 3 1/2 inches by 2 inches) assembled in indexed form by location.

1.12 WARRANTY

A. Warrant paint for one year against loss of adherence, blisters, running, peeling, scaling, chalking, streaks, stains, and other defects detrimental to performance or appearance.

B. Refinish defective and unsatisfactory work at no additional cost.

PART - 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Standard trade sales product materials: Except as otherwise specified, provide best quality materials manufactured by one of, but not limited to, the following:

B. Subject to compliance with requirements, provide products from the following manufacturers:

1. Albi Manufacturing Co., Inc.
2. Benjamin Moore & Co.
3. Coronado Paint Company.
4. Dulux - ICI Paint Stores, Inc.
5. Fire Research Laboratories.
6. Flame Control Coatings, Inc.
7. Kelley-Moore Paint Co.
8. MAB Paints (M.A. Bruder & Sons).
9. PPG Industries, Inc. (Pittsburgh Paints).
10. Sherwin-Williams Co. (Sherwin-Williams).
11. Tnemec Company Inc.

C. Apparatus Bay Floor:

1. H & C Silicone Acrylic Concrete Sealer (Sherwin-Williams) - No Substitutions.
2. Color – Dorean Gray

2.02 MATERIALS

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best quality paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Provide custom colors of the finished paint systems to match the Architect's selections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine installation areas and surfaces indicated to receive field applied finishes. Report unsatisfactory conditions in writing to Architect. Do not proceed until unsatisfactory conditions have been corrected.

1. Verify that surfaces are ready to receive field applied finishes, as required and instructed by product manufacturers.
2. Substrate Moisture Content: Measure with electronic moisture meter. Do not apply finishes unless moisture content is below following maximums:
   a. Gypsum Wallboard and Plaster: 12%.
   b. Concrete Masonry Units (CMU) and Concrete: 12%.
   c. Common Stock Boards and Dimension Lumber: 12%, measured in accordance with ASTM D 2016.
   d. Detail Architectural Woodwork, Standing and Running Trim, Cabinets and Casework: 8% to 13% range permitted in individual pieces, measured in accordance with ASTM D 2016.
   e. Concrete: In addition to electronic moisture meter tests, test for moisture content by placing a one square yard piece of nonpermeable plastic on surface and sealing edges with nonpermeable tape. On below grade walls, apply plastic sheet near floor line.

(1) Allow plastic sheet to remain in place for 24 hours minimum before removing; surface dampness indicates presence of moisture detrimental to bonding of nonlatex and nonbreathing type paints and coatings.
(2) Where moisture is present, before starting painting obtain written approval from paint or coating manufacturer indicating that paint or coating proposed for use may be applied to damp substrates.

f. Canvas Coverings: 12%.

3. Alkali Content: Use litmus paper to test concrete, masonry, plaster, and other cement based surfaces for high alkalinity conditions. pH level greater than 10 shall constitute high alkalinity and not suitable for coating.

B. Starting installation / application constitutes acceptance of conditions as satisfactory for application of field applied finishes by Contractor, who shall correct damage and unacceptable or defective work at no additional cost.

3.02 PREPARATION

A. Comply with coating manufacturer's substrate preparation and application instructions.

1. Clean substrates of powder residue, dirt, dust, oil, grease, wax, loose and unbonded coatings and finishes, efflorescence, mildew, loose particles, stains, mortar and other contamination or conditions detrimental to application, performance, or appearance of finishes.
2. Rake out and fill holes, checks, splits, cracks and other surface irregularities with suitable patching compound; finish repairs to match adjacent surface profile, color, and texture.
3. Neutralize alkali conditions.
4. Etch glossy, glazed or dense surfaces.
5. Seal marks.
6. Verify compatibility of primer and sealer coats with substrates and subsequent finishing materials.
7. Perform coating compatibility and adhesion tests on prepared substrates in inconspicuous locations, to determine primer compatibility with substrates and adhesion of primers and subsequent field applied finishes.

B. Steel and Iron:

1. Shop Primed Surfaces: Clean ruptured, abraded, chipped, damaged, defective or unacceptable areas of shop prime coats down to bare metal, including welded areas. Spot prime with shop primer scheduled.
2. Uncoated Surfaces: Clean; remove rust, mill-scale and weld splatters. Prime with shop primer scheduled.

C. Galvanized Metal: Thoroughly solvent clean. Apply one coat Wash Primer.

D. Concrete Masonry Units (CMU):

1. Allow 14 days minimum after units are laid before applying block filler.
2. Provide approved block filler material; brush or roller apply over units to fill pock marks, air holes and other surface imperfections. Allow to thoroughly dry before applying subsequent field finishes. Use block filler material compatible with finish to be applied.

E. Wood:

1. Set anchorage in smooth surfaced wood below surface. Fill anchorage holes, cracks, voids and other depressions full with putty colored to match finish coat. Allow putty to thoroughly dry before applying subsequent materials. Sand putty flush and smooth after prime coat has been applied.

   a. Apply primer and finish only when wood is satisfactorily dry.

2. Wood Receiving Stain Finish:

   a. Sand smooth surfaced woods with fine sandpaper or steel wool, parallel with grain, until surface irregularities are removed flush and smooth with adjacent surfaces, prior to applying primer.
   b. Prime with following:

      1) Surfaces Exposed in Final Installation: Approved stain colored to match final finish.
      2) Back Surfaces Concealed From View in Final Installation: Approved stain colored to match final finish.

3. Wood Receiving Transparent Natural Finish:

   a. Sand smooth surfaced woods with fine sandpaper or steel wool, parallel with grain, until surface irregularities are removed flush and smooth with adjacent surfaces, prior to applying primer.
   b. Prime surfaces with following:

      (1) Surfaces Exposed in Final Installation: Approved sealer.
      (2) Back Surfaces Concealed From View in Final Installation: Sanding Sealer.

4. Wood Receiving Paint Finish:

   a. Sand smooth before applying primer. Clean, scrape and apply thin coat of shellac to knots before applying primer coat.
   b. Prime back surfaces on all surfaces with primer paint before installing; use Acrylic Stain Blocking Primer of type compatible with finish coats. Give particular attention to sealing of cross grained surfaces.

5. Glazing Compounds and Sealants: Allow to cure per manufacturer's instructions prior to painting.
6. Gypsum wallboard:

   a. Sand joint treatments smooth.
   b. Spackle, sand smooth and seal cracks and minor irregularities.
   c. Exercise care to avoid raising nap of paper.
   d. Apply one coat of indicated texture (if scheduled) or primer compatible with finish to be applied.

7. Concrete:

   a. New concrete:

      (1) Allow to cure 30 days minimum, unless longer curing time is recommended by manufacturer of finish to be applied.

      (2) Wash with approved neutralizer applied as directed by manufacturer whenever needed and necessary. Do not apply primer until pH level is less than 10 and surface is dry.

(3) Fill pock marks, air holes or other surface imperfections with approved filler material compatible with finish to be applied; brush or rub over units. Rub excess filler from surface and allow to thoroughly dry before painting.

8. Mildew: Remove from impervious surfaces by PPG Mildew Check 18-1, or equivalent, per manufacturer's instructions. Rinse with clean water and allow surface to dry.
9. Aluminum Surfaces Scheduled for Paint Finish:
    a. Remove surface contamination by steam or high pressure water.
    b. Remove oxidation with acid etch and solvent washing, immediately followed by power wash to remove contaminants detrimental to bonding of subsequent finish coats.
    c. Apply one coat Wash Primer immediately following clearing.
10. Canvas Coverings: Remove dirt, grease, and oil.
11. Doors Scheduled for Painting:
    a. Shop Primed Doors: Verify compatibility of shop prime finish with field applied finish materials.
    b. Prime top and bottom edges of doors not factory primed with shop primer compatible with subsequent applied finish.

3.03 APPLICATION

A. Apply products in compliance with manufacturer's instructions.

B. Apply each coat to uniform finish, of approved color, smooth, free from runs, sags, drops, ridges, waves, laps, skips, detective brushing and clogging, and with clean-cut edges.

C. Apply each coat of paint slightly darker than preceding coat, unless otherwise approved.

D. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess fillers from surface.

E. Paint edges of doors occurring between areas having different finishes to match color finish of room or space from which door edges are visible when doors are in partly opened position.

F. Unless otherwise specified, except where primers are specified in other specifications sections, provide materials for succeeding coats on a surface as produced by manufacturer furnishing previous coats.

G. Paint Film Thickness: Make as many applications of material as necessary to obtain the required minimum dry film thickness specified in connection with each finish system. Use the more stringent requirements where the manufacturer's instructions differ from this Specification. The film thickness shall be a minimum of the profile depth of the surface to be coated plus the specified dry film thickness.

    1. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color and appearance. Ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

H. Lifesafety Markings: Identify rated and smoke walls above ceiling with the note: "Fire

Barrier, Fire and Smoke Barrier, or Smoke Barrier - Protect all Openings" as appropriate, complying with requirements of local jurisdictins.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Division 15 and 16 Specifications Sections for schedule of color coding and identification banding of equipment, ductwork, piping, and conduit.

B. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports occurring in finished areas, except where items are prefinished.

C. Replace identification markings on mechanical or electrical equipment when painted accidentally.

D. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

E. Paint exposed conduit and electrical equipment occurring in finished areas.

F. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

G. Color code and identify equipment, piping, conduit, and exposed ductwork in accordance with requirements of Division 15 and 16 Specifications Sections.

H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

3.05 CLEANING

A. Promptly remove paint, oil and stains where spilled, splashed, or spattered on adjacent finishes. Use cleaning materials and methods recommended by manufacturers of materials being cleaned.

1. If adjacent finishes cannot be successfully cleaned, remove fouled materials and finishes and replace with new materials and finishes as originally specified at no additional cost.

B. Maintain premises free of unnecessary accumulations of tools, staging, scaffolding, equipment, surplus materials, and debris.

C. Collect waste, cloths, and material which may constitute a fire hazard; remove from site at and of each work day and legally dispose of them.

3.06 SCHEDULE - GENERAL

A. OSHA Safety Code Colors: Color mark all items constituting a physical hazard and all protective, fire-fighting and safety equipment to comply with requirements of ANSI Z53.1, Section 3, "Color Definitions" and OSHA Section 1910.144, "Safety Color Code for Marking Physical Hazards".

1. Number of coats specified in this Section are minimum. Apply additional coats as required to cover completely and comply with quality specified at no additional cost.

2. Apply each coat in minimum dry film thickness specified in this Section, unless greater thickness is recommended by manufacturer of coating material being applied.

3. Gloss Levels:

Type of Gloss / Sheen	ASTM D 523 Test Method	Gloss Range
Flat	85° meter	Below 15
Eggshell	60° meter	5 to 20
Lo-Lustre	60° meter	15 to 25
Satin	60° meter	15 to 35
Semi-Gloss	60° meter	30 to 65
Gloss	60° meter	Over 65

3.07 EXTERIOR COATING SYSTEMS

A. Concrete Masonry Units: (In sheen as selected by Architect)

1. First: Masonry Latex Hi-Fill Block Filler at 9-19 mils dry film thickness. Allow a minimum cure of 6 hours at 77 degrees F and 50% relative humidity prior to topcoating.
2. Second: Exterior Urethane Modified Acrylic Latex at 1.3-1.5 mils dry film thickness. Allow a minimum cure of 4 hours at 77 degrees F and 50% relative humidity prior to topcoating.
3. Third: Exterior Urethane Modified Acrylic Latex at 1.3-1.5 mils dry film thickness. Allow a minimum cure of 4 hours at 77 degrees F and 50% relative humidity.

B. Aluminum (Other than factory finished): (In sheen as selected by Architect)

1. First (Prime): Zinc Chromate Acid Etching Wash Primer at 0.3-0.5 mils dry film thickness. Allow a minimum cure of 4 hours at 77 degrees F and 50% relative humidity prior to topcoating.
2. Second: Acrylic Latex DTM at 3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 70 degrees F and 50% relative humidity
3. Third: Acrylic Latex DTM at 3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 70 degrees F and 50% relative humidity.

C. Galvanized Metal (and Copper or Stainless Steel when scheduled or directed): (In sheen as selected by Architect)

1. First (Prime): Zinc Chromate Acid Etching Wash Primer at 0.3-0.5 mils dry film thickness. Allow a minimum cure of 30 minutes at 77 degrees F and 50% relative humidity prior to topcoating.

2. Second Coat: Acrylic Aliphatic Polyurethane at 2.0-3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 77 degrees F and 50% relative humidity prior to topcoating.
3. Third Coat: Acrylic Aliphatic Polyurethane at 2.0-3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 77 degrees F and 50% relative humidity prior to topcoating.

D. Metal Doors and Frames: (In sheen as selected by Architect)

1. First (Prime): Acrylic Latex DTM Primer at 3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 77 degrees F and 50% relative humidity prior to topcoating.
2. Second: Acrylic Latex DTM at 3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 70 degrees F and 50% relative humidity.
3. Third: Acrylic Latex DTM at 3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 70 degrees F and 50% relative humidity.

E. Ferrous Structural Metal: (In sheen as selected by Architect)

1. Dry End-Use Environment (not items not submerged or in standing water):

   a. First (Prime): Low VOC Modified Alkyd Shop Primer at 3.0-4.0 mils dry film thickness. Allow a minimum cure of 30 minutes at 77 degrees F and 50% relative humidity prior to topcoating.
   b. Second: Acrylic Latex DTM at 3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 70 degrees F and 50% relative humidity
   c. Third: Acrylic Latex DTM at 3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 70 degrees F and 50% relative humidity.

3.08 INTERIOR COATING SYSTEMS

A. Gypsum Board and Concrete: (In sheen as selected by Architect)

1. First: WB Alkali Resistant Primer at 1.5 mils dry film thickness. Allow a minimum cure of 6 hours at 77 degrees F and 50% relative humidity prior to topcoating.
2. Second: Interior Acrylic Latex at 1.3-1.5 mils dry film thickness. Allow a minimum cure of 4 hours at 77 degrees F and 50% relative humidity prior to topcoating.
3. Second: Interior Acrylic Latex at 1.3-1.5 mils dry film thickness. Allow a minimum cure of 4 hours at 77 degrees F and 50% relative humidity prior to topcoating.

B. Metals – Aluminum, Ferrous, Galvanized: (In sheen as selected by Architect)

1. First (Prime): Polyamide Epoxy Primer at 2.0-3.0 mils dry film thickness. Allow a minimum cure of 16 hours at 77 degrees F and 50% relative humidity prior to topcoating.

2. Second: Acrylic Aliphatic Polyurethane at 2.0-3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 70 degrees F and 50% relative humidity prior to topcoating.
3. Third: Acrylic Aliphatic Polyurethane at 2.0-3.0 mils dry film thickness. Allow a minimum cure of 4 hours at 70 degrees F and 50% relative humidity.

C. Natural-Finish Woodwork: Provide the following natural finishes over interior woodwork:

1. Waterborne Satin-Varnish Finish: Minimum two finish coats of waterborne clear satin varnish over a sanding sealer. Wipe wood filler before applying stain.

a. Filler Coat: Open-grain wood filler.
b. Sealer Coat: Clear sanding sealer.
c. Finish Coats: Interior waterborne clear satin varnish.

D. All-Service Jacket over Insulation: Provide the following finish system on cotton or canvas insulation covering:

1. Flat Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.

a. First and Second Coats: Interior flat latex-based applied at the rate recommended by the manufacterer.

E. Plywood Backing Panels: Provide the following intumescent paint system over interior plywood surfaces:

1. First (Prime) Coat: Latex type primer applied at the spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 4 mils.
2. Second and Third Coats: Flat, intumescent type, fire retardant latex paint, applied at the spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 4 mils for each coat (total 8 mils).

F. Exposed Structure / Ceiling:

1. Surface Preparation and First (Prime) Coat: As recommended by manufacturers of structural steel framing, joists, metal deck and other items, in compliance with specifications. Touch up with original primer.
1. Second and Third Finish Coats: Modified alkyd rust inhibitive primer/finish.

a. Apply each finish coat to achieve 2 - 3.5 mils each, for a minimum total thickness of 4 mils.

1. The coating system must provide a luminous reflectance of at least 83 percent in accordance with ASTM E 308. The coating system must be intended for direct application to a variety of surfaces including concrete, galvanized deck and other primed metals.

a. Dry fall type products are not acceptable.

G. Apparatus Bay Floor:

1. Surface Preparation and First (Prime) Coat: As recommended by manufacturers.

2. Second and Third Finish Coats: Per Manufacturer's Recommendations.

END OF SECTION

Division 10
Specialties

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section for miscellaneous specialties includes the following:

1. Key control lockbox.
2. Building Plaque.
3. Wall mounted Gear Rack.
4. Louver Style Swing Gates.

1.03 SUBMITTALS

A. Product Data: For each specialty item specified and indicated. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: For each specialty item.

1. Include dimensioned plans, elevations and details, sections of typical members, and other components. Show anchors, grounds, reinforcement and layout, and indicate finishes. Include installation details and instructions.
2. Include setting drawings, templates, and directions for installing anchor bolts and other anchorages to be installed as a unit of Work in other Sections.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available for the following:

1. Aluminum Trim and Accessories: 4-inch- long sections of extrusions and not less than 2-inch squares of sheet or plate for each exposed metal surface showing available metal finishes.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage experienced installers who are authorized or can demonstrate successful experience with installations of items similar to those required by this Project.

1.05 PROJECT CONDITIONS

A. Field Measurements: When possible, verify rough openings for specialty items by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

A. Key Control Lockbox Design Basis:

1. Type: High security type with UL listed tamper switch; anti-theft locking mechanism with drill resistant hardplat lock protector, thru-wall mounting with anchor bolts furnished by manufacturer, or approved equal.
2. Construction: 1/4 inch thick steel plate housing, 5/8 inch thick steel door, 11 gage recessed flange, weatherproof gasket on inside door, 1/8 inch stainless steel lock cover with tamper seal mounting.
3. Size: 7 inch square x 5 inch deep, 60 cubic inch capacity.
4. Lock: Double action rotating tumblers and hardened steel pins, accessed by a blas-cut key to withstand 55 inch pounds twist before failure.
5. Finish: Zinc phosphate primer with weather resistant polyester powder coating, color as selected by Architect from manufacturer's standard array.
6. Manufacturer and Model: Series 4400 by Knox-Vault Company, or approved equal.
7. Location: Station front entrance area as determined by Architect.
8. Subject to compliance with requirements, other manufacturers with equivalent products may be considered, when approved by Architect.
9. Lockbox @ 48". Knox Lock Box @ 8'-0".

B. Wall mounted Gear Ready Rack:

1. Type: Wall mounted Ready Rack storage system for turnout gear consisting of two levels of open wire shelves. Each level is mounted to the wall with brackets that include a built in shelf support, hanging rod support, and mounting plate, that accept four bolts for wall mounting purposes.
2. Size: 20" wide sections.
3. Finish: Red heavy duty powder coat finish.
4. Manufacturer and Model: Groves Incorporated: Wall Mounted Red Rack, or approved equal.

C. Building Plaque:

1. Material and Construction: Cast bronze, 85-5-5-5 standard U.S. bronze alloy, 0.30 inch thick overall tablet thickness.
2. Tablet Size: 20 inches wide x 24 inches high, 1/16 inch raised letters and single line beveled edges.
3. Letter Style: To be determined. Minimum 12 lines of text as provided by Owner. Include City Seal.
4. Plaque Finish: Letters and edges with satin finish on oxidized dark background with pebble texture; provide two coats of clear aluminum lacquer.
5. Mounting: Concealed mount with threaded studs, flush mounting to masonry.
6. Manufacturers:
   a. The Southwell Company
   b. OMC Industries
   c. ANDCO Industries
   d. Other manufacturers with equivalent product as approved by Architect.

D. Louver Gates.

1. Design Basis: Swing type, fixed louver style gates; aluminum tube construction, with 80% direct visual screening capability, as manufactured by Ametco, Willoughby, Ohio, or Architect approved equivalent. 800 362-1360.
2. Provide with manufacturer's standard posts, as indicated or required, hinges, and padlockable cane bolt.
3. Finish: Unless required and approved otherwise, as selected from manufacturer's standard polyester powder coat finish system, or equivalent.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine wall surfaces, with the Installer present, for compliance with requirements and other conditions affecting installation of building miscellaneous specialties.

1. Do not proceed with installations until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install specialtiy units plumb and level, in locations and with mountings shown or required. Securely attach to supporting structure with concealed fasteners, according to accepted shop drawings and manufacturer's written installation instructions for each item.

3.03 CLEANING AND PROTECTING

A. At completion of installation, clean surfaces according to manufacturer's written instructions.

B. Protect installed specialty items from damage until acceptance by Owner at the time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Porcelain enamel markerboards.
2. Tackboards.

1.03 SUBMITTALS

A. Product Data: For each type of visual display board indicated.

B. Shop Drawings: For each type of visual display board required.

1. Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.
2. Include sections of typical trim members.
3. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available for the following:

1. Markerboards: Actual sections of porcelain enamel finish for each type of markerboard required.

D. Samples for Verification: Of the following products, showing color and texture or finish selected. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected. Prepare Samples from the same material to be used for the Work.

1. Visual Display Boards: Sample panels not less than 8-1/2 by 11 inches, mounted on the substrate indicated for the final Work. Include a panel for each type, color, and texture required.

2. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate. Include Sample sets showing the full range of color variations expected.

E. Product Certificates: Signed by manufacturers of tackboards certifying that vinyl-fabric-faced cork tackboard materials furnished comply with requirements specified for flame-spread ratings.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of markerboard manufacturer for both installation and maintenance of the type of units required for this Project.

B. Source Limitations: Obtain visual display boards through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display boards and are based on the products indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Fire-Test-Response Characteristics: Provide vinyl-fabric-faced tackboards with the following surface-burning characteristics as determined by testing assembled materials composed of facings and backings identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify vinyl-fabric-faced tackboards with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less.
2. Smoke Developed: 10 or less.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify field measurements before preparation of Shop Drawings and before fabrication to ensure proper fitting. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.06 WARRANTY

A. General Warranty: The special porcelain enamel markerboard warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Porcelain Enamel Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within the specified warranty period, provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

1. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Porcelain Enamel Markerboards:

a. Best-Rite Chalkboard Co.
b. Carolina Chalkboard Co.
c. Claridge Products and Equipment, Inc.
d. Ghent Manufacturing, Inc.
e. Greensteel, Inc.
f. Lemco, Inc.
g. Marsh Chalkboard Company.
h. Nelson Adams Company.
i. Peninsular Slate Company.

2. Tackboards:

a. Best-Rite Chalkboard Co.
b. Carolina Chalkboard Co.
c. Claridge Products and Equipment, Inc.
d. Ghent Manufacturing, Inc.
e. Greensteel, Inc.
f. Lemco, Inc.
g. Marsh Chalkboard Company.
h. Nelson Adams Company.

2.02 MATERIALS

A. Porcelain Enamel Markerboards: Balanced, high-pressure-laminated, porcelain enamel boards of 3-ply construction consisting of face sheet, core material, and backing.

1. Face Sheet: 0.024-inch enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F.

    a. Cover Coat: Provide manufacturer's standard matte-finish cover coat, with color selected from manufacturer's standards.

2. Optional Face Sheet: 0.024-inch-, "Vitracite," porcelain enamel clad, Type 1, stretcher-leveled aluminized-steel face sheet, as manufactured by Claridge Products and Equipment. Fuse porcelain enamel coating to steel at approximately 1000 deg F.

    a. Cover Coat: Provide manufacturer's standard matte-finish cover coat, with color selected from manufacturer's standards.

3. Core Option A: 3/8-inch-thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
4. Core Option B: 1/4-inch-thick, tempered hardboard core material.
5. Backing Sheet Option A: 0.015-inch-thick, aluminum-sheet backing.
6. Backing Sheet Option B: 0.018-inch-thick, galvanized steel sheet backing.
7. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.

B. Tackboard Material: Plastic-impregnated cork seamless sheet, 1/4-inch-thick, ground natural cork compressed with a resinous binder with washable vinyl finish and integral color throughout, laminated to burlap backing. Provide color and texture as scheduled or as selected from manufacturer's standards.

C. Plastic-Impregnated-Cork Tack Assembly: 1/4-inch-thick, plastic-impregnated cork sheet factory laminated to 1/4-inch-thick hardboard backing.

2.03 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

2. Field-Applied Trim: Manufacturer's standard snap-on trim with no visible screws or exposed joints.
3. Markertray: Manufacturer's standard, continuous, box-type, aluminum markertray with slanted front and cast-aluminum end closures for each markerboard.

2.04 FABRICATION

A. Porcelain Enamel Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

B. Assembly: Provide factory-assembled markerboard units, unless field-assembled units are required.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
2. Provide manufacturer's standard vertical joint system between abutting sections of markerboards.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting modified-acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.
2. Color: As selected by Architect from manufacturer's full range of colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.

1. Surfaces to receive markerboards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of markerboards.

2. Surfaces to receive tackboards shall be dry and free of substances that would impair the bond between tackboards and substrate.
3. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

C. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.03 ADJUSTING AND CLEANING

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units according to manufacturer's written instructions.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Fixed, extruded-aluminum louvers.

1.03 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section, unless otherwise defined in this Section or in referenced standards.

B. Standard Free Area: Free area of a louver 48 inches wide by 48 inches high, identical to that provided.

C. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 inches wide by 48 inches high, identical to that provided.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind loads shall be determined by the more restrictive of the following using the appropriate factors and coefficients. Wind load pressures shall be computed and applied using the design wind speed indicated.

a. ASCE 7-98
b. Florida Building Code

2. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, and other detrimental effects:

a. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

B. Wind Driven Rain: Metal wall louvers shall be tested by the BSRIA (Building Services Research and Information Association) in accordance with the HEVAC Technical Specification "Laboratory Testing and Rating of Weather Louvers when Subjected to Simulated Rain", 4th Edition. Louver shall be at least 99% effective at 1435 fpm free area velocity when tested at an exterior wind velocity of 29 mph and a simulated rainfall rate of 2.95 in/hr for 60 minutes. Louver shall be 100% effective against water penetration when tested at an exterior wind velocity of 45 mph and a rainfall rate of 4.3 in/hr for 60 minutes.

C. Air Performance: Metal wall louvers shall provide a minimum of 49.6% free area and shall intake 760 fpm free area velocity at a static pressure drop not exceeding 0.16 inches of water for a 4 foot by 4 foot unit per AMCA 500.

1.05 SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

1. For installed louvers and vents indicated to comply with design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Samples for Verification: Of each type of metal finish required, prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

E. Product Certificates: Signed by manufacturers of louvers certifying that the products furnished comply with requirements indicated.

F. Product Test Reports: Indicate compliance of products with requirements based on comprehensive testing of current products.

1. Wind Driven Rain: Test results for model of louver proposed confirming performance.
2. Air Performance: Test results for model of louver proposed confirming performance.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.06 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of louvers that are similar to those indicated for this Project in material, design, and extent.

B. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied color finish.

C. Welding Standards: As follows:

1. Comply with AWS D1.2, "Structural Welding Code--Aluminum."
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Airolite Co.
2. Arrow United Industries.
3. Construction Specialties, Inc.
4. Ruskin Manufacturing; Tomkins Industries, Inc.
5. Nystrom Building Products

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

E. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.

1. Frame Type: Channel type, unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide sill extensions, sill flashings and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

F. Join frame members to one another and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view; unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

G. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions, unless continuous vertical assemblies are indicated.

H. Provide sill extensions, sill flashings and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

2.04 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Louver Construction: Provide fixed-blade louvers with extruded-aluminum frames and blades. Stormproof rain guard type made to withstand a wind load calculated in compliance with paragraph entitled "Structural Performance". Louvers shall bear the AMCA certified ratings program seal for air performance and shall have BSRIA certification for water penetration in compliance with paragraph entitled "Wind Driven Rain".

B. Extruded Aluminum Louvers: Fabricated of extruded 6063-T5 or –T52 aluminum with a wall thickness of not less than 0.081 inch.

C. Mullions and Mullion Covers: Same material and finish as louvers. Provide mullions where indicated and for all louvers more than 6 feet in width at not more than 6 feet on centers. Provide mullion covers on both faces of joints between louvers.

2.05 LOUVER SCREENS

A. Provide louvers with screens at locations indicated.

B. Provide each exterior louver with louver screens complying with the following requirements:

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening, unless otherwise indicated.

C. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

D. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.

    a. Reinforce extruded-aluminum screen frames at corners with clips.

2. Finish: Mill finish, unless otherwise indicated.
3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.

E. Louver Screening for Aluminum Louvers: As follows:

1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.06 CLOSURE ANGLES AND CLOSURE PLATES

A. Fabricate from minimum 2 mm (0.074-inch) thick stainless steel or aluminum.

B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.

C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as specified.

D. Provide minimum 0.8 mm (0.032-inch) thick stainless steel or aluminum sleeves in cavity walls and elsewhere as shown.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.08 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

a. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate Setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.02 INSTALLATION

A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

B. Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations to meet requirements of paragraphs entitled "Structural Performance" and "Wind Driven Rain".

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.03 ADJUSTING, CLEANING, AND PROTECTING

A. Periodically clean exposed surfaces of louvers that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Protect louvers from damage during construction. Use temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at the time of Substantial Completion.

D. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes ground-set, fixed, cone tapered aluminum flagpoles.

1.03 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Product data: Submit product data and installation instructions for each type of flagpole required.

C. Shop drawings: Submit for flagpoles and bases, showing, general layout, jointing, grounding method, and anchoring / supporting systems.

1. Include details of foundation system for ground-set poles.

D. Samples: Submit for each finished metal to be exposed for flagpoles and accessories as requested by Architect.

1.04 QUALITY ASSURANCE

A. Manufacturing Standards: Provide each flagpole as a complete unit produced by a single manufacturer, including fittings, accessories, bases, and anchorage devices.

B. Design Criteria: Provide flagpoles and installations constructed to withstand minimum basic wind speeds indicated on Drawings when flying flag of appropriate size. Use heavy pipe sizes if required for flagpole type and height required or shown.

C. Pole Construction: Construct pole and ship to site in one piece if possible. If more than one piece is necessary, provide snug-fitting, precision joints with self-aligning, internal splicing sleeve arrangement for weather-tight, hairline field joints.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy Kraft paper or other weather-tight wrapping and prepare for shipment in hard fiber tube or other protective container.

B. Deliver flagpoles and accessories completely identified for installation procedure. Handle and store flagpoles to prevent damage or soiling.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Flagpole Div. of Kearney-National, Inc.
2. Baartol Co., Inc.
3. Concord Industries, Inc.

2.02 FLAGPOLE TYPES

A. Aluminum Flagpoles: Fabricate from seamless extruded tubing complying with ASTM B 241, alloy 6063-T6, having a minimum wall thickness of 3/16 inch (0.1875 inch), tensile strength not less than 30,000 psi, and a yield point of 25,000 psi. Heat-treat and age-harden after fabrication.

1. Provide cone-tapered aluminum flagpoles.
    a. 25 feet exposed height.

2.03 FLAGPOLE MOUNTING

A. Provide manufacturer's standard base system for the type of flagpole installation required.

B. Foundation Tube: For ground-set flagpoles, provide 16-gage minimum galvanized corrugated steel tube, or 12-gage rolled steel tube, sized to suit flagpole and installation. Furnish complete with welded steel bottom base and support plate, lightning ground spike, and steel centering wedges, all welded construction. Provide loose hardwood wedges at top for plumbing pole after erection. Galvanize steel parts after assembly, including foundation tube.

1. Provide manufacturer's standard flash collar, finished to match flagpole.

2.04 SHAFT FINISH

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Aluminum: Finish designations prefixed by "AA" conform to the Aluminum Association system for designating aluminum finishes. Provide fine, directional, medium satin polish (AA-M32), finished as follows:

1. Natural clear anodized finish complying with AA-C22A41, Class I (0.7 mil).

2.05 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, size as indicated or, if not indicated, to match pole butt diameter.

1. 14-gage spun aluminum, clear anodized finish.

B. Truck: Ball-bearing, non-fouling, revolving, double-track assembly of cast metal finished to match pole shaft.

C. Cleats: Two 9-inch cast metal cleats with fasteners, finished to match pole shaft. Provide lockable cleat covers in finish to match pole.

D. Halyards: Provide two continuous halyards for each flagpole, as follows:

1. Polypropylene, braided, white.
2. Size: 5/16 inch (No. 10).

PART 3 - EXECUTION

3.01 PREPARATION FOR GROUND-SET POLES

A. Excavation: Excavate for foundation concrete to neat clean lines in undisturbed soil. Provide forms where required due to unstable soil conditions. Remove wood, loose soil, rubbish, and other foreign matter from excavation; and moisten earth before placing concrete. Back fill open excavation after concreting with original excavated material.

B. Concrete: Provide concrete composed of portland cement, coarse and fine aggregate, and water mixed in proportions to attain 28-day compressive strength of not less than 3000 psi, complying with ASTM C 94.

C. Place concrete immediately after mixing. Compact concrete in place by use of vibrators. Moist-cure exposed concrete for not less than 7 days, or use a nonstaining curing compound in cold weather.

D. Finish trowel exposed concrete surfaces to smooth, dense surface. Provide positive slope for water runoff to base perimeter.

3.02 FLAGPOLE INSTALLATION

A. Prepare and install flagpoles where shown and in compliance with accepted shop drawings and manufacturer's instructions.

1. Provide positive lightning ground for each flag pole installation.
2. Paint below-grade portions of ground-set flagpole with heavy coat of bituminous paint.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Provide labor, materials, and equipment necessary for the complete installation of identifying devices as indicated on the Drawings and specified herein.

1. Exterior building numbers and letters.
2. Interior signage. Plate signs, mounted on door or wall surfaces as specified, indicated or required. Owner will assign Room Names and Numbers. Provide one plate at entrance of each space shown on Room Finish Schedule, unless indicated or directed otherwise.
3. Cast-metal plaque.
4. Exterior Building Sign

1.03 SUBMITTALS

A. Furnish required shop drawings and other submittals as required for Architect selection in accordance with Division I requirements.

B. Samples:

1. Interior room number and name signs.
2. Exterior building numbers and letters.
3. Plaque sample finish and letter style.
4. Sample of attachment or mounting method materials.

C. Signage Listing: Contractor shall provide a comprehensive list of all room names and numbers for each building space as well as quantities and locations for all other signs specified.

1.04 QUALITY ASSURANCE

A. Reference Codes and Specifications: Standard Building Code.

1.05 AMERICANS WITH DISABILITIES ACT (ADA) REQUIREMENTS

A. Signage shall be provided to conform with ADA requirements. ADA requirements supersede Technical Specifications in this Section, if not in agreement. Manufacturer shall conform to tactile, braille, letter size, and other requirements as may be required by ADA Accessibility Guidelines for Buildings and Facilities, Section 4.30, Signage, and other applicable sections; and State and Local Codes and Regulations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturer's products that may be incorporated into the Work include, but are not limited to, the following

1. Andco Industries Corp., Greensboro, North Carolina
2. A.R.K. Ramos
3. Best Sign Systems, Montrose, Colorado
4. Metallic Arts, Inc.
5. Design-A-Sign Co., Inc.
6. Spanjer Brothers, Inc.

2.02 INTERIOR SIGNAGE

A. Plate Signage Material: Plastic Laminate: High pressure plastic laminate engraving stock with face and core plies in contrasting colors, in finishes and color combinations indicated or, if not indicated, as selected from the manufacturer's standard array.

B. Comply with requirements indicated for materials, thicknesses, finishes, color, designs, shapes, sizes, and details of construction. Surfaces shall be constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.

C. Unframed Identification Plates: Fabricate signs with edges mechanically and smoothly finished to conform with the following:

1. Edge Condition: Square cut.
2. Edge Color for Plastic Laminate: Same as background.
3. Corner Condition: Square corners.

D. Graphic Content and Styles: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes and color of letters, numbers and other graphic devices.

1. Message Content: Center message content on sign.

2. Sign Sizes, Lettering Style and Size: Uppercase Helvetica type style in the following letter heights for each of the following sign types:

   a. For Door / Room Signs: 3 inches long, 1/8 inch thick, by length required, with 1 1/4 inch letter height.
   b. Signs for hazardous areas at Decontamination, mechanical and electrical rooms: Provide minimum 12 inches by 12 inches.
   c. Sign for required ADA public restroom: Minimum 6 inches by 6 inches, or as otherwise required by ADA requirements.
   d. 911 Telephone Enclosure Sign: Wording to be "Emergency 911 Telephone."
   e. Fire Extinguisher and Fire Alarm Signs: 1 inch letter height minimum.
   f. Provide signs of plastic laminate, unframed.

E. Mounting: Unless required and approved otherwise, mount with silicone adhesive recommended by manufacturer

2.03 ADA COMPLIANT SIGNAGE

A. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10.

B. Letters and numbers shall be raised 1/32 inch, upper case, Sans Serif or simple Serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8 inch high minimum and 2 inches high maximum. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 6 inches minimum in height. The standard dimensions for literary Braille are as follows:

   1. Dot diameter: .059 inch.
   2. Inter dot spacing: .090 inch.
   3. Horizontal separation between cells: .241 inch.
   4. Vertical separation between cells: .395 inch.

C. Finish and Contrast: Characters and backgrounds of plates must be eggshell, matte, or other non-glare surface. Characters and symbols shall contrast with their background. Contrasting minimum 50 %. All signage will strive to attain the greatest readability through the use of light-colored characters on a dark background.

2.04 CAST-METAL PLAQUES

A. General: Provide castings free from pits, scale, sand holes, and other defects. Comply with requirements specified for metal, border style, background texture, and finish and in required thickness, size, shape, and copy.

B. Available Manufacturers:

   1. A.R.K. Ramos.

2. American Graphics Inc.
3. Gemini Incorporated.
4. Matthews International Corporation; Bronze Division.
5. Metal Arts; Div. of L&H Mfg.
6. Mills Manufacturing, Inc.
7. Southwell Co. (The).
8. York Bronze/Bryan.

C. Bronze Castings: ASTM B 584, alloy UNS No. C83600 (No. 1 manganese bronze).

D. Size: 20 inches wide by 16 inches high.

E. Border Style: Raised flat band. .

F. Letter Style: Tiffany and Tiffany Italic.

G. Logo: Flat Relief Orange County Logo.

H. Background Texture: Manufacturer's standard leatherette finish with satin raised area finish.

I. Chemical Patina: Gold Oxide.

J. Mounting: Concealed studs for substrates encountered.

K. Architect to forward text for plaque from requirements provided by Owner.

2.04 EXTERIOR SIGNAGE

A. Station Building Sign:

1. Unless indicated or required otherwise, fabricate as a double sided fiberglass, internally illuminated sign with vinyl lettering and Fire Rescue Logo.
2. Provide aluminum post and framing as detailed. Refer to Division 3 Section "Cast-in-Place Concrete for requirements of foundation concrete.

B. Building Station Number Sign:

1. Unless indicated or required otherwise, fabricate from aluminum pipe or tube and framing with cast aluminum numbers of style and size indicated.
2. Coordinate roof penetration and flashing with Division 7 Section "Sheet Metal Roofing."
3. Refer to Division 3 Section "Cast-in-Place Concrete for requirements of foundation concrete.

2.05 EXTERIOR SHIELD

A. Provide a Fire Rescue Shield at indicated exterior front entrance location.

1. Comply with design requirements of Owner. Architect to coordinate and provide required information.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide full size mounting and installation kits for mounting building letters.

B. Install interior signage in accordance with approved shop drawings, ADA requirements, and at locations indicated on the Architect's Drawings and in conformance with manufacturer's instructions using only approved materials and methods.

C. Install level, plumb and at heights indicated or approved, and with sign surfaces free from distortion or other defects in appearance.

D. Provide all items and accessories as required for a complete installation in every respect.

E. At completion of installation, clean soiled sign surfaces, and related adjacent surfaces soiled from this installation, in accordance with manufacturers instructions.

F. Protect from damage until acceptance by Owner.

G. Remove and dispose of excess materials, litter and debris, and leave work areas in clean condition.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Standard metal lockers.

1.03 SUBMITTALS

A Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show base, sloping tops, filler panels and other accessories.
2. Include locker identification system.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: metal lockers and locker benches, in manufacturer's standard sizes.

E. Qualification Data: For Installer.

F. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal lockers and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

B. Deliver combination control charts to Owner by registered mail or overnight package service, unless directed otherwise.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:

1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
2. Recessed openings.

1.07 COORDINATION

A. Coordinate size and location of metal bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures.
    b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for All-Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.

B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

C. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior wallsfor corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.03 STANDARD METAL LOCKERS

A. Available Products:

1. Art Metal Products, Div. of Fort Knox Storage Co.; Standard Quiet Lockers.
2. DeBourgh Mfg. Co.; Worley Lockers.
3. General Storage Systems, Div. of North American Steel; Decor Tri-Lok.
4. Hadrian Inc.; Emperor Lockers.
5. List Industries Inc.; Standard Quiet Lockers.
6. Lyon Workspace Products; Standard Lockers.
7. Penco Products, Inc., Subsidiary of Vesper CorporationLockers.
8. Republic Storage Systems Company; Standard Lockers.
9. Shanahan's Ltd.; Deluxe Series Lockers.
10. Tennsco Corp.; Tennsco Lockers.

B. Locker Size and Arrangement: 18 inches wide by 24 inches deep by 72 inches high; Single tier

C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.0209 inch, with single bend at sides.
2. Backs and Sides: 0.0209 inch thick, with full-height, double-flanged connections.
3. Shelves: 0.0209 inch thick, with double bend at front and single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.0528-inch- thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

E. Doors: One-piece; fabricated from 0.0528-inch- thick, cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges.

1. Doors less than 12 inches wide may be fabricated from 0.0428-inch- thick, cold-rolled steel sheet.
2. Box lockers less than 15 inches wide may be fabricated from 0.0428-inch- thick, cold-rolled steel sheet.
3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.0428-inch- thick, cold-rolled steel sheet; welded to inner face of doors.
5. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
6. Door Style: Vented panel as follows:]

    a. Louvered Vents: Not less than six louver openings at top and bottom for single-tier lockers.

F. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Hinges: Manufacturer's standard, steel continuous or knuckle type.

G. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic and prelocking.

a. Latch Hooks: Equip doors 48 inches and higher with 3 latch hooks fabricated from minimum 0.0966-inch- thick steel; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated with vinyl or nylon to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

H. Built-in Combination Locks: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.

1. Bolt Operation: Manually locking deadbolt or automatically locking spring bolt.

I. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
2. Coat Rods: One for each compartment of metal lockers.

J. Accessories:

1. Continuous Base: Fabricated from cold-rolled steel sheet, manufacturer's standard thickness, but not less than 0.0528 inch thick.

a. Height: 4 inches.

2. Continuous Sloping Tops: Fabricated from cold-rolled steel sheet, manufacturer's standard thickness, but not less than 0.0329 inch thick.

a. Closures: Vertical -end type.

3. Recess Trim: Fabricated from 0.0428-inch- thick, cold-rolled steel sheet.
4. Filler Panels: Fabricated from cold-rolled steel sheetmanufacturer's standard thickness, but not less than 0.0329 inch thick.
5. Boxed End Panels: Fabricated from 0.0528-inch- thick, cold-rolled steel sheet.
6. Finished End Panels: Fabricated from 0.0209-inch- thick, cold-rolled steel sheet.
7. Center Dividers: Fabricated from 0.0209-inch- thick, cold-rolled steel sheet.

K. Finish: Baked enamel.

1. Color(s): Two colors, with door one color and frame and body another color; as selected by Architect from manufacturer's full range.

2.04 FABRICATION

A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.

B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

E. Coat Rods: Fabricated from 1-inch- diameter steel; chrome finished

F. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch high.

G. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.

H. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practicable; finished to match lockers.

I. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.

J. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.05 STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

D. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
3. Anchor back-to-back metal lockers to floor.

B. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

    a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

4. Attach recess trim to recessed metal lockers with concealed clips.

5. Attach filler panels with concealed fasteners. Locate fillers panels where indicated on Drawings.
6. Attach sloping top units to metal lockers, with closures at exposed ends.
7. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

D. Fixed Locker Benches: Provide not less than 2 pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

SECTION 10520
FIRE EXTINGUISHERS, CABINETS
AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes, but is not limited to fire extinguishers, cabinets and accessories, and frames.

1. Locations of items are indicated on drawings.

B. Definition: "Fire extinguishers" as used in this Section refers to units which can be hand-carried as opposed to those which are equipped with wheels or that are fixed to fire extinguishing systems.

C. Types of products required include:

1. Fire extinguishers and cabinets, including recessed and semi-recessed fire extinguisher cabinets for installation in masonry or stud walls, and recessed and semi-recessed fire valve cabinets for installation in masonry or stud walls.
2. Fire extinguishers and mounting brackets.

D. Fixed fire protection systems, hoses and cabinets are specified in Division-15 Sections.

1.03 SUBMITTALS

A. Product Data:

1. For cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials and finishes.
2. For extinguishers show type / style, bracket data (for extinguishers without cabinets), finishes, dimensions and other related data.

1.04 QUALITY ASSURANCE

A. Regulatory requirements: Comply with all specified and other governing codes and applicable regulations for fire extinguishers and installations.

B. Single Source Responsibility: Obtain products in this Section from one manufacturer.

C. Coordination: Verify that fire extinguisher cabinets are sized to accommodate fire extinguishers of type and capacity indicated.

D. UL-Listed Products: Provide new portable fire extinguishers which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

PART 2- PRODUCTS

2.01 ACCEPTABLE MANUFACTURES

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. J. L. Industries.
2. Larsen's Manufacturing. Co.
3. Modern Metal Products, Division of Technico, Inc.
4. Potter-Roemer, Division of Smith Industries, Inc.

2.02 FIRE EXTINGUISHERS

A. Fire extinguishers: Multi-Purpose Dry Chemical Type; UL-rated 3A: 40B:C, 10 pound nominal capacity, in enameled steel container for Class A, Class B and Class C fires.

1. Provide fire extinguishers for each extinguisher cabinet and mounting bracket, at locations indicated, in colors and finishes selected by Architect from manufacturer's standard which comply with requirements of governing authorities.

B. Fill and service extinguishers to comply with requirements of governing authorities and manufacturer's requirements.

C. Abbreviations indicated above identify extinguisher types related to UL classification and rating system and not, necessarily, to type and amount of extinguishing material contained in extinguisher.

2.03 EXTINGUISHER CABINETS

A. Provide manufacturer's standard cabinets, recessed and semi-recessed as shown on the construction documents or required. Provide rated units if installed in rated wall assemblies. Inside box dimensions - 9 inches wide x 24 inches high x 5 3/4 inches deep; units to be constructed of sheet steel. Provide door with full length piano hinge and lock.

B. Other Cabinet Features:

1. Door and Frame: Stainless steel, Type 304, satin finish.
2. Design: Duo-vertical panel with side break glass.

3. Glazing: Full glass door, tempered safety glass. Color: Clear.
4. Mounting: Flush (recessed).
5. Design Basis Model: Potter-Roemer Inc.; Atlas Series, Model No. 7060-DV-2-HR.

2.04 MOUNTING BRACKETS

A. Provide manufacturer's standard brackets designed to prevent accidental dislodgment of extinguisher, of sizes required for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.

B. Provide brackets for extinguishers not located in cabinets.

PART 3 -EXECUTION

3.01 EXAMINATION

A. Examine rough-in for cabinets and verify locations prior to cabinet installation.

1. Examine walls and partitions for thickness and framing for cabinets to verify cabinet depth and mounting prior to cabinet installation.

B. Do no proceed until unsatisfactory conditions have been corrected.

C. Follow manufacturer's printed instruction for installation.

1. Prepare recesses in walls for cabinets as required by type, size of cabinets, and style of trim.

3.02 INSTALLATION

A. Securely fasten mounting brackets and fire extinguisher cabinet to structure, square and plumb, to comply with manufacturer's instructions.

B. Locations by types, unless indicated otherwise: Locations as acceptable to governing authorities.

1. Bracket type: Mechanical rooms and as otherwise indicated on Drawings.
2. Cabinet type: At locations indicated on Drawings.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes, but is not limited to:

1. Toilet room accessories.
2. Metal framed mirrors in toilet rooms.
3. Mop racks in janitor rooms.
4. Framed glass shower doors.

1.03 QUALITY ASSURANCE

A. Reference specifications and standards:

1. ASTM: A123 Zinc (Hot-Dip) Galvanized) Coatings on Iron and Steel Products.
2. ASTM: A167 Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet and Strip.
3. NAAMM: Metal Finishes Manual.

1.04 SUBMITTALS

A. Shop drawings: Indicate dimensions and details, including joining and forming details for custom-fabricated items.

B. Product data (manufacturer's detailed literature): Manufacturer's catalog cuts and data sheets, complete parts list, and installation requirements for each accessory item specified.

C. Maintenance data, operating instructions, and keys required for each type of equipment and lock.

1.05 PRODUCT HANDLING

A. Maintain protective coverings on all items until installation has been completed.

1.06 WARRANTY

A. Warrant mirrors against silver spoilage for 15 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Accessories:

1. A J Washroom Accessories.
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corporation.

2.02 MATERIALS

A. Stainless steel: ASTM A167 Type 302/304; 400 series is not acceptable. NAAMM No. 4, polished finish.

B. Concealed mounting devices: Carbon steel with hot-dip galvanized coating in accord with ASTM A123 or stainless steel.

C. Provide each item complete with stainless steel screws and fittings, including concealed anchorage as required to provide a secure mechanical attachment.

D. Sanitary sealants: Mildew-resistant silicone as specified in Section: "Joint Sealants."

2.03 FABRICATION

A. Fabricate recessed units with seamless one-piece flange on exposed face.

B. Locked dispensing units: Key alike for all accessories and in accord with Architect / Owner requirements.

C. Coin-operated dispensing units: Key coin boxes separately from dispensing unit.

D. Weld corners, grind welds smooth, and finish to match adjacent finish surfaces.

E. Eliminate exposed cutting edges.

2.03 SCHEDULE OF ACCESSORIES

A. Glass Shower Doors: Framed style; fabricated from Type 304 polished stainless steel, or clear anodized aluminum, of indicated or required sizes.

1. Glass: Tempered 1/4 inch, obscure.
2. Hardware: Manufacturer's standard polished stainless steel or clear anodized aluminum. Provide non-corrosive piano style hinges.

B. Refer to Schedule in Contract Drawings for all other accessory items.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check openings scheduled to receive recessed units for correct dimensions, plumbness of blocking, backing plates or frames, and preparation that would affect installation of accessories.

B. Check areas to receive surface-mounted units for conditions that would affect quality and execution of work.

C. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.

D. Do not begin installation of toilet accessories until openings and surfaces are acceptable.

3.02 INSTALLATION

A. Locate accessories accurately, set plumb and level, and attach securely in position.

B. Drill holes to correct size and application that is concealed by item, with 1/8 in. tolerance.

C. Mount recessed accessories, if any, into wall openings with sheet metal screws into metal frames.

D. Plumb, align, and mount surface-mounted accessories, if any, to backup with fasteners appropriate for fastening conditions.

E. Set accessories with continuous bead of sanitary sealant.

3.03 ADJUST AND CLEAN

A. Adjust accessories for proper operation.

B. After completion of installation, clean and polish all exposed surfaces.

C. Remove protective covers at final cleaning of installation and immediately prior to acceptance by Owner.

D. Deliver keys and instruction sheets to Owner.

END OF SECTION

Division 11
Equipment

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following building equipment:

1. Brackets for wall mounted televisions and equipment.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, features, and finishes. Include details of anchors, hardware, and fastenings. If applicable, include assembly, disassembly, and storage instructions.

B. Shop Drawings: Show location and extent of equipment. Include elevations, sections, and details not shown in Product Data. Show method of field assembly, connections, installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

1. Blocking and Reinforcement: Show locations of blocking and reinforcement required for support of equipment.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer demonstrating evidence of satisfactory installations of similar equipment.

B. Source Limitations: Obtain each type of equipment through one source from a single manufacturer.

1.05 COORDINATION

A. Coordinate layout and installation of mounting equipment components with other construction that penetrates walls, or is supported by them.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Television mounting brackets:

a. Peerless Industries, Inc. (Design Basis)
b. Bretford Manufacturing, Inc.
c. Other accepted manufacturers of equivalent products.

2.02 EQUIPMENT / MATERIALS

A. Television Wall Mounting Bracket:

1. Designed to fit 23" monitors required, complete with mounting hardware for attachment to required substrates and conditions.
2. Model No.: Peerless Model – ('Peerless JMS 2640'). Finish / color: As selected by Architect from manufacturers standard array.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine prior construction substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Verify critical dimensions.
2. Examine supporting structure and wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked for installers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install TV mounting brackets at Fitness Room location indicated or directed by Architect. Comply with manufacturer's written installation requirements.

B. Unless otherwise indicated, install equipment after other finishing operations, including painting, have been completed.

C. Permanently install equipment and components. Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; aligned and in proper relation to adjacent construction.

D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed equipment to structural support and for properly transferring load to in-place construction.

3.03 ADJUSTING

A. Adjust movable components of equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts when required.

3.04 CLEANING AND PROTECTION

A. After completing equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Provide final protection and maintain conditions acceptable to manufacturer and Installer that ensure equipment is without damage or deterioration at time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The supply, delivery, and installation of all food service equipment as listed within the following specification and indicated on the related drawings.

1.02 SCOPE OF WORK

A. Except as otherwise herein stated, the work of this Section consists of the furnishing of all materials, labor, fabrication, transportation, equipment and appliances required for the complete execution of all food service equipment as shown on the drawings, as specified, or both and as may reasonably be inferred as necessary to complete the work for Certificate of Occupancy and intended use by Owner / occupant. This shall include but not be limited to the following:

1. Stands and supports required for equipment, including backing plates.
2. Cutting of holes in equipment for pipes, drains, electric outlets, etc., indicated and those which are not indicated but which are required for this installation.
3. Installation of Owner furnished equipment as listed in the item specifications.

B. Where the word "Contractor" appears in this Section, this shall mean "Food Service Equipment Contractor." Where the abbreviation "G.C." appears in this Section, this shall mean " General Contractor". Where the word "Consultant" appears in this Section, this shall mean "Foodservice Design Associates, Inc." in Orlando, Florida (407) 896-4115.

C. It shall be the Contractor's responsibility to verify the quantities of the items listed herein with those shown on the drawings. Any discrepancies detected by a bidder shall be called to the Consultant's attention by means of a fascimile (fax) letter for clarification. A written response to these inquiries will be made by the Consultant in writing to the General Contractor or Owner, for distribution to all bidders.

D. The Contractor shall adhere to all applicable Union Rules and Jurisdictional Trade Agreements. The Contractor shall work in harmony with other trades on this project to insure the prompt and successful completion of this project.

1.03 RELATED SECTIONS

A. Electric services, including wiring and final connections to the fixtures and equipment furnished under this Section, and Section 11451, and Owner-furnished equipment: Division 16 - Electrical.

B. Water, gas steam and waste services to the fixtures and equipment, except as otherwise specified in individual items: Division 15 Mechanical.

C. Except exposed ducts specified as part of equipment, all ventilation ductwork including final connections to hoods and ventilators: Division 15.

D. Quarry tile: Division 9.

1.04 RESPONSIBILITY

A. The work herein specified and/or shown on the Drawings shall be coordinated with the work of the other Contractors. It shall be the responsibility of the Contractor to maintain regular communication with the G.C. and project team members to assure coordination and cooperation with all other trades performing work on this project.

B. Contractor for work of this Section shall examine and become familiar with drawings and specifications for architectural and mechanical work with reference to work in this Contract, and shall be responsible for correct fitting of his work in connection with such related work. He shall become familiar with all job conditions, building measurements, and other conditions in order to coordinate the planning, design, delivery, storage and installation of his work, all with proper consideration of the project progress schedule.

C. The Contractor will be held responsible for verifying the electric current characteristics. If any of the equipment to be supplied does not coincide with that which is indicated on the Schedule or the Roughing Drawings, it will be the supplier's responsibility to call the discrepancy to the attention of the Consultation prior to submitting the questionable item.

D It shall be this Contractor's responsibility to visit the site and coordinate with other trades to preclude cutting and patching and in the event of units of equipment too large to pass through planned openings, arrange for access to the required areas ahead of time not to delay delivery schedule.

E. In addition to the requirements set forth in the Project Specifications, the Contractor shall be completely responsible for the fulfillment of all the requirements pertaining to the fabrication, assembly and installation of all the items of this Section, including those of his subcontractors.

F. Provide all appurtenances which may not be specifically mentioned in the specifications or shown on drawings, but which are required for the proper function and installation of the equipment.

1.05 QUALIFICATIONS

A. Contractor shall submit satisfactory evidence that he is now, and has been for the past five (5) years, engaged in the food service equipment industry, installing projects of the type herein specified as his principal product. Contractor must be engaged in the fabrication of stainless steel, food service equipment in his own plant, or he must submit to the Consultant the name of his fabricator for approval, prior to bidding. Contractor's fabricator must show evidence he can meet the requirements concerning qualifications. Contractor's fabricator submitted and approved must be sub-contractor used.

B. Contractor shall also submit evidence showing that he has executed contracts of a size comparable to the work herein specified and that he has the experience and financial resources to enable him to execute the work in a satisfactory manner and to deliver the required items of equipment so as not to delay the orderly progress of the work.

C. If, because of trade union rules and jurisdictional trade agreements or their conditions, any work specified to be performed under the Contract must be done by a particular trade, Contractor shall sublet such work to those who may or can do such work or make other arrangements at his won expense and submit name of manufacturer or sub-contractor for approval.

D. The Contractor shall have open accounts with all major food service equipment manufacturers, and shall indicate in writing that he or she is capable of being bonded up to the actual amount of the food service equipment contract.

1.06 QUALITY ASSURANCE

A. Requirements of regulatory agencies:

1. In addition to complying with other legal requirements, comply with:

a. National Sanitation Foundation Regulations. (NSF)
b. AGA: Approved gas-fired equipment.
c. UL: Approval and listing for equipment and electrical devices.

B. Reference specifications and standards:

1. NEMA: LP-3, Plastic Laminates.
2. ASTM: Designations specified.
3. ANSI: Z21.20, Automatic Gas Ignition Systems & Components.

C. Refer to Division 1 Section "Product Requirements".

1.07 SUBMITTALS

A. Rough-in drawings.

1. The KEC shall submit 1/4 inch scale reproducible rough-in drawings for approval. Drawings shall be dimensioned, showing ventilation ducts, floor and wall sleeves, plumbing, gas, steam, and electrical lines, including those items purchased or supplied by the Owner. Elevations and sections of special work shall be prepared for use of the respective trades.
2. The following shall each be drawn on separate sheets and/or plans; Plumbing; Electrical, and Ventilation. In addition, a plan indication slab recesses, wall blocking, Refrigeration Chase, and Beverage Chase locations shall be provided.
3. Utilities shall be stubbed out of walls wherever possible.
4. Kitchen Equipment Contractor shall field verify mechanical, electrical, and ventilating rough-in and sleeve locations before floor slabs are poured.

B. Shop drawings:

1. Submit detail drawings at 3/4 inch and 1-1/2 inch scale.

a. Indicate dimensions, details or construction, installation, relation to adjoining and related work where cutting or close fitting is required. Verify at job site, all dimensions, mechanical, electrical and ventilation rough-in, and sleeve locations before fabrication.
b. Indicate all reinforcements, anchorages and other work required by other trades for complete installation of all items.
c. Include on shop drawings all items furnished by the Owner. Owner will provide Contractor with product data and other information required for detailing.

C. Product data: Manufacturer's detailed literature, catalog cuts, and specifications:

1. Submit for each manufactured item. Include rough-in and service information and details.

D. Maintenance data and operating instructions:

1. Provide the following:

   a. System description.
   b. Wiring diagrams.
   c. Operating sequence.
   d. Manufacturer's data.
   e. Preventative maintenance.
   f. Trouble shooting.
   g. Warranties.
   h. Directory.
   i. Valve directory with tag schedule showing location of each valve, type, number and manufacturer.

2. Compile required operating maintenance data stipulated into individual packages for each item of equipment. Identify each package with equipment name and item number corresponding to name and number in schedule. All data shall be incorporated in 1-1/2" hardback, (3) ring binders. Include a complete list of service agencies for all equipment.

1.08 PRODUCT HANDLING

A. Procedures: In accordance with Division 1.

1.09 WARRANTY

A. Guarantee all equipment furnished under this Section for a period of one year from the date of substantial completion, covering defective materials, design and workmanship. Upon receipt of notice of failure of any part of the warranted equipment during the warranty period, the affected part or parts shall be replaced promptly and at the expense of the food service equipment installer.

1. Until the time replacement equipment is installed, the Owner shall have full use of the defective equipment.
2. Warranty shall include installation, start-up and one year free service for all self-contained refrigeration equipment with evidence of manufacturer's one year warranty on the entire cabinet and additional four year Warranty on sealed compressor motor assembly except for labor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless steel: ASTM A240, U.S. Standard gauges, 18-8 type 302 or 304, not over 0.12% maximum carbon. Provide No. 4 finish unless otherwise specified.

B. Galvanized steel: Arco, gauges as specified or indicated on Drawings.

C. Sink wastes: All custom fabricated and die-drawn sinks: Rotary type waste outlet with one-piece connected overflow assembly and stainless steel removable basket strainer manufactured by Component Hardware Group as "Drain Master" Model DSS-8000.

D. Legs: 1-5/8 inch diameter 16 gauge stainless steel tubular legs with bullet type feet,

Model A10-0881 as manufactured by Component Hardware Group, unless specified or detailed otherwise.

E. Hardware: Except where specified otherwise, all hardware shall be solid material, and where exposed, chrome plated or stainless steel.

1. Provide locking type hardware. Identify hardware with manufacturer's name and number so that broken or worn parts may be ordered and replaced.
2. Unless otherwise specified, provide stainless steel 4" D pulls, Klein Hardware, Model #12000, and Klein Model #242, solid brass, satin finish door catches for side sliding doors, access panels and hinged doors.
3. Faucets and Pre-Rinse Spray Units: "Encore" as manufactured by Component Hardware Group. Provide pre-rinse spray units with wall bracket assembly. Model numbers as shown on Drawings.
4. Drawers: Model S90-0020 manufactured by Component Hardware Group.
5. Sound Deadening Material: Q75-2500 "Multiflec Sound Deadener" as manufactured by Component Hardware Group. Color Grey.

F. Sink bowls: 14 gauge or heavier polished stainless steel (installed in tops as an integral part of the fixture).

G. Casters: Size and type specified, double ball bearing, rubber-tired, heavy duty, 1 inch tread width, cadmium plated, as manufactured by Jarvis and Jarvis, Inc., except that the manufacturer's standard casters will be accepted on standard items. Approved Alternate Mfr: Component Hardware Group.

H. Plumbing Products: All plumbing products shall utilize "lead free" castings and comply with NSF Standard 61, Section 9 (11 micrograms or less of lead when normalized to one liter).

I. Miscellaneous materials: Provide as specified with specific equipment item.

J. Sink and work table tops and undershelves: Work table tops shall be 14 ga. and undershelves shall be 16 ga. min. unless otherwise noted.

2.02 FABRICATION

A. All custom fabricated equipment shall be provided by approved fabricator. Approved fabricators:

Florida Stainless: 407-679-2710
B&W Stainless: 407-677-5137
Stanley Knight Co.

B. All other fabricators must be approved prior to bidding.

C. Drawings: Drawings indicate general arrangement of the piping and location of equipment.

1. Should it be necessary to deviate from the arrangement indicated in order to meet structural conditions, such deviations, as approved, shall be made without additional expanse to the Owner.
2. Exact locations, distances and levels shall be governed by the building conditions.

D. General:

1. Provide all fabrication in accord with NSF Standards.
2. Verify size and location of all duct connections required for ventilators, including Owner furnished ventilators, prior to fabrication.
3. Fully welded all type 304 s/s construction.
4. All exposed surfaces shall be min. #4 finish unless otherwise noted.

E. Welding:

1. Make all shop and field welds continuous and hidden or ground smooth.
2. Polish exposed welds in stainless steel to original finish after grinding, with no visible welds, line or buckles.
3. Grind galvanized steel so no visible welds, lines or buckles show, and touch-up with galvanizing stick, where galvanizing has been removed.

F. Manufacturer's instructions: Follow manufacturer's directions in all cases where the manufacturer of items used in this work furnish directions or prints covering points not indicated or specified.

G. Metal tops:

1. Fabricate all tops from 14 gauge No. 4 finish stainless steel unless specified otherwise. Provide one piece welded construction reinforced on the underside with 14 gauge stainless steel channels.
2. Provide cross braces not more than 30 inch o.c. Coat underside of all tops with a minimum of 1/8 inch thick approved hard-drying, sound-deadening mastic material dried smoothly without dirt-catching crevices.

H. Enclosed cabinet type bases:

1. Made of formed sheets reinforced to create a rigid structure. All unexposed sections, upright partitions and back shall be 18 gauge galvanized steel or heavier, except as specified otherwise.
2. Exposed body facings, partitions, stiles and aprons shall be 18 gauge stainless steel, No. 4 finish, unless otherwise specified.
3. Shop weld all seams and joints where possible. Ground welds smooth and polish welds to match original finish. Faces to be all flush welded.
4. Finish ends of all fixtures, splashbacks, shelves, etc., flush to walls or adjoining fixtures.
5. Provide access holes in panels in the equipment to allow plumbing and electrical trades to make their respective connections.
6. Coved corners:
   a) Provide all dishtables, drain tables, work tops, splashbacks and turned-up edges with radius bends on all inside horizontal and vertical corners, and coves at intersections.
   b) Provide all shelves, undershelves, elevated shelves, port shelves, etc., with turned-up edges and radius bends on all inside horizontal corners.
   c) Unless specified otherwise in individual items, provide rounded and coved corners or radius ends of 3/4 inch radius or larger.
7. Fabricate equipment legs and cross rails from 1-5/8 inch diameter 16 gauge stainless steel tubing unless otherwise noted. Grind smooth and polish all welds

at cross-rails. Fit bottom of each leg at floor with a sanitary stainless steel bullet type foot with not less than 2 inch adjustment. Fasten legs to equipment as follows:

a) To sinks by means of cylinder gussets: Provide stainless steel gussets reinforced with bushing, and set screw for securing legs. (United Show Case No. LC-158).

b) To metal top tables and dishtables: Provide cylinder gussets or equivalent, welded to 14 gauge or heavier channel. Weld bracing to underside to tops.

c) Closed gussets shall be a minimum 3-inch diameter on top continuously welded to frame members of sink bottoms.

I. Sinks:

1. Provide fabricated sink compartments with fully coved vertical and horizontal interior corners. All coves 3/4" RAD.
2. Where one or more sink compartments are adjacent, provide double thickness partitions, continuously welded at top. Fronts of multiple compartment sinks continuous on the exterior.
3. Crease bottoms of each sink compartment to insure complete drainage to waste opening.
4. Install inset type sinks in tops as an integral part of the fixture.

J. Drawers:

Model S90-0020 manufactured by Component Hardware Group or custom fab to following standards:

1. Fabricated die stamped 18 gauge stainless steel with stainless steel fronts. Fabricate support slides so that drawers may be pulled out a minimum of two-thirds or its length and still support heavy loads without deflection.
2. Fabricate to allow easy removal without the use of tools. Provide with 4" D type pulls. All drawers mounted on open tables shall have enclosure on sides and rear and shall be self-closing.
3. Mount drawers in refrigerated sections on large ball bearings surface in flat tracks.
4. Wheels and bearings shall be corrosion resistant, long wearing material, grease packed before assembly.

K. Doors:

1. All doors shall be double pan type, outer pans cased, with welded corners.

a) Sliding doors: Removable double pan type, reinforced and stiffened with closed hat sections, and mounted on ball bearing quiet rollers in overhead tracks.

b) Hinged doors: Flush type mounted on heavy duty stainless steel piano hinges. Fill inside core of doors with sound deadening material. Provide D type stainless steel pulls.

L. Shelves:

1. Overhead shelves: Constructed of #16 gauge stainless steel not less than 12" wide, unless otherwise specified. The shelves shall be polished on all surfaces (top and bottom). Each shelf shall be made in one (1) piece or butt welded, ground and

polished smooth. Shelves shall be made as shown, welded, ground, and polished. Where shelves adjoin walls, gauge stainless steel wall brackets, triangular shaped, spaced not more than 48 inches on center, welded to stainless steel 1-1/4" diameter, #16 gauge stanchions mounted through table backsplash unless otherwise specified for particular item.

2. Undershelves: At open tables constructed of #16 gauge polished stainless steel, having edges turned down 1-1/2" and under 3/4" except at walls turned up 2"; with all corners welded, ground and polished; where required shelves suitable reinforced with stainless steel channels running the full length. Shelves connected to legs by means of notching and continuous welding. All cabinet bottoms will be #16 gauge stainless steel reinforced as required and shown on the contract drawing, completely integrally flush-welded to cabinet face. Provide ferruled openings in bottom shelves top entry of service where required.

2.03 HEATING EQUIPMENT

A. Provide electric or steam heating equipment or thermostat control for such equipment, and of materials, sizes or ratings specified within the equipment items or details.

1. All such equipment shall be of nature and so installed as to be readily cleanable or made easily removable for cleaning.

B. Electrical appliances or heating element circuits of 120 volts shall not exceed 1650 watts.

2.04 ELECTRICAL SWITCHES AND CONTROLS

A. Provide on each motor driven appliance or electrical heating unit a suitable control switch or starter of proper type in accord with UL requirements.

1. All other switches and controls, including line switches, safety cut-outs, control panels, fuse boxes, other controls, fittings and connections will be furnished and installed by the electrical trade except where specific instances specified otherwise.

B. Provide all internal wiring for fabricated equipment items, including all devices, wiring controls, switches, electrical boxes, receptacles, stainless steel face plates, conduit and wiring, etc., built into or forming an integral part of these items, in factory or at the job site, with all items completed to a junction box for final connection to the building services by the electrical trade. Fixture internal wiring shall conform to applicable local and national requirements.

C. Provide standard 3-prong plug to fit "U" slot grounding type receptacles, similar to Hubbell No. 5262, for all equipment items noted as powered by plug connection into 110-120 volts, single phase A.C. Provide suitable length 3-wire cord for all such equipment.

D. Load Centers: Load centers (if required) shall be fabricated and installed in full compliance with UL standards. KEC shall confirm if local codes require fabrication of entire unit (counter or table) by a fabricator certified to produce UL Listed assemblies.

2.05 CONNECTION TERMINALS

A. Provide equipment complete with connection terminals as standardized by equipment manufacturers except where specified otherwise, for other trades to make plumbing, gas, steam, electrical, ventilation and refrigeration connections.

B. Provide equipment including refrigerated drawer sections and ice bins, and all indirect wastes or other special applications, with 1 inch minimum copper drain tubing of sufficient length to extend to floor sinks.

   1. Wrap drain tubing with 1/4 inch thick foamed plastic insulation to prevent condensation.

C. All drains extended from equipment to indirect wastes shall be by plumber.

2.06 TRIMMING AND SEALING EQUIPMENT

A. Seal spaces between all units at walls, ceilings, floors and adjoining non-portable units with enclosed bodies against entrance of food particles or vermin by means of s/s trim, strips, welding, soldering or commercial joint materials as suited to the nature of the equipment. Use silicone sealants where applicable.

B. Close ends of all hollow sections.

C. Fixtures resting on concrete bases shall be set into sealant bed to eliminate crevices between fixture and base, and caulked after installation has been completed.

2.07 EXHAUST VENTILATORS (See Item Specification)

A. Acceptable Manufacturers: AVTEC, Gaylord, or Ventmaster (Others as noted in item specification)

B. Kitchen Equipment Contractor (K.E.C.) must provide factory authorized start-up supervision and inspection with written confirmation of same issued to Architect within 48 hours of start-up. Confirmation letter shall include names of Owner's representative(s), Contractor's representative(s), and factory service rep present at time of start-up.

Item No. 2 - Chef's Table
Custom Fabricated Assembly, 96" x 30" all welded type 304 s/s construction, bull-nose edges, (2) locking all s/s drawer assemblies, race track style pot rack, adj NSF bullet feet, s/s undershelf.

Stainless steel: ASTM A240, U.S. Standard gauges, 18-8 type 302 or 304, not over 0.12% maximum carbon. Provide No. 4 finish unless otherwise specified.

Legs: 1-5/8 inch diameter 16 gauge stainless steel tubular legs with bullet type feet, Model A10-0881 as manufactured by Component Hardware Group, unless specified or detailed otherwise.

Drawers: Model S90-0020 manufactured by Component Hardware Group.
Sound Deadening Material: Q75-2500 "Multiflec Sound Deadener" as manufactured by Component Hardware Group. Color Grey.

Work table tops and undershelves: Work table tops shall be 14 ga. and undershelves shall be 16 ga. min. unless otherwise noted.

Provide shop drawing to client for review prior to construction.
Approved Alternate Mfgr: Universal Stainless (per above spec)

Item No. 3 – 30" Oven & Range
SEE SPECIFICATION SECTION 11451

Item No. 4 - Counter, Enclosed Base
Custom Fabricated Assembly, 48" wide, 30" front-to-back enclosed counter, height to match residential range unit #3, 6" rear splash, front hinged doors with intermediate shelf unit, all welded type 304 s/s construction, bull-nose front and Left side edges and flush 90 degree angle edge on right (range) side.

Stainless steel: ASTM A240, U.S. Standard gauges, 18-8 type 302 or 304, not over 0.12% maximum carbon. Provide No. 4 finish unless otherwise specified.
Legs: 1-5/8 inch diameter 16 gauge stainless steel tubular legs with bullet type feet, Model A10-0881 as manufactured by Component Hardware Group, unless specified or detailed otherwise.
Sound Deadening Material: Q75-2500 "Multiflec Sound Deadener" as manufactured by Component Hardware Group. Color Grey.
Work table tops and undershelves: Work table tops shall be 14 ga. and undershelves shall be 16 ga. min. unless otherwise noted.
Provide shop drawing to client for review prior to construction.
Approved Alternate Mfgr: Universal Stainless (per above spec)

Item No. 5 – Dishwasher
SEE SPECIFICATION SECTION 11451

Item No. 6 - Sink Counter, Enclosed Base
Custom Fabricated Assembly, 7'-9" wide, 27" (approx) front-to-back enclosed counter, 36" working height to match counters #4 and #13, with 6" rear and Left side splash, enclosed base construction to accommodate residential dishwasher #5, all welded type 304 s/s construction, bull-nose front and Right side edges. Provide with T&S swing arm faucet, 1/2" supply, splash mounted, sink sizes per plan.
Legs: 1-5/8 inch diameter 16 gauge stainless steel tubular legs with bullet type feet, Model A10-0881 as manufactured by Component Hardware Group, unless specified or detailed otherwise.
Sound Deadening Material: Q75-2500 "Multiflec Sound Deadener" as manufactured by Component Hardware Group. Color Grey.
Sink tops shall be 14 ga. and undershelves shall be 16 ga. min.
Sink bowls: 14 gauge or heavier polished stainless steel (installed in tops as an integral part of the fixture).
Sink wastes: All custom fabricated and die-drawn sinks: Rotary type waste outlet with one-piece connected overflow assembly and stainless steel removable basket strainer manufactured by Component Hardware Group as "Drain Master" Model DSS-8000.
Stainless steel: ASTM A240, U.S. Standard gauges, 18-8 type 302 or 304, not over 0.12% maximum carbon. Provide No. 4 finish unless otherwise specified.
Plumbing Products: All plumbing products shall utilize "lead free" castings and comply with NSF Standard 61, Section 9 (11 micrograms or less of lead when normalized to one liter).
Provide shop drawing to client for review prior to construction.

Approved Alternate Mfgr: Universal Stainless (per above spec)

Item No. 6A – Faucet for the counter with sinks – See sheet FSE – 1.

Item No. 7 – Stainless Steel Microwave shelf

Item No. 8 – Microwave Oven
SEE SPECIFICATION SECTION 11451

Item No. 9 – 36" Range Hood
SEE SPECIFICATION SECTION 11451
Mount hood 30" above range burners in conjunction with "fire suppression system".

Item No. 10 – Coffee Machine – By OCFD

Item No. 11 - Wall Cabinet, 36"
Qty (1) Custom Fabricated wall cabinet, 36" wide, hinged front doors with intermediate shelf, flat top, all welded type 304 s/s construction. See elevation drawing for height. Similar to Advance Tabco Model WCH-15-36 with flat top option. Provide with key locks.

Item No. 12 - Wall Cabinet, 48"
Qty (3) Custom Fabricated wall cabinet, 48" wide, hinged front doors with intermediate shelf, flat top, all welded type 304 s/s construction. See elevation drawing for height. Similar to Advance Tabco Model WCH-15-48 with flat top option. Provide with key locks.

Item No. 13 - Counter, Enclosed Base with Drawers
Custom Fabricated Assembly, 48" wide, 30" front-to-back enclosed counter, height to match residential range unit #3, 6" rear splash, front hinged doors with intermediate shelf unit, all welded type 304 s/s construction, bull-nose front and Right side edges and flush 90 degree angle edge on Left (range) side.
Drawers: Model S90-0020 manufactured by Component Hardware Group.
Locks and keys: Equip door and drawers with locks.
Stainless steel: ASTM A240, U.S. Standard gauges, 18-8 type 302 or 304, not over 0.12% maximum carbon. Provide No. 4 finish unless otherwise specified.
Legs: 1-5/8 inch diameter 16 gauge stainless steel tubular legs with bullet type feet, Model A10-0881 as manufactured by Component Hardware Group, unless specified or detailed otherwise.
Sound Deadening Material: Q75-2500 "Multiflec Sound Deadener" as manufactured by Component Hardware Group. Color Grey.
Work table tops and undershelves: Work table tops shall be 14 ga. and undershelves shall be 16 ga. min. unless otherwise noted.
Provide with (3) locking all s/s drawer assemblies
Provide shop drawing to client for review prior to construction.
Approved Alternate Mfgr: Universal Stainless (per above spec)

Item No. 14 – Range Top Fire Suppression system
Qty (1) Guardian III Fire Suppression System (BASIS-OF-DESIGN)

Item No. 15 – Two (2) open Stainless Steel Shelves

Item No. 16 - Trash Container
Qty (1) Synthetic trash container (Similar to Rubbermaid "Slim-Jim" style). Confirm size with counter #6 shop drawings.

Item No. 17 - S/S 36" Wall Cabinet
Qty (1) Custom Fabricated s/s wall cabinet on top of range hood between wall cabinets.

Item No. 18 - Garbage Disposer
SEE SPECIFICATION SECTION 11451

Item No. 19 – Stainless Steel Backsplash
To be installed to completely cover the area between the counter-top and the upper cabinets.

Item No. 20 – Icemaker
SEE SPECIFICATION SECTION 11451

Item No. 21-In-line water filter
Qty (1) 3/8" Pentek GS-10cb1 Inline Water Filter for ice-maker (BASIS-OF-DESIGN)

PART 3 - EXECUTION

3.01 GENERAL:

A. Review all drawings pertaining to the food facilities and food facilities areas, including the utility load information prepared by the Consultant. Provide all equipment in accordance with the requirements of these documents (i.e., voltage characteristics, kw loads, special valves, etc.).

B. Notify the Consultant and Owner of any discrepancies between plans and specifications and actual conditions on the job before fabrication of equipment.

C. K.E.C. review of job conditions: The KEC shall visit the job site to field check actual wall dimensions and roughing-in and be responsible for furnishing, fabricating, and installing the equipment in accordance with the available space and utility services as they exist on the job site.

D. Check all door openings, passageways, elevators, etc., to be sure that the equipment can be conveyed to its proper location within the building and, if necessary, check with the General Contractor regarding the possibility of holding wall erection, placement of doorjambs, windows, etc., for the purpose of moving the equipment to its proper location. Any removal and rebuilding of walls, partitions, doorjambs, etc., necessary to place the equipment or, if caused by incorrect information on the Contractor's drawings, shall be done at the expense of the Contractor, at no additional cost to the Owner.

E. Ensure equipment accurately fits the space as it exists and conforms to actual field dimensions on the job. Any changes required after fabrication has been started shall be made at no additional cost to the Owner.

F. Contractor shall review drawings and physically check the location and utility size of all "rough-ins" at the job site for compatibility with the equipment being installed before finished floors, walls, and/or ceilings are in place. K.E.C. shall take full responsibility for coordination of rough-ins. If rough-ins have been completed by others, Contractor

shall review same, note any missing or problem areas, shall so advise Consultant, and shall coordinate corrections or shall adjust his equipment to suit conditions.

G. Provide all necessary appurtenances to accommodate plumbing, electrical, and refrigeration, etc., rough-in as shown on utility load information; for example, an S.R. (single receptacle) connection shown on the plan requires that the appropriate rounded cord and plug be provided to fit the receptacle as part of the equipment item to which the connection will be made.

H. Where portions of an item pass through masonry, walls, or partitions, provide complete installation of the item, including trim, field welding, dimensions, and coordinate all other work being performed relative to the item being installed.

I. All equipment, such as pass-through refrigerators and warmers, which pass through a wall where one side is exposed to public view shall be provided and installed with the operating controls located on the kitchen or working side of the wall. All equipment such as coffee urns, which are located on or in a counter having a pick-up side and a working side, shall be provided and installed with the operating controls facing the working side of the counter.

3.02 DELIVERY:

A. All food service equipment shall be delivered to the job site protected from weather, vandalism and/or loss, and placed within the building. After delivery into the building, assembled and set in place, all responsibility for loss and/or damage to the food service equipment prior to final acceptance by the Owner shall rest with the Contractor. Recognizing that other building trades tend to damage table and equipment tops by standing upon them to reach ceiling areas or using these surfaces for tool storage, the Food Service Equipment Contractor (KEC) is encouraged to temporarily protect these surfaces from damage by the use of cardboard, plastic or similar materials, as well as posting notices warning against this damage.

B. Any items lost or damaged shall be immediately replaced or repaired to a new condition at no cost to the Owner, and to the satisfaction of the Consultant and Owner.

C. Coordination with General Contractor: The KEC shall coordinate all food service equipment delivery and installation activities with the General Contractor, avoiding all interference with the work of the G.C.

D. The KEC shall review the construction schedule, and shall notify the Owner and G.C. of required lead times and Order/Approval dates for all equipment. Additional costs resulting from special handling or air shipment of equipment shall be paid by the KEC unless delays in ordering are unavoidable and the result of actions by the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Clothes washer and dryer.
2. Refrigerator / Freezer.
3. Range hood.
4. Range / Oven.
5. Microwave Oven.
6. Dishwasher.
7. Garbage Disposal.
8. Ice Machine

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance.

B. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

C. Maintenance Data: For each appliance product submit data that includes maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 25 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain residential appliances through one source. Retain subparagraph below and delete option above for projects that require a large number of same type of appliance. Delete for single-family residences and projects that require only one appliance of each type.

1. Provide products from same manufacturer for each type of appliance required.

D. Product Options: Information on Drawings and in Specifications establishes requirements for product's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

E. Regulatory Requirements: Comply with provisions of the following product certifications:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
4. NAECA: Provide residential appliances that comply with NAECA standards.

F. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.

1.05 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Clothes Washer: 10-year limited warranty for at site service on the inner wash basket and outer tub, and five-year limited warranty for at site service on the balance suspension system and drive transmission.
2. Electric Range: Five-year limited warranty for at site service surface-burner elements.
3. Microwave Oven: Five-year limited warranty for defects in the magnetron tube.
4. Refrigerator/Freezer: Five-year limited warranty for service on the sealed refrigeration system.
5. Dishwasher: 10-year warranty for at site service against deterioration of tub and door liner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Each appliance is based on the data provided. Provide products manufactured by established firms that have demonstrated successful experience in producing appliances of types required by this Project, and that are acceptable to Architect and Owner.

2.02 COOKING APPLIANCES

A. Range / Oven –
Qty (1) Maytag Range-Stainless Steel 30" Model - MER7775WS (BASIS-OF-DESIGN)

B. Microwave Oven:
Qty (1) GE 2.0 Cu. Ft. Countertop Microwave Oven-Model - PEB2060SMSS (BASIS-OF-DESIGN)

C. Exhaust Range Hood –
Qty (1) GE 36" Stainless Steel Range Hood See Sheet M0.101.
Model – JV666HSS (BASIS-OF-DESIGN) with 120 volt operation, rear discharge duct connection.

2.03 REFRIGERATION APPLIANCES

A. Refrigerator/Freezer – Quantity (2) Design Basis: General Electric Model No. GSS25JFMWW. (Basis of Design)

B. Ice Machine –
Qty (1) Hoshizaki Ice Maker Model – KM-151BAH (BASIS-OF-DESIGN)

2.04 CLEANING APPLIANCES

A. A.Dishwasher:
Qty (1) Amana Dishwasher, Stainless Steel, Model - ADB1600AWS (BASIS-OF-DESIGN)
B. Garbage Disposer:
Qty (1) GE Model GFC-720V ¾ hp w/ Sound Insulation (BASIS-OF-DESIGN)

2.05 Clothes Washer & Dryer:

A. Clothes Dryer Qty (1) SpeedQueen – Model EED4100SQ (BASIS-OF-DESIGN)

B. Clothes Washer Qty (1) SpeedQueen – Model AWS 17NW (BASIS OF DESIGN)

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish: Provide appliances with manufacturer's standard STAINLESS STEEL, baked enamel or other approved finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

3.03 CLEANING AND PROTECTION

A. Test each item of residential appliances to verify proper operation. Make necessary adjustments.

B. Verify that accessories required have been furnished and installed.

C. Remove packing material from residential appliances and leave units in clean condition, ready for operation.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

Division 12
Furnishings

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Carpet-type mats.

1.03 SUBMITTALS

A. Product Data: Include manufacturer's specifications, material descriptions, dimensions and finishes for each type of floor mat specified.

B. Samples for Initial Selection: For each type of floor mat indicated.

C. Samples for Verification: 12-inch- square assembled sections of floor mats, showing colors of each type of exposed floor matsand accessories required.

D. Maintenance Data: For cleaning and maintaining floor mats to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats through one source from a single manufacturer.

B. Accessibility Requirements: In addition to requirements of authorities having jurisdiction, provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carpet-Type Mats:

    a. AFCO-USA.
    b. Arden Architectural Specialties, Inc.
    c. Balco, Inc.
    d. Bonar Floors.
    e. Cactus Mat Manufacturing Co.
    f. Consolidated Plastics Company, Inc.
    g. Construction Specialties, Inc.
    h. Mats Incorporated.
    i. Musson, R. C. Rubber Co. (The).
    j. Pawling Corporation.

2.02 FLOOR MATS

A. Provide colors, patterns, and profiles of materials indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.

B. Carpet-Type Mats: Nylon, polypropylene, olefin, or polyester carpet bonded to 1/8- to 1/4-inch- thick, flexible vinyl backing to form mats 3/8 or 7/16 inch thick with nonraveling edges.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

3.02 PROTECTION

A. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following types of vertical louver blinds and accessories:

1. With PVC vanes. Locations to be at all interior windows, exterior windows, and storefront, excluding the lobby entry door.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood blocking and grounds for mounting vertical louver blinds and accessories.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of vertical louver blinds. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

C. Samples for Initial Selection: For each colored component of each type of vertical louver blind indicated.

D. Samples for Verification: For the following products, prepared on Samples from the same material to be used for the Work.

1. Louver Vane: Not less than 12 inches long.

E. Window Treatment Schedule: Include vertical louver blinds in schedule using same room designations indicated on Drawings.

F. Product Certificates: For each type of vertical louver blind product, signed by product manufacturer.

G. Product Test Reports: For each type of vertical louver blind product.

H. Maintenance Data: For vertical louver blinds to include in maintenance manuals. Include the following:

1. Methods for maintaining vertical louver blinds and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
3. Operating hardware.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain vertical louver blinds through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide vertical louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver blinds in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install vertical louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where vertical louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Vertical Louver Blinds, PVC Vanes:

a. Hunter Douglas Window Fashions.
b. Levolor Contract; a Newell Company; LouverDrape.
c. Springs Window Fashions Division, Inc.; Graber.

B. Rail System: Headrail

1. Rails: Extruded aluminum, anodized. Long edges returned or rolled; channel-shaped, enclosing operating mechanisms.
2. Wheeled Carriers: Engineered plastic with self-lubricating wheels.

C. Louver Vanes: Lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC that will not crack or yellow; with crowned profile and not less than 3/8-inch overlap when vanes are rotated fully closed.

1. Nominal Vane Width: 3-1/2 inches wide.
2. Slat Finish: One color as indicated.

D. Vane Directional Control: Manual wand.

E. Traversing Control: Manual with wand.

F. Draw and Stack Position: One way, controls and stack right.

G. Mounting: As required by indicated conditions on Drawings.

1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

2.02 VERTICAL LOUVER BLINDS FABRICATION

A. Product Description: Vertical louver blind consisting of equally spaced, synchronized louver vanes and rail system with self-aligning carrier mechanisms, carriers, traverse and vane directional mechanisms and controls, and installation hardware.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Louver Directional and Traversing Control Mechanisms: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Blind Units Installed between (Inside) Jambs: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (12 mm) total less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3 mm), less than head-to-sill dimension of opening in which each blind is installed.
2. Blind Units Installed Outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail and operating hardware, and for hardware position and blind mounting method indicated.

E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, unless anodized or plated finish is indicated. Apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Component Color: Provide exposed-to-view metal and plastic matching or coordinating with vane color, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 VERTICAL LOUVER BLIND INSTALLATION

A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior louver edges in any position are not closer than 2 inches to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

B. Flush Mounted: Install blinds with louver edges flush with finish face of opening when vanes are tilted open.

C. Jamb Mounted: Install headrail flush with face of opening jamb and head.

D. Head Mounted: Install headrail on face of opening head.

E. Recessed: Install headrail concealed within blind pocket.

3.03 ADJUSTING

A. Adjust vertical louver blinds to operate smoothly, easily, safely and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

A. Clean blind surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that vertical louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

County Project Number Y12-731

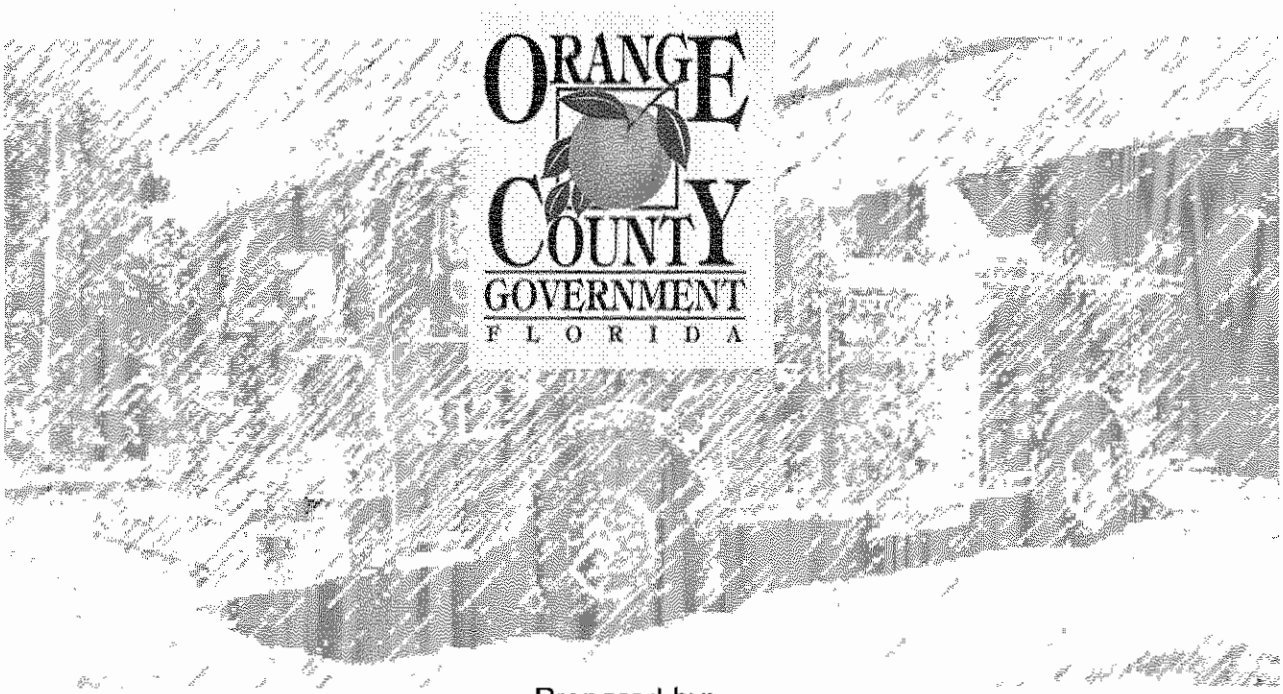
SPECIFICATION MANUAL

VOLUME II

Divisions 15 and 16

ORANGE COUNTY

FIRE STATION NO. 84



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December 6, 2011

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Division 15
Mechanical

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work covered under this Division of the Specifications is intended to include the furnishing of all materials, equipment and labor necessary for or reasonably incidental to, the installation of a complete and fully operative mechanical and plumbing systems as indicated on the drawings and specified in this section.

1. The work shall consist generally of, but is not limited to, the following major items:

a. HVAC Equipment
b. Ductwork and Insulation
c. Piping and Insulation
d. Plumbing
e. Plumbing Equipment and Rough-ins for Kitchen
f. Temperature Controls
g. Test and Balance

B. Work Not Included:

The following work is not included in this Section:

1. Electrical

C. Fees and Permits:

1. Obtain all permits required for his/her work and include the cost of same in his/her bid.

D. Certificate of Inspection:

1. The Contractor shall, at his/her expense, have a final inspection made of the complete mechanical installation and shall deliver a certificate of approval of the complete work to the Owner before receiving his/her final payment.

1.02 SUBMITTALS

A. Submit properly identified manufacturer's literature and technical data to the form defined in Section 01340, before commencing work.

B. Shop Drawings:

1. Submit copies of manufacturer's drawing of HVAC equipment, piping, insulation, plumbing fixtures and any other special mechanical

equipment to be installed, and shall receive the Project Engineer's acceptance before ordering the same for installation.

2. All shop drawings shall be submitted in 3-ring binders with each specification section indicated with tabs.

3. If shop drawings are submitted intermittently and not in 3-ring binders, they will not be reviewed and will be returned to contractor for proper submittal.

4. Accepted Equivalent:

   Any manufacturer and/or catalog number listed on the drawings or in the Project Manual shall be construed to mean "or accepted equivalent".

   a. Any substitutions to be considered as "Accepted Equivalent" shall be submitted with both the cut of the proposed substitution and a cut of the specified equipment to the Project Engineer in writing, and returned to the Contractor at least ten days prior to bid opening.

   b. No substitutions shall be submitted or will be allowed after the contract has been awarded.

1.03 QUALITY ASSURANCE

A. Qualifications of manufacturers, materials and equipment:

1. Material and equipment, except as herein otherwise noted, shall be new and conform to standards specified herein defined to include equipment, piping, insulation, and the like.

2. Materials and equipment shall be of an approved design.

   a. Similar materials shall be of one manufacturer wherever possible.

3. Equipment offered under these Specifications shall be limited to products regularly produced and recommended for service ratings in accordance with manufacturer's catalogs, engineering data, or other comprehensive literature made available to the public and in effect at the time of opening of bids.

4. Install equipment in strict accordance with manufacturer's instruction for type, capacity and suitability of each piece of equipment used.

   a. Obtain these instructions which shall be considered a part of these Specifications.

B. Qualifications of supervisor, workmanship and installers:

1. The Contractor shall have a master mechanic constantly supervising the work covered by these Specifications, and so far as possible shall keep the same foreman on the job from start to finish.

    a. The workmanship of the entire job shall be first class in every way and only experienced and competent workers shall be employed for the work.

1.04 CODES AND REGULATIONS

A. Work shall be installed in accordance with the regulations and requirements of the Life Safety Code NFPA No. 101, Standard Building Code as well as all rules, state and local codes regulations and requirements.

B. Where ducts and/or pipes penetrate fire rated walls, ceilings or floors, the penetrations shall be firestopped in accordance with Chapter 7, Section 705 of the standard building code.

    1. The above shall be ascertained and fully coordinated before the installation of any material, equipment, and the like, and any discrepancy shall be immediately brought to the attention of the Project Architect in writing, and the Contractor shall receive a disposition of same before proceeding with the work.

    2. Furnish, without additional charge, any additional materials and labor that may be required for compliance with these codes, law, rules, regulations or requirements even though the work is not mentioned in these Specifications or shown on the Drawings.

C. Material and equipment shall bear the label of approval of the National Board of Fire Underwriters Laboratory.

1.05 INSPECTIONS

A. All work and materials covered by these Specifications and shown on the Drawings shall be subject to inspection at any and all times by representatives of the Project Architect or Owner.

B. If the Project Engineer or Owner's inspectors find that any material does not conform with these Specifications, the Contractor shall within three days after being notified by the Project Engineer or Owner, remove the material from the premises, and if said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.

C. Tests:

The Owner reserves the right to inspect and test any portion of the equipment during the progress of this work.

1. The Contractor shall test the entire system in the presence of the Owner

or the Owner's representative when the work is completed to insure that all portions are free from defects.

2. All equipment, material and labor necessary to conduct the above tests shall be furnished at the Mechanical Contractor's expense.

1.06 PRODUCT HANDLING

A. Protection of Equipment, Material and Work: The Contractor shall effectively protect, at his/her own expense, much of his/her work, materials or equipment, as is liable to injury during the construction period.

1. Openings into any part of the duct and piping system as well as associated fixtures, equipment, and the like, both before and after being set in place, shall be securely covered or otherwise protected to prevent obstruction or injury due to carelessness or maliciously dropped tools or materials, grit, dirt, or any foreign matter.

a. The Contractor will be held responsible for all damage done until his/her work is fully and finally accepted.

2. Cover duct and pipe ends with capped bushings.

B. Repair of damage: In the event of damage, repair shall be made immediately, to the Project Architect's satisfaction and at no additional cost to the Owner.

C. Special Handling: Special care, storage and handling of new and existing pluming fixtures shall be taken to minimize breakage.

1.07 JOB CONDITIONS

A. Accuracy of Data: The data given herein and on the Drawings are as exact as could be secured.

1. The Specifications and Drawings are for the assistance and guidance of the Contractor.

2. Exact locations, distances, levels, and the like, will be governed by the building field conditions and the Contractor shall use the data contained herein with this understanding.

B. Drawings:

1. The mechanical drawings are diagrammatic, but shall be followed as closely as actual construction and work of other Contractors will permit.

2. Deviations from drawings required to make the work of the Contractor conform to the building as constructed, and to the work of other contractors, shall be made by the Contractor at his/her expense.

3. It is not the intention of the drawings or specifications to indicate each

piece of pipe, ductwork, fittings and the like, required for the satisfactory operation of the installation and whereby one is indicated, but not specified, or specified but not indicated on the drawings, it shall be considered to be both specified and indicated.

C. Measurements:

1. Review the Contract Drawings and Specifications and visit the job site to ascertain all conditions, including conduit runs, interfacing, interferences, conflicts, discrepancies, etc., and shall report the same to the Engineer for clarification ten days prior to submittal of the bid.

2. Failure to comply with this condition shall constitute an acceptance of the conditions and any necessary changes will be at Contractor's expense.

3. The Contractor shall make all measurements necessary for his/her work and shall assume responsibility for their accuracy.

D. Structural difficulties: Should any structural difficulties prevent the setting of equipment, and the like, at points indicated on the drawings, the necessary deviation therefrom, as determined by the Project Architect will be permitted and shall be made without additional cost.

E. Cooperation with Other Contractors

1. The Contractor shall arrange all parts of his/her work in proper relation to the work of other contractors.

2. Where interferences occur, the Contractor shall, before installing the work involved, consult with the Project Engineer as to exact location and level of his/her work.

3. The Contractor shall be responsible for arrangement of his/her work and equipment and maintenance of proper headroom under this work.

4. Should work installed by him/her require any modifications to avoid interference with the other work, such changes shall be made without additional cost.

5. The Engineer's decision as to determination or allocation or responsibility where conditions require changing of work, shall be final.

6. If any work of the Contractor is dependent for its proper execution on contiguous work, examine such work and report in writing any defect thereon or conditions rendering it unsuitable.

7. The beginning of work, without making such report, shall constitute an acceptance of such work, and any defects in his/her own work consequently shall be his/her responsibility.

1.08 CLEANING

A. Keep the premises free of debris and unusable materials resulting from the work, and immediately upon completion of the work remove such debris and material from the site and leave floors broom clean in areas affected by the work.

1.09 GUARANTEE

A. Leave the mechanical installation in proper working order and without charge, replace any work or materials which develop defects within one year from date of final inspection and acceptance by the Owner.

1.10 DEFINITIONS

A. In this Division "provide" is used as a term contraction meaning "to furnish, install and connect up completely in the specified or in an approved manner for the item and/or material described".

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 15030
ELECTRICAL PROVISIONS OF MECHANICAL WORK

PART 1 - GENERAL

1.01 Standards: For electrical equipment and products, comply with applicable NEMA Standards, and refer to NEMA standards for definitions of terminology herein. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

PART 2 - PRODUCTS

2.01 MOTORS:

A. Manufacturer: Except where item of mechanical equipment (which otherwise complies with requirements) must be integrally equipped with motor produced by another manufacturer, provide motor for mechanical equipment by one of the following single manufacturers:

1. Allis Chambers
2. U.S. Motors
3. Century Electric
4. General Electric
5. Louis Allis
6. Marathon Electric
7. Reliance Electric
8. Westinghouse Electric

B. Motor Characteristics: Except where more stringent requirements are indicated, and except where required item of mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work:

1. Temperature Rating: Rated for 40 deg. environment with maximum 50 deg. temperature rise for continuous duty at full load (Class A Insulation).
2. Starting Capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts/hour for manually controlled motors.
3. Phases and Current Characteristics: Provide squirrel-cage induction polyphase motors for 1/2 hp and larger, and provide capacitor-start single phase motors for 1/3 hp and smaller, except 1/6 hp and smaller may, at equipment manufacturer's option, be split phase type. Coordinate current characteristics with power specified in Division 16 sections, and with individual equipment requirements specified in other Division 15 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
4. Service Factor: 1.15 for polyphase motors, and 1.35 for single phase motors.

C. Motor Construction: Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.

1. Frame: NEMA No.48.
2. Bearing: Ball or roller bearing with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division 15 for fractional-hp light duty motors where sleeve type bearings are permitted.
3. Enclosure Type: Except as otherwise indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 15 for other enclosure requirements.
4. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors located in occupied spaces of building.
6. Efficiency: All motors shall be "Energy Efficient", provide motors having minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency is not scheduled, provide motor with higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, test Method B.

D. Name Plate: Provide metal nameplate on each motor, indicating full identification of manufacturer, rating, characteristics, construction, special features, and similar information.

E. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

2.02 STARTERS, ELECTRICAL DEVICES AND WIRING:

A. Motor Starter Manufacturer: Except where item of mechanical equipment must be integrally furnished with motor starter produced by another manufacturer, provide motor starters for mechanical equipment manufactured by only one of the following manufacturers:

1. Allen Bradley
2. Cuttler Hammer
3. General Electric
4. Square D

5. Westinghouse Electric

B. Motor Starter Characteristics: Comply with NEMA standards and NEC. Provide Type I general purpose enclosures with padlock ears, and with frames and supports for mounting on wall, floor, or panel as indicated. Where starter location is not within sight of motor, provide disconnect switch within sight of motor. Provide type and size of starter recommended by motor manufacturer and equipment manufacturer for applicable protection and start-up conditions; refer to individual equipment sections for basic load requirements.

1. Manual Switches: provide manual switch and pilot light for motors 1/3 hp and smaller, except where interlocked or automatic operation is indicated. Provide extra switch positions and pilot lights for multi-speed motors.
2. Overload Protection: Provide melting alloy type thermal overload relays.

C. Magnetic Starters: Provide magnetic starters for motors 1/2 hp and larger, and for smaller motors where interlock or automatic operation is indicated. Include the following:

1. Maintained contact push-button and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
2. Trip-free thermal overload relays, each phase.
3. Interlocks, switches, and similar devices as required for coordination with control requirements of Division 15 Controls section.
4. Built-in 120 volt control circuit transformer, fused from line side, where services exceed 240 volts.
5. Externally operated manual reset.
6. Undervoltage release or protection.

D. Deliver starters and wiring devices which have not been factory installed on equipment to electrical installer for installation.

E. Electrical Heating Elements: Where electric resistance coils and other heating elements are included in mechanical equipment, or otherwise indicated as mechanical work, and except as otherwise indicated, provide 120 volt units where rating is less than 2 KW, higher voltage single phase units where rating is 2 KW but less than 5 KW and higher voltage 3 phase units where rating is 5 KW and greater.

F. This Contractor shall furnish all motor starters except those in the motor control center which are provided under Division 16. This Contractor shall coordinate and supply all technical information to electrical on the equipment with starters in the motor control center.

PART 3 - EXECUTION

3.01 EQUIPMENT FABRICATION:

A. General: Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of

motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives, arranged for lubrication and similar running maintenance without removal of guards.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Requirements specified in Division 15 Section "Basic Mechanical Requirements" apply to this Section.

1.02 SUMMARY

A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:

1. Mechanical equipment nameplate data.
2. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment.
3. Miscellaneous metals for support of mechanical materials and equipment.
4. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.
5. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
6. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

1.03 DEFINITIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
2. Subbase: as used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
3. Subgrade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.
4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.

1.04 SUBMITTALS

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

B. Product data for the following products:

1. Access panels and doors.
2. Joint sealers.

C. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.

D. Coordination drawings for access panel and door locations in accordance with Division 15 Section "Basic Mechanical Requirements."

E. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.

F. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.

G. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.

1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division 1 Section "Summary of Work."

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers, access panels, and doors.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

1. Provide UL Label on each fire-rated access door.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-

component materials.

B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.07 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:

1. Maintain and protect existing building services which transit the area affected by selective demolition.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available and included in Section. Data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
4. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
5. Remove existing underground utilities indicated to be removed.

    a. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
    b. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Architect prior to utility interruption.

6. Use of explosives is not permitted.

C. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do no apply joint sealers to wet substrates.

1.08 SEQUENCE AND SCHEDULING

A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.

B. Notify the Architect at least 5 days prior to commencing demolition operations.

C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS

2.01 MECHANICAL EQUIPMENT NAMEPLATE DATA

A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name,

model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.02 SOIL MATERIALS

A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.

C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

2.03 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.

F. Fasteners: Zinc-coated, type, grade, and class as required.

2.04 MISCELLANEOUS LUMBER

A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less that 15/32 inches.

2.05 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Architect from manufacturer's standard colors.

C. Elastomeric Joint Sealers: Provide the following types:

1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.
3. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following.
4. Products: Subject to compliance with requirements, provide one of the following:

    a. One-Part, Nonacid-Curing, Silicone Sealant:

        1) "Chem-Calk N-Cure 2000," Bostic Construction Products Div.
        2) "Dow Corning 790," Dow Corning Corp.
        3) "Silglaze N SCS 2501," General Electric Co.
        4) "Silpruf SCS 2000," General Electric Co.
        5) "864," Pecora Corp.
        6) "Rhodorsil 5C," Rhone-Poulenc, Inc.
        7) "Spectrum 1," Tremco, Inc.
        8) "Spectrum 2," Tremco, Inc.
        9) "Dow Corning 795," Dow Corning Corp.
        10) "Rhodorsil 6B," Rhone-Poulenc, Inc.
        11) "Rhodorsil 70," Rhone-Poulenc, Inc.
        12) "Omniseal," Sonneborn Building Products Div.
        13) "Chem-Calk 100," Bostik Construction Products Div.
        14) "Gesil N SCS 2600," General Electric Co.

    b. One-Part, Mildew-Resistant, Silicone Sealant:

        1) "Dow Corning 786," Dow Corning Corp.
        2) "SCS 1702 Sanitary," General Electric Co.
        3) "863 #345 White," Pecora Corp.
        4) "Rhodorsil 6B White," Rhone-Poulenc, Inc.
        5) "Proglaze White," Tremco Corp.
        6) "OmniPlus," Sonneborn Building Products Div.

D. Acrylic-Emulsion Sealants: One-part, nonsag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.

1. Available Products: Subject to compliance with requirements, products

which may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

    a "Chem-Calk 600," Bostik Construction Products Div.
    b. "AC-20," Pecora Corp.
    c. "Sonolac," Sonneborn Building Products Div.
    d. "Tremco Acrylic Latex 834," Tremco, Inc.

E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire- rated walls and floors. Sealants and accessories shall have fire- resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. "Dow Corning Fire Stop Foam," Dow Corning Corp.
    b. "Pensil 851," General Electric Co.
    c. "Tremco Firestop Foam", Tremco, Inc.

2.06 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

1. For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge

and self-closing mechanism.

D. Locking Devices: Flush, screwdriver-operated cam locks.

E. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide 2 keys.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

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

1. Bar-Co., Inc.
2. J.L. Industries.
3. Karp Associates, Inc.
4. Milcor Div. Inryco, Inc.
5. Nystrom, Inc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION FOR JOINT SEALERS

A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.04 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below

finished grade elevation.

C. Install sediment and erosion control measures in accordance with local codes and ordinances.

D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

F. Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

G. Trenching: Excavate trenches for mechanical installations as follows:

1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of pipe and equipment.
2. Excavate trenches to depth indicated or required for piping to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
3. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.
4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and pipe.
5. Excavate trenches for piping and equipment with bottoms of trench to

accurate elevations for support of pipe and equipment on undisturbed soil.

a. For pipes or equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.

H. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg 2 C).

I. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
2. Under building slabs, use drainage fill materials.
3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
4. For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of piping, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
5. Other areas, use excavated or borrowed materials.

J. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval, and locations of underground utilities have been recorded.
2. Removal of concrete formwork.
3. Removal of shoring and bracing, and backfilling of voids.
4. Removal of trash and debris.

K. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

L. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

M. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.

N. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

   a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
   b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
   c. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

O. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.05 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between

members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.06 APPLICATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
2. Comply with recommendations of ASTM C 790 for use of acrylic- emulsion joint sealants.

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around mechanical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.07 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies piping materials and installation methods common to more than one section of Division 15 and includes joining materials, piping specialties, and basic piping installation instructions.

B. Related Sections:

1. Division 15 Basic Mechanical Requirements section applies to the work at this Section.
2. Piping materials and installation methods peculiar to individual systems are specified within their respective system specification sections of Divisions 2 and 15.
3. Valves are specified in a separate section and in individual piping system sections of Division 15.
4. Expansion Compensation is specified in a separate section of Division 15.
5. Supports and Anchors are specified in a separate section of Division 15.
6. Mechanical Identification is specified in a separate section of Division 15.
7. Fire Barrier Penetration Seals are specified in Division 7, Section 07842 – Firestopping Systems.

1.03 SUBMITTALS:

A. Refer to Division 1 and Basic Mechanical Requirements for administrative and procedural requirements for submittals.

B. Product Data: Submit product data on the following items:

1. Escutcheons
2. Dielectric Unions and Fittings
3. Mechanical Sleeve Seals
4. Strainers

C. Quality Control Submittals:

1. Submit welders' certificates specified in Quality Assurance below.

1.04 QUALITY ASSURANCE:

A. Welder's Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

B. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.

C. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturer Uniformity: Conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering piping materials and specialties which may be incorporated in the work include, but are not limited to, the following:

C. Manufacturer: Subject to compliance with requirements, provide piping materials and specialties from one of the following:

1. Pipe Escutcheons:

a. Chicago Specialty Mfg. Co.
b. Sanitary-Dash Mfg. Co.
c. Grinnell

2. Dielectric Waterway Fittings:

a. Epco Sales, Inc.
b. Victaulic Company of America
c. Or approved equal.

3. Dielectric Unions:

a. Eclipse, Inc.
b. Perfection Corp.
c. Watts Regulator Co.

4. Strainers:

a. Armstrong Machine Works.
b. Hoffman Specialty ITT; Fluid Handling Div.
c. Metraflex Co.
d. R-P&C Valve; Div. White Consolidated Industries, Inc.
e. Spirax Sarco.
f. Trane Co.
g. Victaulic Co. of America. (low pressure applications only)
h. Watts Regulator Co.

5. Mechanical Sleeve Seals:

a. Thunderline Corp.
b. Or approved equal.

2.02 PIPE AND FITTINGS:

A. Refer to the individual piping system specification sections in Division 15 for specifications on piping and fittings relative to that particular system.

2.03 JOINING MATERIALS:

A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.

D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.04 PIPING SPECIALTIES:

A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with setscrew. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.

B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.

C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.

D. Dielectric Waterway Fittings: Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.

E. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch.

1. Provide strainers with 125 psi working pressure rating for low pressure applications, and 250 psi pressure rating for high pressure application.
2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
3. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
4. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
5. Butt Welded Ends, 2-1/2" and Larger For Low Pressure Application: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
6. Butt Welded Ends, 2-1/2" and Larger For High Pressure Application: Schedule 80 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
7. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

F. Sleeves:

1. Sheet-Metal Sleeves: 10 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

G. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe

and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.02 INSTALLATIONS:

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.

B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.

C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.

E. Install piping tight to slabs, beams, joists, columns, walls and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.

H. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.

I. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained. Refer to Division 7 for special sealers and materials

3.03 FITTINGS AND SPECIALTIES:

A. Use fittings for all changes in direction and all branch connections.

B. Remake leaking joints using new materials.

C. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

D. Install unions adjacent to each valve, and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

E. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.

F. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).

G. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

3.04 JOINTS:

A. Steel Pipe Joints:

1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten joint to leave not more than 3 threads exposed.

2. Pipe Larger Than 2":

a. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.
b. Weld pipe joints of exterior water service pipe in accordance with AWWA C206.
c. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.

B. Non-ferrous Pipe Joints:

1. Brazed And Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 - Standard Code for Pressure

Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.

2. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emory cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
3. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.

C. Joints for other piping materials are specified within the respective piping system sections.

3.05 FIELD QUALITY CONTROL:

A. Testing: Refer to individual piping system specification sections.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. This section is Division 15 Basic Mechanical Materials and Methods section, and is part of each Division 15 section making reference to pipes and pipe fittings specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division 15 sections.

B. Types of pipes and pipe fittings specified in this section include the following:

1. Steel Pipes.
2. Copper Tube.
3. Cast Iron Pressure Pipes.
4. Cast Iron Soil Pipes.
5. Plastic Pipe (Preinsulated)
6. Grooved Piping Products.
7. Miscellaneous Piping Materials/Products.

C. Pipes and pipe fittings furnished as part of factory fabricated equipment, are specified as part of equipment assembly in other Division 15 sections.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar services for not less than 5 years.

1.04 CODES AND STANDARDS:

A. Welding: Qualify welding procedures, welders, and operations in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.

1. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).

B. Brazing: Certify brazing procedures, brazers, and operators in accordance

with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job site brazing of piping work.

1.05 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.

B. Welding Certifications: Submit reports as required for piping work.

C. Brazing Certifications: Submit reports as required for piping work.

D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 1.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Except for concrete, corrugated metal, hub and spigot, clay and similar units of pipe, provide factory applied plastic end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

B. Pipe/Tube Fittings: Provide factory fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.02 STEEL PIPES AND PIPE FITTINGS:

A. Black Steel Pipe: ASTM A 54, A 106 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

B. Galvanized Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

C. Seamless Steel Pipe: ASTM A 53, A 106, or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

D. Galvanized Seamless Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.

E. Electric Resistance Welded Steel Pipe: ASTM A 135.

F. Electric Fusion Welded Steel Pipe: ASTM A 671.

G. Steel Water Pipe: AWWA C200 for pipe 6" and larger.

H. Coal Tar Protective Coating and Linings for Steel Water Pipe: AWWA C203 for enamel and tape, hot applied.

I. Chlorinated Rubber Alkyd Paint System for Steel Water Pipe: AWWA C204.

J. Cement Mortar Protective Lining and Coating for Steel Pipe: AWWA C205.

K. Cast Iron Flange Fittings: ANSI B16.1, including bolting.

L. Cast Iron Threaded Fittings: ANSI B16.4

M. Malleable Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.

N. Malleable Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze, or brass); plain or galvanized as indicated.

O. Threaded Pipe Plugs: ANSI B16.14.

P. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated:

1. Material Group: Group 1.1.
2. End Connections: Buttwelding.
3. Facings: Raised face.

Q. Steel Pipe Flanges For Waterworks Service: AWWA C207.

R. Forged Steel Socket Welding and Threaded Fittings: ANSI B16.11, except

MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.

S. Wrought Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns; rated to match connected pipe.

U. Yoloy Steel Buttwelding Fittings: ASTM A 714.

V. Cast Iron Threaded Drainage Fittings: ANSI B16.12.

W. Forged Branch Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.

X. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

2.03 COPPER TUBE AND FITTINGS:

A. Copper Tube: ASTM B 88; Type (wall thickness) as indicated for each service; hard drawn temper, except as otherwise indicated.

B. DWV Copper Tube: ASTM B 306.

C. ACR Copper Tube: ASTM B 280.

D. Cast Copper Solder Joint Fittings: ANSI B16.18.

E. Wrought Copper Solder Joint Fittings: ANSI B16.22.

F. Cast Copper Solder Joint Drainage Fittings: ANSI B16.23.

G. Wrought Copper Solder Joint Drainage Fittings: ANSI B16.29.

H. Cast Copper Flared Tube Fittings: ANSI B16.26.

I. Bronze Pipe Flanges/Fittings: ANSI B16.24.

J. Copper Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.04 CAST IRON PRESSURE PIPES AND PIPE FITTINGS:

A. Ductile Iron Pipe: ANSI A21.51; AWWA C151.

B. Cement Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water: ANSI A21.4; AWWA C104.

C. Polyethylene Encasement for Gray and Ductile Cast Iron Piping: ANSI A21.5; AWWA C105.

D. Cast Iron Fittings: AWWA C110.

E. Gray Iron Fittings: AWWA C110.

F. Ductile Iron Fittings: AWWA C110.

G. Rubber Gasket Joints: AWWA C111.

2.05 CAST IRON SOIL PIPES AND PIPE FITTINGS:

A. Hubless Cast Iron Soil Pipe: FS WW-P-401.

B. Cast Iron Hub and Spigot Soil Pipe: ASTM A 74.

C. Cast Iron Hub and Spigot Soil Pipe Fittings: Match soil pipe units; complying with same standards (ASTM A 74).

D. Compression Gaskets: ASTM C 564.

2.06 GROOVED PIPING PRODUCTS:

A. General: As Installer's option, mechanical grooved pipe couplings and fittings may be used for piping systems having operating conditions not exceeding 230 degrees F. (110 deg. C.), excluding any other service not recommended by manufacturer, in lieu of welded, flanged, or threaded methods, and may also be used as unions, flexible connections, expansion joint, or expansion compensators.

B. Coupling Housing: Malleable iron conforming to ASTM A 47.

C. Coupling Housing: Ductile iron conforming to ASTM A 536.

D. Coupling Housing Description: Grooved mechanical type, which engages grooved or shouldered pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts. Permit degree of contraction and expansion as specified in manufacturer's latest published literature.

E. Gaskets: Mechanical grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D 2000.

1. Water Services: EDPM Grade E, with green color code identification.
2. Other Services: As recommended by manufacturer.

F. Bolts and Nuts: Heat-treated carbon steel, ASTM A 183, minimum tensile 110,000 psi.

1. Exposed Locations: Tamper resistant nuts.

G. Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.

H. Fittings: Grooved or shouldered end design to accept grooved mechanical couplings.

1. Malleable Iron: ASTM A 47.
2. Ductile Iron: STM A 536.
3. Fabricated Steel: ASTM A 53, Type F for 3/4" to 1-1/2"; Type E or S, Grade B for 2" to 20".
4. Steel: STM A 234.

I. Flanges: Conform to Class 125 cast iron and Class 150 steel bolt hole alignment.

1. Malleable Iron: ASTM A 47.
2. Ductile Iron: ASTM A 536.

J. Grooves: Conform to the following:

1. Standard Steel: Square cut.
2. Lightweight Steel: Roll grooved.
3. Cast Iron: Radius cut grooved, AWWA C606.

K. Available Manufacturers: Subject to compliance with requirements, manufacturers offering grooved piping products which may be incorporated in the work include, but are not limited to the following:

1. ITT Grinnell Corp.
2. Stockham Valves & Fittings, Inc.
3. Victaulic Co. of America.

2.07 PLASTIC PIPE PVC-DWV:

A. Plastic piping for domestic waste and vent system can be Schedule 40 PVC in accordance with ASTM D2665 PVC solvent cement shall be in accordance with ASTM D2564.

2.08 PLASTIC PIPE – CPVC:

A. Plastic piping for domestic water service can be CPVC in accordance with ASTM D2846. CPVC solvent cement shall be in accordance with ASTM F493.

2.09 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

1. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.

1. Tin Lead Solder: ASTM B 32, Grade 50A (copper drainage).
2. Tin Antimony Solder: ASTM B, Grade 95TA (domestic water).
3. Silver Lead Solder: ASTM B 32, Grade 96TS (refrigerant piping).

C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

D. Gaskets for Flanged Joints: ANSI B16.21; full faced for cast iron flanges; raised face for steel flanges, unless otherwise indicated.

E. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

1. Available manufacturers: Subject to compliance with requirements, manufacturers offering piping connectors which may be incorporated in the work include, but are not limited to the following:

a. Fernco, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping system, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance.

1. Comply with ANSI B31 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Located runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where

possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

C. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

3.02 PIPING SYSTEM JOINTS:

A. General: Provide joints of type indicated in each piping system.

B. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

C. Braze copper tube and fitting joints where indicated, in accordance with ASME B31.

D. Solder copper tube and fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into depth fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

E. Mechanically Formed Tee Connections: In lieu of providing tee fittings in copper tubing, Installer may, as option, provide mechanically formed tee connections, providing they are in accordance with the following:

1. Size and wall thickness of both run tube and branch tube are listed by Manufacturer of forming equipment as "Acceptable Application".
2. Height of drawn collar is not less than 3 times wall thickness of run tubing.
3. End of branch tube is notched to conform to inner curve of run tube, and dimpled to set exact penetration depth into collar.
4. Resulting joint is minimum of 3 times as long as thickness of thinner joint member, and brazing using B-CuP series filler metal.

F. Mechanically Formed Couplings: In lieu of providing couplings in copper tubing, Installer may, as option, provide mechanically formed couplings, provided they are in accordance with the following:

1. Form couplings by first annealing area at end of tube where expansion will occur. Insert tube expander to die size required and expand tube end to accept tubing of same size.
2. Resulting joint is minimum of 3 times as long as thickness of tube, and

brazed using B-CuP series filler metal.

G. Weld pipe joints in accordance in with ASME Code for Pressure Piping, B31.

H. Weld pipe joints in accordance with recognized industry practice and as follows:

1. Weld pipe joints only when ambient temperature is above 0 deg. F. (-18 deg. C.) where possible.
2. Bevel pipe ends at a 37.5 deg. angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
3. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
4. Build up welds with stringer bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow holes and non-metallic inclusions.
5. Do no weld-out piping system imperfections by tack welding procedures; refabricate to comply with requirements.
6. At Installer's option, install forged branch connection fittings wherever branch pipe is indicated; or install regular "T" fittings.

I. Weld pipe joints of steel water pipe in accordance with AWWA C206.

J. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

K. Lead Joint Installation: Tightly pack joints with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicated minimum depth measured from face of bell. After lead has cooled, calk joint tightly by use of hammer and caulking iron.

L. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

M. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.03 PIPING INSTALLATIONS:

A. Install drainage piping (perforated, porous or tile) from lowest end of slope to highest, solidly bedded in filtering or drainage fill. Shape bed for bells of piping (if any). Place bells/hubs and grooved ends of units up stream. Lay perforated pipe with perforations down.

B. Install gray and ductile cast iron water mains and appurtenances in accordance with AWWA C600.

3.04 CLEANING, FLUSHING, INSPECTING:

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

1. Inspect pressure piping in accordance with procedures of ASME B31.

B. Disinfect water mains and water service piping in accordance with AWWA C601.

3.05 PIPING TESTS:

A. Test pressure piping in accordance with ASME B31.

B. General: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Required test periods is 2 hours.
2. Test long runs of Schedule 40 pipe at 150 psi, except where fittings are lower Class or pressure rating.
3. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
4. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. This section is Division 15 Basic Mechanical Materials and Methods section, and is part of each Division 15 section making reference to valves specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of valves required by this section is indicated on drawings and/or specified in other Division 15 sections.

B. Types of valves specified in this section include the following:

1. Gate Valves.
2. Globe Valves.
3. Drain Valves.
4. Ball Valves.
5. Plug Valves.
6. Butterfly Valves.
7. Check Valves (Swing Check and Wafer Check).

C. Valves furnished as part of factory fabricated equipment, are specified as part of equipment assembly in other Division 15 sections.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of same type by same manufacturer.

C. Valve identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

D. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged or welded end valve bodies, comply with ANSI B16.10

"Face-to-Face and End-to-End Dimensions of Ferrous Valves".

3. UL and FM Compliance: Provide valves used in fire protection piping, which are UL listed and FM approved.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing Manufacturer's figure number, size, location, and valve features for each required valve.

B. Shop Drawings: Submit manufacturer's assembly type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 VALVES:

A. General: Provide factory fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube and equipment connections. Where more than one type is indicated, selection is Installer's option.

B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

C. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, 6" and smaller, other than plug valves. Provide one wrench for every 10 plug valves. Provide gear operators for quarter-turn valves 8" and larger.

2.02 GATE VALVES:

A. Comply with the following standards:

1. Cast Iron Valves: MSS Sp-70.
2. Bronze Valves: Mss Sp-80
3. Steel Valves: ANSI B16.34

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gate valves which may be incorporated in the work include, but are not limited to the following:

1. Crane Co.
2. Fairbanks Co.
3. Hammond Valve Corp.
4. ITT Grinnell Valve Co., Inc.
5. Jenkins Bros.
6. Lunkenheimer Co.
7. Milwaukee Valve Co., Inc.
8. Nibco, Inc.
9. Stockham Valves and Fittings
10. Walworth Co.

2.03 GLOBE VALVES:

A. Comply with the following standards:

1. Cast Iron Valves: MSS SP-85.
2. Bronze Valves: MSS SP-80
3. Steel Valves: ANSI B16.34.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering globe valves which may be incorporated in the work include, but are not limited to the following:

1. Crane Co.
2. Fairbanks Co.
3. Hammond Valve Corp.
4. ITT Grinnell Valve Co., Inc.
5. Jenkins Bros.
6. Lunkenheimer Co.
7. Milwaukee Valve Co., Inc.
8. Nibco, Inc.
9. Stockham Valves and Fittings.
10. Walworth Co.

2.04 DRAIN VALVES:

A. Comply with the following standards:

1. Water Heater Drain Valves: ASSE 1005.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering drain valves which may be incorporated in the work include, but are not limited to, the following:

1. Hammond Valve Corp.
2. Lee Brothers; Div. Phelps Dodge Brass Co.
3. Mansfield Plumbing Products.
4. Nibco Inc.
5. Prier Brass Mfg. Co.
6. Tanner Mfg.Co.

2.05 PLUG VALVES:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plug valves which may be incorporated in the work, include but are not limited to the following:

1. Lunkenheimer Co.
2. Powell (The Wm) Co.
3. Rockwell International; Flow Control Div. (Nordstrom).
4. Walworth Co.

2.06 BALL VALVES:

A. Comply with the following standards:

1. Cast Iron Valves: MSS SP-72.
2. Steel Valves: ANSI B16.34.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ball valves which may be incorporated in the work include, but are not limited to the following:

1. Conbraco Industries, Inc.
2. Crane Co.
3. Fairbanks Co.
4. Hammond Valve Corp.
5. ITT Grinnell Valve Co., Inc.
6. Jamesbury Corp.
7. Jenkins Bros.
8. Metraflex Co.
9. Nibco, Inc.
10. Stockham Valves and Fittings, Inc.
11. Walworth Co.
12. Watts Regulator Co.

2.07 BUTTERFLY VALVES:

A. General: Comply with MSS SP-67. Where butterfly valves are used as shutoffs for terminal or equipment removal or repair, select lug-body type valves. Select wafer type valves for other applications. Provide gear operators on butterfly valves 8" and larger.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering butterfly valves which may be incorporated in the work include, but are not limited to the following:

1. Center Line; Mark Controls Corp.
2. Crane Co.
3. Demco; Div. Cooper Industries, Inc.
4. Fairbanks Co.

5. ITT Grinnell Valve Co., Inc.
6. Jamesbury Corp.
7. Jenkins Bros.
8. Keystone Valve USA.
9. Nibco, Inc.
10. Stockham Valves and Fittings.

2.08 SWING CHECK VALVES:

A. Comply with the following standards:

1. Cast Iron Valves: MSS SP-71.
2. Bronze Valves: MSS SP-80.
3. Steel Valves: ANSI B16.34.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering swing check valves which may be incorporated in the work include, but are not limited to the following:

1. Crane Co.
2. Fairbanks Co.
3. Hammond Valve Corp.
4. Jenkins Bros.
5. Lunkenheimer Co.
6. Milwaukee Valve Co., Inc.
7. Nibco, Inc.
8. Stockham Valves and Fittings.
9. Walworth Co.

2.09 WAFER CHECK VALVES:

A. General: Provide wafer style, butterfly type, spring actuated check valves designed to be installed with gaskets between 2 standard Class 125 flanges.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering wafer check valves which may be incorporated in the work include, but are not limited to the following:

1. Center Line; Mark Controls Corp.
2. ITT Bell & Gossett.
3. Mission Mfg. Co., TRW Inc.
4. Metraflex Co.

2.10 VALVE FEATURES:

A. General: Provide valves with features indicated and where no otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building service piping, and ASME B31.1 for power piping.

B. Drain: Comply with MSS SP-45, and provide threaded pipe plugs.

C. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5, (steel), or ANSI B16.24 (bronze).

D. Threaded: Valve ends complying with ANSI B2.1.

E. Butt-Welding: Valve ends complying with ANSI B16.25.

F. Socket Welding: Valve ends complying with ANSI B16.11.

G. Solder Joint: Valve ends complying with ANSI B16.18.

H. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General: Except as otherwise indicated, comply with the following requirements:

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

B. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

C. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:

1. Pipe Size 2" and Smaller: One of the following, at Installer's option:

a. Threaded valves.
b. Grooved-end valves.
c. Flanged valves.
d. Single flanged valves.

2. Pipe Size 2-1/2" and Larger: One of the following, at Installer's option:

a. Grooved-end valves.
b. Flanged valves.
c. Wafer valves.
d. Single flange valves

D. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

E. Non-Metallic Disc: Limit selection and installation of valves with non-metallic disc to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

F. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

G. Fluid Control: Except as otherwise indicated, install gate, ball, globe, and butterfly valves to comply with ANSI B31.9. Where throttling is indicated or recognized as principal reason for valve, install globe or butterfly valves.

H. Installation of Check Valves:

1. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.
2. Wafer Check Valves: Install between 2 flanges in horizontal or vertical position, position for proper direction of flow.

3.02 ADJUSTING AND CLEANING:

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve is leak persists.

B. Valve Identification: Tag each valve in accordance with Division 15 section "Mechanical Identification".

C. Cleaning: Clean factory finished surfaces. Repair any marred or scratched surface with manufacturer's touch-up paint.

3.03 VALVE SCHEDULE:

A. General: Provide the following valves for various valve types listed in Division 15 piping sections.

B. Gate Valves:

1. 2" and Smaller: Class 125, bronze, screw-in bonnet, non-rising stem, solid wedge.

	Threaded Ends
Crane	438
Fairbanks	0250
Grinnell	3000

Hammond	IB645
Jenkins	370
Lunkenheimer	2129
Milwaukee	105
Nibco	T-113
Stockham	B-103
Walworth	55

2. 2-1/2" and Larger: Flanged ends, class 125, iron body, bolted bonnet, solid wedge, bronze mounted

	OS&Y
Crane	465 1/2
Fairbanks	0405
Grinnell	6020
Hammond	IR1140
Jenkins	651A
Lunkenheimer	1430
Milwaukee	F-2885
Nibco	617-0
Stockham	G-623
Walworth	8726-F

3. Threaded End; 2" and Smaller: FM, UL Listed, 175 psi, bronze body, solid wedge, outside screw and yoke, rising stem. Provide cap and chain.

Crane:	459
Fairbanks:	0222
Hammond:	IB681
Jenkins:	275U
Nibco:	T-104-O
Stockham:	B-133
Walworth:	904

C. Globe Valves:

1. 2" and Smaller: Class 125, bronze body, screw-in bonnet, integral seat, renewable disc.

	Threaded Ends
Crane	1
Fairbanks	045
Grinnell	3200
Hammond	IB440
Jenkins	746
Lunkenheimer	2140
Milwaukee	502
Nibco	T-211-B

Stockham	B-16
Walworth	3058

2. Flanged Ends; 2-1/2 and Larger: Class 125, iron body, bolted bonnet, renewable seat and disc, bronze mounted.

	Straight Body
Crane	351
Fairbanks	0131
Hammond	IR116
Jenkins	613
Lunkenheimer	1123
Milwaukee	F2981
Nibco	F-718-B
Stockham	G-512
Walworth	8906-F

D. Drain Valves:

1. Class 125: bronze body, screw-in bonnet, rising stem, composition disc, 3/4" hose outlet.

	Threaded Ends
Hammond	712
Lee	717-20
Mansfield	526.40
Nibco	73
Prier	C-73ST
Tanner	806

E. Plug Valves:

1. 2" and Smaller: 150 psi, bronze body, straightaway pattern, square head, threaded ends.

Lunkenheimer: 454

2. 2-1/2" and Larger: 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.

Nordstrom:	143
Powell:	2201
Walworth:	1718F

F. Ball Valves:

1. 1" and Smaller: 150 psi, bronze body, standard port, bronze trim, 2-piece construction, TFE seats and seals.

Threaded Ends

Conbraco	70
Crane	2182
Grinnell	3700
Jamesbury	21-1100
Jenkins	900T
Metraflex	IT
Nibco	T-585
Powell	4520R20
Stockham	S-216BRRT
Watts	B-6000

2. 1-1/4" to 2": 150 psi, bronze body, standard port, 3-piece body, TFE seats with bronze trim.

Threaded Ends

Conbraco	82
Fairbanks	0851
Nibco	T-595-Y
Watts	B-6800

G. Butterfly Valves:

1. 6" and Smaller: 150 psi, cast iron body, extended neck, aluminum bronze disc, reinforced resilient EDPM seat, manual lever and lock.

Wafer

Center Line	Series A
Crane	12
Demco	Series CE
Fairbanks	302
Grinnell	WC-8211
Hammond	3804
Jamesbury	815W
Keystone	100
Nibco	WL-082-3
Stockham	LG-511-BS3E

Grooved Ends: Victaulic Series 700.

2. 8" and Larger: 150 psi, cast iron body, extended neck, aluminum bronze, disc, reinforced resilient EDPM seat, gear operator.

Wafer

Center Line	Series A
Crane	12
Demco	Series CE

Fairbanks	402
Grinnell	WC-8212
Keystone	100
Nibco	WL-082-5
Stockham	LG-521-BS3E

Grooved Ends: Victaulic Series 701.

H. Check Valves:

1. 2" and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc.

	Threaded Ends
Crane	37
Fairbanks	0640
Grinnell	3300
Hammond	IB940
Jenkins	92-A
Lunkenheimer	2144
Milwaukee	509
Nibco	T-413
Stockham	B-319
Walworth	3406

2. 2-1/2" and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends.

Crane:	373
Fairbanks:	0702
Grinnell:	6300
Hammond:	IR1124
Jenkins:	624
Lunkenheimer:	1790
Milwaukee:	F2971
Nibco:	F-918
Stockham:	G-931
Walworth:	8928-F

I. Wafer Check Valves:

1. All Sizes: 125 psi, cast iron body, aluminum bronze or plated iron plates, stainless steel stem, Buna-N seat, stainless steel springs.

Bell & Gossett:	NS
Center Line:	CLC
Metraflex:	Chexx
Mission:	12HMP
Stockham:	WG970

Grooved Ends: Victaulic Series 711.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections apply to work of this section.

B. This section is Division 15 Basic Mechanical Materials and Methods section, and is part of each Division 15 section making reference to expansion compensation products specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of expansion compensation products required by this section is indicated on drawings and/or specified in other Division 15 sections.

B. Types of expansion compensation products specified in this section include the following:

1. Packless Expansion Joints.

a. Expansion Compensators.
b. Rubber Expansion Joints.

2. Slip Joints.
3. Flexible Ball Pipe Joints.
4. Expansion Joints for Grooved Piping.

a. Combination Coupling and Nipples.
b. Slip Type Expansion Joints.

5. Pipe Alignment Guides.

C. Expansion compensation products furnished as part of factory fabricated equipment are specified as part of equipment assembly in other Division 15 sections.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications; Firms regularly engaged in manufacture of expansion compensation products of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. EJMA Compliance: Construct expansion compensation products in

accordance with standards of the Expansion Joint Manufacturer's Association (EJMA).

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of expansion compensation product. Submit expansion compensation schedule showing Manufacturer's figure number, size, location, and features for each required expansion compensation product.

B. Shop Drawings: Submit manufacturer's assembly type shop drawings for each type of expansion compensation product, indicating dimensions, weight, required clearances, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of expansion compensation product. Include this data, product data, and shop drawings in Maintenance Manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 PACKLESS EXPANSION JOINTS:

A. General: Provide packless expansion joints where indicated for piping systems, with materials and pressure/temperature ratings selected by Installer to suit intended service. Select packless expansion joints to provide 200% absorption capacity of piping expansion between anchors.

B. Expansion Compensators: Pressure rated for 60 psi for low pressure systems, 175 psi for high pressure systems; 2-ply phosphor bronze bellows, brass shrouds and end fittings for copper piping systems, or 2-ply stainless steel bellows, carbon steel shrouds and end fittings for steel piping systems. Provide internal guides and anti-torque device, and removable end clop for proper positioning.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering expansion compensators which may be incorporated in the work include but are not limited to the following:

a. Flexonics Div.; UOP, Inc.
b. Hyspan Precision Products, Inc.
c. Keflex, Inc.
d. Metraflex Co.
e. Vibration Mountings and Controls, Inc.

C. Rubber Expansion Joints: Construct of duck and butyl rubber with full faced integral flanges, internally reinforced with steel retaining rings. Provide steel retaining rings over entire surface of flanges, drilled to match flange bolt holes, and provide external control rods.

1. Available Manufacturers; Subject to compliance with requirements, manufacturers offering rubber expansion joints which may be incorporated in the work include, but are not limited to the following:

   a. Garlock; Mechanical Packing Div.
   b. Keflex, Inc.
   c. Metraflex Co.
   d. Vibration Mountings and Controls, Inc.

2.02 SLIP JOINTS:

A. General: Provide slip joints where indicated for piping systems, with materials and pressure/temperature ratings selected by Installer to suit intended service. Select slip joints to provide 200% absorption capacity of piping expansion between anchors.

B. Slip Joints: Slip type designed for repacking under pressure, with drip connections for steam piping systems, and ends to mate with piping systems.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering slip joints which may be incorporated in the work include but are not limited to the following:

1. Adsco Manufacturing Corp.
2. Flexonics Div.; UOP, Inc.

2.03 EXPANSION JOINTS FOR GROOVED PIPING:

A. General: For piping systems fabricated from cut grooved pipe and couplings, use one of the following methods for expansion compensation:

1. Combination Coupling and Nipples: Provide expansion joints constructed of cut grooved short pipe nipples and couplings, designed by manufacturer to suit intended service. Provide removable ties to hold joint compressed or expanded during piping fabrication, depending on application. Select coupling and gasket materials to match balance of piping system.
2. Slip Type Expansion Joints: Provide slip type expansion joints constructed of carbon steel pipe and couplings, designed by manufacturer to suit intended service. Select couplings and gasket material to match balance of piping system.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering expansion joints for grooved piping which may be incorporated in the work include but are not limited to the following:

1. ITT Grinnell
2. Stockham Valves & Fittings, Inc.
3. Vitaulic Co. of America.

2.04 PIPE ALIGNMENT GUIDES:

A. General: Provide pipe alignment guides on both sides of expansion joints, and elsewhere as indicated. Construct with 4 finger spider traveling inside guiding sleeve, with provisions for anchoring to building substrate.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe alignment guides which may be incorporated in the work include but are not limited to the following:

1. Hyspan Precision Products, Inc.
2. Metraflex Co.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which expansion compensation products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 EXPANSION JOINTS:

A. General: Install expansion joints where indicated, and elsewhere as determined by Installer for adequate expansion of installed piping systems. Install in accordance with manufacturer's instructions. Provide pipe anchors and pipe alignment guides as indicated, and in accordance with manufacturer's recommendations. Align units properly to avoid end loading and torsional stress.

3.03 EXPANSION COMPENSATION FOR RISERS AND TERMINALS:

A. General: Install connection between piping mains and risers with at least 5 pipefittings including tee in main. Install connections between piping risers and terminal units with at least 4 pipefittings including tee in riser.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

B. This section is Division 15 Basic Mechanical Materials and Methods section, and is part of each Division 15 section making reference to supports and anchors specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 15 sections.

B. Types of supports and anchors specified in this section include the following:

1. Horizontal Piping Hangers and Supports.
2. Vertical Piping Clamps.
3. Hanger Rod Attachments.
4. Building Attachments.
5. Saddles and Shields.
6. Spring Hanger and Supports.
7. Miscellaneous Materials.
8. Anchors.
9. Equipment Supports.

C. Supports and anchors furnished as part of factory fabricated equipment are specified as part of equipment assembly in other Division 15 sections.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. Code Compliance: Comply with applicable plumbing codes, pertaining to product materials and installation of supports.
2. UL and FM Compliance: Provide products which are UL listed and FM approved.
3. MSS Standard Compliance:

a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
b. Select and apply pipe hangers and supports, complying with MSS SP-69.
c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
d. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

B. Shop Drawings: Submit manufacturer's assembly type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 HORIZONTAL PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper plated hanger and supports for copper piping systems.

B. Adjustable Steel Clevis Hangers: MSS Type 1.

C. Steel Double Bolt Pipe Clamps: MSS Type 3.

D. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast iron floor flange.

E. Adjustable Roller Hangers: MSS Type 43.

F. Adjustable Pipe Roll Stands: MSS Type 46.

2.02 VERTICAL PIPING CLAMPS:

A. General: Except as otherwise indicated, provide factory fabricated vertical piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS

SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper plated clamps for copper piping systems.

B. Two Bolt Riser Clamps: MSS Type 8.

C. Four Bolt Riser Clamps: MSS Type 42.

2.03 HANGER ROD ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated hanger rod attachments complying with MSS SP-58 of one of the following MSS types listed, selected by Installer to suit horizontal piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger rod attachments to suit hanger rods. Provide copper plated hanger rod attachments for copper piping systems.

B. Steel Turnbuckles: MSS Type 13.

2.04 BUILDING ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper plated building attachments for copper piping systems.

B. Concrete Inserts: MSS Type 18.

C. Center Beam Clamps: MSS Type 21.

D. Welded Beam Attachments: MSS Type 22.

E. Steel Brackets: One of the following for indicated loading:

1. Medium Duty: MSS Type 32.

2.05 SADDLES AND SHIELDS:

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39, fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

D. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:

1. Elcen Metal Products Co.
2. Pipe Shields, Inc.
3. Or approved equal.

2.06 SPRING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory fabricated spring hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

B. Spring Cushion Hangers: MSS Type 48.

2.07 MANUFACTURERS OF HANGERS AND SUPPORTS:

A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:

1. B-Line Systems, Inc.
2. Carpenter and Patterson, Inc.
3. Corner & Lada Co., Inc.
4. Elcen Metal Products Co.
5. Fee & Mason Mfg. Co.; Div. Figgie International.
6. ITT Grinnel Corp.

2.08 MISCELLANEOUS MATERIALS:

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No.2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION:

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS:

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforced bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion

bends and similar units.

2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
4. Insulated Piping: Comply with the following installation requirements.

    a. Clamps: Attach clamps, including spacers (if any) to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
    b. Shields: Where low-compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8" and over, install wood insulation saddles.
    c. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.05 INSTALLATION OF ANCHORS:

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instruction, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in piperuns between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.06 EQUIPMENT SUPPORTS:

A. Concrete housekeeping bases will be provided as work of Division 3. Furnish to Contractor, scaled layouts of all required bases. Furnish templates, anchor bolts, and accessories, necessary for base construction.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory fabricated tank saddles for tanks mounted on steel stands.

3.07 ADJUSTING AND CLEANING:

A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on

attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This section pertains to the furnishing of all labor, equipment, material and services necessary to provide complete vibration isolation systems for equipment, piping and ductwork including:

1. Vibration isolators.
2. Equipment bases.

B. The general provisions of the contract, including General and Supplementary Conditions, and Special Conditions apply to the work specified in this section.

C. The vibration isolators and equipment bases shall be the product of one manufacturer who shall determine mounting sizes and provide field supervision and inspection to assure proper installation and performance.

1.02 QUALITY ASSURANCE:

A. The general provisions of the contract, including General and Supplementary Conditions, and Special Conditions apply to the work specified in this section.

1.03 SUBMITTALS:

A. Shop drawings as listed shall be submitted.

1. Vibration isolators: Provide catalog cuts, isolation efficiencies and deflections.
2. Equipment bases: Provide catalog cuts or drawings.

1.04 DELIVERY, STORAGE AND HANLDING:

A. Preparation for Transport: Prepare isolators for shipping as follows:

1. Ensure isolators are dry and protected against rusting.

2. Protect valve ends against mechanical damage.

B. Storage: Use the following precautions during storage:

1. Do not remove isolators unless necessary for inspection: then reinstall for storage.

2. Protect valves against weather. Where practical store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support isolators off the

ground or pavement and protect in watertight enclosures.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Spring type isolators shall be free standing and laterally stable without any housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflections, compressed spring height and solid spring height.

B. Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation busing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30 deg. arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include a scale drawing of the hanger showing the 30 deg. capability.

C. Air handling equipment shall be protected against excessive displacement which might result from high air thrusts in relation to the equipment weights. The horizontal thrust restraint shall consist of a spring element in series with a neoprene pad as described in Specification B with the same deflection as specified for the mountings or hangers. The spring element shall be contained within a steel frame and designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished complete with rods and angle brackets for attachment to both the equipment and ductwork or equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrically on either side of the unit.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Installation shall be in accordance with the manufacturers instructions.

B. Vibration isolators shall provide the required deflection under imposed loads and shall produce uniform loading and deflection even when equipment weight is not evenly distributed. Leveling bolts shall not be used as jacking devices. Isolators shall be as follows, except as noted:

TABULATION OF VIBRATION ISOLATION FOR MECHANICAL SYSTEMS

EQUIPMENT ITEM	SPAN OF SUPPORTING	TYPE ISOLATOR	MASON INDUSTRIES	MINIMUM STATIC

	STRUCTURE DEFLECTION		SPEC.REFER.	
Air Handling Units	30N	D	B-J	.75"
Inline Fans	30N	D	B-J	.75"

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

B. This section is Division 15 Basic Mechanical Materials and Methods section, and is part of each Division 15 section making reference to identification devices specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division 15 sections.

B. Types of identification devices specified in this section include the following:

1. Painted identification materials.
2. Plastic pipe markers.
3. Underground type plastic line markers.
4. Plastic duct markers.
5. Valve tags.
6. Engraved plastic laminate signs.
7. Plastic equipment markers.
8. Plasticized tags.

C. Mechanical identification furnished as part of factory fabricated equipment is specified as part of equipment assembly in other Division 15 sections.

D. Refer to other Division 15 sections for identification requirements at central station mechanical control center; not work of this section.

E. Refer to Division 16 sections for identification requirements of electrical work; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut off and similar special uses, by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mechanical identification materials which may be incorporated in the work include, but are not limited to the following:

1. Allen Systems, Inc.
2. Brady (W.H.) Co.; Signmark Div.
3. Industrial Safety Supply Co., Inc.
4. Seton Name Plate Corp.

2.02 MECHANICAL IDENTIFICATION MATERIALS:

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 15 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.03 PAINTED IDENTIFICATION MATERIALS:

A. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.

B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

C. Identification Paint: Standard identification enamel of colors indicated of, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

2.04 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 preprinted, 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 deg. 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.
3. Laminated or bonded application of pipe marker to pipe (or insulation).
4. Taped to pipe (or insulation) with color coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

D. Large Pipes: For external diameters of 6" and larger (including insulation, if any) provide either full band or strip type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe (or insulation).
2. Taped to pipe (or insulation) with color coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
3. Strapped to pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

E. Lettering: Manufacturer's standard preprinted nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.

F. Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.

1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions) or as separate unit of plastic.

2.05 PLASTIC DUCT MARKERS:

A. General: Provide manufacturer's standard laminated plastic, color-coded duct markers. Conform to the following color code:

1. Green: Cold air.
2. Yellow: Hot air.
3. Yellow/Green: Supply air.
4. Blue: Exhaust, outside return, and mixed air.

B. Nomenclature: Include the following:

1. Direction of airflow.
2. Duct service (supply, return, exhaust, etc.)
3. Duct origin (from).
4. Duct destination (to).
5. Design cfm.

2.06 PLASTIC TAPE:

A. General: Provide manufacturer's standard color-coded pressure sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1 except where another color selection is indicated.

2.07 UNDERGROUND TYPE PLASTIC LINE MARKERS:

A. General: Manufacturer's standard permanent, bright colored, continuous printed plastic 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.

2.08 VALVE TAGS:

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32" hole for fastener.

1. Provide 1-1/2" diameter tags, except as otherwise indicated.
2. Fill tag engraving with black enamel.

B. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and number corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.09 ENGRAVED PLASTIC LAMINATE SIGNS:

A. General: Provide engraving stock melamine plastic laminate, complying with FS

L-P-387, in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16", except as otherwise indicated.

C. Thickness: 1/8" except as otherwise indicated.

D. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

E. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.10 PLASTIC EQUIPMENT MARKERS:

A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers. Conform to the following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any of the above criteria.
6. For hazardous equipment, use colors and designs recommended by ANSI A13.1.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible.

1. Name and plan number.
2. Equipment service.
3. Design capacity.
4. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.

C. Size: Provide approximate 1-1/2" x 4 markers for control devices, dampers, and valves, and 4-1/2" x 6" for equipment.

2.11 PLASTICIZED TAGS:

A. General: Manufacturer's standard pre-printed or partially pre-printed accident prevention tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large size primary wording (as examples: DANGER, CAUTION, DO NOT OPERATE).

2.12 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations, and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No.3, Air Supply No.1H, Standpipe F12).

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS:

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

3.02 DUCTWORK IDENTIFICATION:

A. General: Identify air supply, return, exhaust, intake and relief ductwork with duct markers; or provide stenciled signs and arrows, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment) and at 50' spacing along exposed runs.

C. Access Doors: Provide duct markers or stenciled signs on each access door in ductwork and housing, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

D. Concealed Doors: Where access doors are concealed above acoustical ceilings or similar concealment, plasticized tags may be installed for identification in lieu of specific signs, at Installer's option.

3.03 PIPING SYSTEM IDENTIFICATION:

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow.

1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or

rectangle 2" beyond ends of lettering.

2. Stenciled markers with lettering color complying with ANSI A13.1.
3. Plastic pipe markers with application systems as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.
4. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine room, 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.

3.04 UNDERGROUND PIPING IDENTIFICATION:

A. General: During back-filling/top-soiling of each exterior underground piping system, install continuous underground type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker. For tile fields and similar installations, mark only edge pipe lines of fields.

3.05 VALVE IDENTIFICATION:

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, plumbing fixture faucets, convenience and lawn watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

1. Tagging Schedule: Comply with requirements of "Valve Tagging Schedule" at end of this section.

3.06 MECHANICAL EQUIPMENT IDENTIFICATION:

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operation devices.

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Meters, gages, thermometers and similar units.
3. Pumps, compressors, chillers, condensers and similar motor-driven units.
4. Heat exchangers, coils, evaporators, cooling towers, heat recovery units and similar equipment.
5. Fans, blowers, primary balancing dampers and mixing boxes.
6. Packaged HVAC central station and zone type units.
7. Tanks and pressure vessels.
8. Strainers, filter, humidifiers, water treatment systems and similar equipment.

B. Optional Sign Types: Where lettering larger than 1" height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

C. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 or 3/4 of size of principal lettering.

D. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

E. Optional Use of Plasticized Tags: At Installer's option, where equipment to be identified is concealed above acoustical ceiling or similar concealment, plasticized tags may be installed within concealed space to reduce amount of text in exposed sign (outside concealment).

3.07 ADJUSTING AND CLEANING:

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.08 EXTRA STOCK:

A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

1. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provision of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. Division 15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:

a. Fiberglass.
b. Cellular Glass.

2. Ductwork System Insulation:

a. Fiberglass

3. Equipment Insulation:

a. Fiberglass

C. Refer to Division 15 section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.

D. Refer to Division 15 section "Low Pressure Ductwork" for duct linings, not work of this section.

E. Refer to Division 15 section "Mechanical Identification" for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instruction for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and fumished accessories for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

C. Samples: Submit manufacturer's sample of each piping insulation type required, and of each duct and equipment insulation type required. Affix label to sample completely describing product.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged, or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Armstrong World Industries, Inc.
2. Knauf Fiber Glass GmbH.
3. Manville Products Corp.
4. Owens-Corning Fiberglass Corp.
5. Pittsburg Corning Corp.

2.02 PIPING INSULATION MATERIALS:

A. All insulation material and mastic shall be asbestos-free.

B. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated.

1. Class 1 for use to 450 deg. F. (230 deg. C.).

C. Cellular Glass Piping Insulation: ASTM C52, Type II, Class 2.

1. Type I - flat block; Type II - pipe and tubing insulation.

D. Jackets for Piping Insulation: ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient.

1. Encase pipefitting insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.

E. Staples, Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.

F. Adhesives, Sealers, and Protective Finished: As recommended by insulation manufacturer for application indicated.

2.03 DUCTWORK INSULATION MATERIALS:

A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class

1. Class 1 - 400 deg. F (204 deg. C.)

B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, type 1, Class B-4.

1. Type I - Resilient, flexible.

C. Jackets for Ductwork Insulation: ASTM C 921, Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.

D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.04 EQUIPMENT INSULATION MATERIALS:

A. Rigid Fiberglass Equipment Insulation: ASTM C 612, Class 2.

B. Jacketing Material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per sq. yd., or metal jacket at

Installer's option, except as otherwise indicated.

C. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

D. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors, and stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.01 INSPECTIONS:

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PLUMBING PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.

B. Cold Piping:

1. Application Requirements: Insulate the following cold plumbing piping systems:

a. Interior above ground storm water piping in ceiling space only.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1" thickness.

C. Hot Piping:

1. Application Requirements: Insulate the following hot plumbing piping systems:

a. Potable hot water piping.
b. Potable hot water recirculating piping.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1-1/2" thick for pipe sizes up to and including 6", 2" thick for pipe sizes over 6".

b. Foam Rubber: 3/4" thick for pipe sizes up to 3".

3.03 HVAC PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on cold piping within unit cabinets provided piping is located over drain pan.

B. Sub-Freezing Piping (0-39 deg. F)(-18-4 deg. C.):

1. Application Requirements: Insulate the following sub-freezing HVAC piping systems:

a. Refrigerant suction lines between evaporators and compressors.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes over 1".

C. Cold Piping (40 deg. F.)(4.4 deg. C) to ambient:

1. Application Requirements: Insulate the following cold HVAC piping systems:

a. Air conditioner condensate drain piping.
b. Refrigerant suction lines.

2. Insulate each piping system specified above with one of the following types and thickness of insulation:

a. Cellular Glass: 1-1/2" thick.
Foam Rubber: 3/4" thick.

3.04 DUCTWORK SYSTEM INSULATION:

A. Cold Ductwork (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold ductwork:

a. Supply air and return air ductwork.

b. Outdoor air intake ductwork between air entrance and return air duct.

2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:

a. Machine, fan and equipment rooms: 2" thick flexible fiberglass, minimum R-6.

b. Concealed spaces: 2" thick flexible fiberglass or 1 2" thick rigid fiberglass, minimum R-6.

3.05 EQUIPMENT INSULATIONS:

A. Cold Equipment (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold equipment:

a. Drip pans under chilled equipment.

2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:

a. Cellular Glass: 1 2" thick.
b. Foam Rubber: 3/4" thick.

3.06 INSTALLATION OF PIPING INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purposes.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulations joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor barrier jackets on pipe insulation and protect to prevent puncture or other damage.

F. Cover valves, fittings, and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise indicated.

3.07 INSTALLATION OF DUCTWORK INSULATION:

A. General: install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through wall, floors, and similar ductwork penetrations, except where otherwise indicated.

F. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

G. Blanket Fiberglass Insulation:

1. Insulation shall be tightly wrapped on the ductwork with all circumferential joints butted and longitudinal joints lapped 2 inches and stapled. Joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 3 inches onto adjacent insulation. One coast of mastic shall be embedded in the mastic to ensure complete adhesion of the cloth. Adhere insulation to ducts with 4-inch wide strips of an approved bonding adhesive, at 8 inches on center. Additionally secure insulation to bottom of rectangular ducts over 24 inches wide with weld pins to stick clips at no more than 18 inches on center.

2. Insulation shall be butted with facing overlapping all joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth; extending 2 inches onto adjacent insulation. One coast of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in to ensure complete adhesion of the cloth. Breaks, punctures, pin penetrations in facing shall be sealed with vapor barrier tape and vapor barrier adhesive.

3.08 INSTALLATION OF EQUIPMENT INSULATION:

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purposes.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

E. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored blocks, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

F. Cover insulated surfaces with all service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

G. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

3.09 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 15411
POTABLE WATER SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

B. Division 15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of potable water system work, is indicated on drawings and schedules, and by requirements of this section.

B. Insulation for potable water piping is specified in other Division 15 sections, and is included as work of this section.

C. Refer to other Division 15 sections for insulation required in conjunction with potable water piping; not work of this section.

D. Refer to other Division 15 sections for plumbing equipment; not work of this section.

E. Refer to other Division 15 sections for plumbing fixtures; not work of this section.

F. Refer to other Division 15 sections for plumbing pumps; not work of this section.

G. Trenching and backfill required in conjunction with exterior water piping is specified in other Division 15 sections, and is included as work of this section.

H. Refer to Division 2 sections for trenching and backfill required in conjunction with exterior water piping; not work of this section.

I. Trenching and backfill required in conjunction with potable water piping inside of building foundations is specified in other Division 15 sections, and is included as work of this section.

1.02 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of potable water systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with potable water systems similar to that required for project.

C. Codes and Standards:

1. Plumbing Code Compliance: Comply with applicable portions of the 2007 Florida Plumbing Code pertaining to selection and installation of plumbing materials and products.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for potable water systems materials and products.

B. Shop Drawings: Submit scaled layout drawings of potable water piping and fittings including, but not necessarily limited to, pipe and tube sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and approximate equipment.

C. Record Drawings: At project closeout, submit record drawings of installed potable water system piping and piping products, in accordance with requirements of Division 1.

D. Maintenance Data: Submit maintenance data and parts lists for potable water systems materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual, in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTS:

A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with 2007 Florida Plumbing Code where applicable. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in potable water systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.02 BASIC IDENTIFICATION:

A. General: Provide identification complying with Division 15 Basic Mechanical Materials and Methods section "Mechanical Identification" in accordance with the following listing:

1. Potable Water Piping: Plastic pipe markers.
2. Water Service: Underground type plastic line markers.
3. Potable Water Valves: Polished brass tags.

2.03 BASIC PIPES AND PIPE FITTINGS:

A. General: Provide pipe and pipe fittings complying with Division 15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings" in accordance with the following listing:

1. Interior Water Piping:

a. Tube Size 2" and Smaller: Copper tube; Type L, hard drawn temper; wrought copper fittings, solder joints.
b. Tube Size 2-1/2" and Larger: Copper tube, Type L, hard drawn temper; wrought copper fittings, solder joints.
c. CPVC (chlorinated Polyvinyl choride) plastic pipe and fittings 2" and smaller schedule 80 in accordance with ASTM F441; pipe and ASTM F437; fittings.

2. Exterior Water Piping:

a. Tube Size 3/4" and Smaller: Copper tube; Type K, soft annealed temper; cast copper flared tube fittings.
b. Tube Size 1" through 2": Copper tube; Type K, soft annealed temper; wrought copper fitting, solder joints.

3. Exterior & Underfloor Water Piping:

a. Pipe Size 3" and Larger: Ductile iron pipe, with cement mortar lining; Schedule 150; ductile iron fittings, with rubber gasket joints.

2.04 BASIC PIPING SPECIALTIES:

A. General: Provide piping specialties complying with Division 15 Basic Mechanical Materials and Methods section "Piping Specialties" in accordance with the following listing:

1. Pipe escutcheons.
2. Low pressure Y-type pipeline strainers.
3. Dielectric unions.
4. Mechanical sleeve seals.
5. Fire barrier penetration seals.
6. Water hammer arresters.
7. Drip pans.
8. Pipe sleeves.
9. Sleeve seals.

B. Basket Strainers: Provide basket strainers with cast iron body, 125 psi flanges, bolted type. Furnish with removable, non-corrosive perforated strainer basket,

with 1/8" perforations and lift-out handle.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering basket strainers which may be incorporated in the work include; but are not limited to, the following:

1. Josam Mfg. Co.
2. Metraflex Co.
3. Spirax Sarco.
4. Smith (Jay R.) Mfg. Co.

2.05 BASIC SUPPORTS AND ANCHORS:

A. General: Provide supports and anchors complying with Division 15 Basic Mechanical Materials and Methods section "Supports and Anchors" in accordance with the following listing:

1. Adjustable steel clevis and adjustable pipe saddle supports for horizontal piping hangers and supports.
2. Two bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.
4. Protection shields for insulated piping supports in hangers.

2.06 BASIC VALVES:

A. General: Provide valves complying with Division 15 Basic Mechanical Materials and Methods section "Valves" in accordance with the following listing:

1. Sectional Valves:

a. 2" and Smaller: Gate valves or ball valves.
b. 2-1/2" and Larger: Gate valves or butterfly valves.

2. Shutoff Valves:

a. 2" and Smaller: Gate valves or ball valves.
b. 2-1/2" and Larger: Gate valves.

3. Drain Valves:

a. 2" and Smaller: Gate valves or ball valves.
b. 2-1/2" and Larger: Gate Valves.

4. Check Valves:

a. All Sizes: Swing check valves.

2.07 BALANCE COCKS:

A. Threaded Ends 2" and Smaller: Class 125, bronze body, bronze plug, screw

driver operated, straight or angle pattern.

B. Soldered Ends 2" and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.

C. Available Manufacturers: Subject to compliance with requirements manufacturers offering balance cocks which may be incorporated in the work include, but are not limited to the following:

1. American Air Filter Co.
2. Bell & Gossett ITT; Fluid Handling Div.
3. Hammond Valve Corp.
4. Milwaukee Valve Co., Inc.
5. Spirax Sarco.
6. Taco, Inc.

2.08 BIBBS AND FAUCETS:

A. Hose Bibbs:

1. Threaded End: Bronze body, renewable composition disc, tee handle, 3/4" NPT inlet, 3/4" hose outlet.

B. Sill Faucets:

1. Threaded End: Bronze body, renewable composition disc, wheel handle, 3/4" NPT inlet, 3/4" hose outlet.
2. Soldered End: Bronze body, renewable composition disc, 3/4" solder inlet, 3/4" hose outlet.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering bibbs and faucets which may be incorporated in the work include, but are not limited to the following:

1. Hammond Valve Corp.
2. Lee Brothers; Div. Phelps Dodge Brass Co.
3. Mansfield Plumbing Products.
4. Nibco Inc.
5. Prier Brass Mfg. Co.
6. Tanner Mfg. Co.
7. Watts Regulator Co.

2.09 HYDRANTS:

A. Recessed Wall Hydrants: Cast bronze box hydrant, chrome plated face, tee handle key, bronze casing, length to suit wall thickness, vacuum breaker, hinged locking cover, 3/4" inlet, hose outlet.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hydrants which may be incorporated in the work include,

but are not limited to the following:

1. Josam Mfg. Co.
2. Smith (Jay R.) Mfg. Co.
3. Tyler Pipe; Sub. of Tyler Corp.
4. Woodford Mfg. Co.
5. Zurn Industries Inc., Hydromechanics Div.

2.10 BASIC EXPANSION COMPENSATION:

A. General: Provide expansion compensation complying with Division 15 Basic Mechanical Materials and Methods section "Expansion Compensation" in accordance with the following listings:

1. Expansion compensators.
2. Pipe alignment guides.

2.11 BASIC METERS AND GAGES:

A. General: Provide meters and gages complying with Division 15 Basic Mechanical Materials and Methods section "Meter and Gages" in accordance with the following listing:

1. Glass thermometers.
2. Pressure gages.

2.12 RELIEF VALVES:

A. General: Provide relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity in accordance with ASME Boiler and Pressure Vessel Code.

1. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 deg.F. (99 deg.C.), and pressure relief at 150 psi.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering relief valves which may be incorporated in the work include, but are not limited to the following:

1. Cash (A.W.) Valve Mfg. Corp.
2. Conbraco Industries, Inc.
3. Watts Regulator Co.
4. Zurn Industries, Inc.; Wilkins Regulator Div.

2.13 WATER SHOCK ARRESTORS:

A. Provide water shock arrestors of stainless construction with welded expandable bellows and male threaded inlet.

B. Available Manufacturers: Subject to requirements of manufacturers offering water shock arrestors which may be incorporated in the work include, but are not limited to the following:

1. Zurn Industries, Inc.; Wilkins Regulator Div.
2. Smith (Jay R.) Mfg. Co.
3. Josam Mfg. Co.

PART 3 - EXECUTION

3.01 INSPECTION:

A. General: Examine areas and conditions under which potable water systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF BASIC IDENTIFICATION:

A. General: Install mechanical identification in accordance with Division 15 Basic Mechanical Materials and Methods section "Mechanical Identification".

3.03 INSTALLATION OF POTABLE WATER DISTRIBUTION PIPING:

A. General: Install water distribution piping in accordance with Division 15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".

B. Install piping with 1/32" per foot (1/4%) downward slope towards drain point.

3.04 INSTALLATION OF EXTERIOR WATER PIPING:

A. Install exterior water service piping system in compliance with local governing regulations. Work of this section begins 5'-0" from building foundation. Beyond 5'-0" from building foundation is under Site Utilities work.

B. Water Service Piping: Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry; make entry watertight. Provide shutoff valve at water service entry inside building; strainer, pressure gage, test tee with valve.

C. Ductile Iron Pipe: Install in accordance with AWWA C-60.

3.05 INSTALLATION OF PIPING SPECIALTIES:

A. Install piping specialties in accordance with Division 15 Basic Mechanical Materials and Methods section "Piping Specialties.

3.06 INSTALLATION OF SUPPORTS AND ANCHORS:

A. Install supports and anchors in accordance with Division 15 Basic Mechanical

Materials and Methods section "Supports and Anchors".

3.07 INSTALLATION OF VALVES:

A. Install valves in accordance with Division 15 Basic Mechanical Materials and Methods section "Valves".

B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated.

C. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

D. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain potable water system.

E. Check Valve: Install on discharge side of each pump, and elsewhere as indicated.

F. Balance Cocks: Install in each hot water recirculating loop, and elsewhere as indicated.

G. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.

H. Sill Faucets: Install on concealed piping where indicated with vacuum breaker.

I. Hydrants: Install where indicated, in accordance with manufacturer's installation instructions.

3.08 INSTALLATION OF EXPANSION COMPENSATION PRODUCTS:

A. Install expansion compensation products on hot water and hot water recirculating piping in accordance with Division 15 Basic Mechanical Materials and Methods section "Expansion Compensation".

3.09 INSTALLATION OF METERS AND GAGES:

A. Install meters and gages in accordance with Division 15 Basic Mechanical Materials and Methods section "Meters and Gages".

3.10 EQUIPMENT CONNECTIONS:

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Standard Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system

to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.11 INSTALLATION OF WATER SHOCK ARRESTORS.

A. Install water shock arrestors at capacity required for number of fixtures served and per manufacturer's instructions. Locate water hammer arrestors per manufacturer's recommendations.

3.12 FIELD QUALITY CONTROL:

A. Piping Tests: Test potable water piping in accordance with testing requirements of Division 15 Basic Mechanical Materials and Methods section "Pipe and Pipe Fittings".

3.13 ADJUSTING AND CLEANING:

A. Cleaning, Flushing and Inspecting: Clean, flush, and inspect potable water systems in accordance with requirements of Division 15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings"

B. Disinfection: Disinfect water service line in accordance with AWWA C601. Disinfect potable water system in accordance with Standard Plumbing Code.

3.14 SPARE PARTS:

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. Division 15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of soil, waste and vent systems work is indicated on drawings and schedules, and by requirement of this section.

B. Exterior sanitary sewer system is specified in applicable Division 2 sections, and is included as work of this section.

C. Refer to appropriate Division 2 sections for exterior sanitary sewer system required in conjunction with soil and waste systems; not work of this section.

D. Trenching and backfilling required in conjunction with underground building drain piping is specified in applicable Division 15 sections, and is included as work of this section.

E. Refer to Division 7 section "Flashing and Sheet Metal" for flashings required in conjunction with soil and waste systems; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of soil and waste systems products of types, materials and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with soil and waste systems work similar to that required for project.

C. Codes and Standards:

1. Plumbing Code Compliance: Comply with applicable portions of Standard Plumbing Code pertaining to plumbing materials construction and installation of products.
2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil and waste systems.

3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for soil, waste and vent systems materials and products.

B. Shop Drawings: Submit scaled layout drawings of soil, waste and vent pipe and fittings including, but not necessarily limited to pipe sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

C. Record Drawings: At project closeout, submit record drawings of installed soil, waste and vent systems, in accordance with requirements of Division 1.

D. Maintenance Data: Submit maintenance data and parts lists for soil, waste and vent systems materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual, in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTS:

A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.02 SOIL, WASTE AND VENT SYSTEMS:

A. All soil, waste and vent piping in building and all sanitary sewers below ground floor slabs shall be as follows: Service weight cast-iron pipe with DWV fitting or Schedule 40 PVC pipe and DWV fittings where allowed by code.

1. Pipe fittings shall be marked to show compliance with the required standards. In addition, PVC pipe and fittings shall bear markings indicating type of compound used in their production.

2. The Seal of Approval of the National Sanitation Foundation Testing Laboratory Inc. will be considered evidence of compliance with the above standards.

2.03 BASIC IDENTIFICATION:

A. General: Provide identification complying with Division 15 Basic Mechanical Materials and Methods section "Mechanical Identification", in accordance with the following listing:

1. Above Ground Soil, Waste and Vent Piping: Plastic pipe markers.
2. Underground Building Drain Piping: Underground type plastic line markers.

2.04 BASIC PIPES AND PIPE FITTINGS:

A. General: Provide pipes and pipe fittings complying with Division 15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:

1. Above Ground Soil, Waste, and Vent Piping:

a. Pipe Size 15" and Smaller: Cast iron hub and spigot soil pipe; service weight; cast iron, hub and spigot soil pipe fittings, compression gasket joints.
b. Pipe size 15" and smaller: Schedule 40 PVC pipe with solvent cemented fittings.

2. Underground Building Drain Piping:

a. Pipe Size 15" and Smaller: Cast iron hub and spigot soil pipe; cast iron hub and spigot soil pipe fittings, compression gasket joints.
b. Pipe size 15" and smaller: Schedule 40 PVC pipe with solvent cemented fittings.

2.05 BASIC PIPING SPECIALTIES:

A. General: Provide piping specialties complying with Division 15 Basic Mechanical Materials and Methods section "Piping Specialties", in accordance with the following listing:

1. Pipe Escutcheons,
2. Vandalproof Vent Caps.
3. Mechanical Sleeve Seals.
4. Fire Barrier Penetration Seals.
5. Drip Pans.
6. Pipe Sleeves.
7. Sleeve Seals.

2.06 BASIC SUPPORTS AND ANCHORS:

A. General: Provide supports and anchors complying with Division 15 Basic Mechanical Materials and Methods section "Supports and Anchors" in accordance with the following listing:

1. Adjustable steel clevis hangers, steel pipe clamps, and pipe saddle

supports for horizontal piping hangers and supports.
2. Two bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.

2.07 DRAINAGE PIPING PRODUCTS:

A. General: Provide factory-fabricated drainage piping products of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations.

B. Cleanout Plugs: Cast bronze or brass, threads complying with ANSI B2.1, countersunk head.

C. Floor Cleanouts: Cast iron body and frame; cleanout plug; adjustable round top as follows:

1. Nickel-Bronze Top: Manufacturers standard cast unit of the pattern indicated:

a. Pattern: Exposed rim type, with recess to receive 1/8" thick resilient floor finish.
b. Pattern: Exposed rim type, with recess to receive 1" thick terrazzo floor finish.
c. Pattern: Exposed finish type, standard mill finish.
d. Pattern: Exposed flush type, standard non-slip scored or abrasive finish.

2. Cast Iron Top: Manufacturers standard cast unit of the pattern indicated:

a. Pattern: Exposed flush type, standard mill finish.
b. Pattern: Exposed flush type, standard non-slip scored or abrasive finish.

D. Wall Cleanouts: Cast iron body adaptable to pipe with cast bronze or brass cleanout plug; stainless steel cover including screws.

E. Flashing Flanges: Cast iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

F. Vent Flashing Sleeves: Cast iron calking type roof coupling for cast iron stands and cast iron threaded type roof coupling for steel stacks.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering drainage piping products which may be incorporated in the work include but are not limited to the following:

1. Josam Mfg. Co.
2. Smith (Jay R.) Co.
3. Tyler Pipe; Subs. of Tyler Corp.
4. Zurn Industries Inc.; Hydromechanics Div.

2.08 FLOOR DRAINS:

A. General: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein.

B. Floor Drain Type "A": Cast iron body and round, ductile iron tractor grate, flashing flange and collar, sediment bucket, bottom outlet and trap primer connection or deep seal trap.

C. Floor Drain Type "B": Cast iron body and flashing collar with nickel bronze adjustable strainer head with secured round hole grate, with the following features:

1. Sediment bucket.
2. Heel-proof grate.
3. Trap primer connection.
4. Side outlet, inside calk.
5. Clean-out plug.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering floor drains which may be incorporated in the work include but are not limited to the following:

1. Ancon
2. Josam Mfg. Co.
3. Smith (Jay R.) Mfg. Co.
4. Tyler Pipe; Subs. of Tyler Corp.
5. Zurn Industries, Inc.; Hydromechanics Div.

2.09 TRAP PRIMERS:

A. General: Provide bronze trap primer valve with automatic vacuum breaker, complying with ASSE 1018, with 1/2" connections matching mating piping system.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering trap primers which may be incorporated in the work include, but are not limited to the following:

1. Josam Mfg. Co.
2. Precision Plumbing Products, Inc.
3. Smith (Jay R.) Mfg. Co.
4. Tyler Pipe; Subs. of Tyler Corp.
5. Zurn Industries, Inc.; Hydromechanics Div.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine substrated and conditions under which soil an waste systems are to be installed. Do not proceed with work until unsatisfactory conditions have

been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF BASIC IDENTIFICATION:

A. General: Install mechanical identification in accordance with Division 15 Basic Mechanical Materials and Methods section "Mechanical Identification". Install combination waste/vent system in accordance with manufacturer's published design and installation criteria.

3.03 INSTALLATION OF ABOVE GROUND PIPING:

A. General: Install soil and waste piping in accordance with Division 15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings" and with Standard Plumbing Code.

3.04 INSTALLATION OF BUILDING DRAIN PIPING:

A. General: Install underground building drains as indicated and in accordance with Standard Plumbing Code. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

B. Install soil and vent piping pitched to drain at minimum slope of 1/4" per foot (2%) for piping 3" and smaller, and 1/8" per foot (1%) for piping 4" and larger.

3.05 INSTALLATION OF PIPING SPECIALTIES:

A. Install piping specialties in accordance with Division 15 Basic Mechanical Materials and Methods section "Piping Specialties".

3.06 INSTALLATION OF SUPPORTS AND ANCHORS:

A. Install supports and anchors in accordance with Division 15 Basic Mechanical Materials and Methods section "Supports and Anchors".

3.07 INSTALLATION OF BACKWATER VALVES:

A. Install backwater valves in sanitary building drain piping as indicated, and as required by Standard Plumbing Code. For interior installation, provide cleanout cover flush to floor, centered over backwater valve cover, and of adequate size to remove valve cover for service.

3.08 INSTALLATION OF EXPANSION JOINTS:

A. Install expansion joints on vertical risers as indicated and as required by Standard Plumbing Code.

3.09 INSTALLATION OF DRAINAGE PIPING PRODUCTS:

A. Cleanouts: Install in above ground piping and building drain piping as indicated, as required by Standard Plumbing Code; and at each change in direction of piping greater than 45 deg.; at minimum intervals of 50' for piping 4" and smaller and 80' for larger piping; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

B. Flashing Flanges: install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

C. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.10 INSTALLATION OF FLOOR DRAINS:

A. General: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate flashing work with work of waterproofing and adjoining substrate work.

C. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems.

D. Install floor drains at low points of surface areas to be drained or as indicated. Set tops of drains flush with finished floor.

E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

F. Position drains so that they are accessible and easy to maintain.

3.11 INSTALLATION OF TRAP PRIMERS:

A. General: Install trap primers as indicated and in accordance with manufacturer's installation instructions. Pitch piping towards drain trap, minimum of 1/8" per foot (1%). Adjust trap primer for proper flow.

3.12 EQUIPMENT CONNECTIONS:

A. Piping Runouts to Fixtures: Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by Standard Plumbing Code. Refer to combination waste/vent system manufacturer's published design criteria for minimum pipe sizes.

B. Locate piping runouts as close as possible to bottom of floor slab supporting

fixtures or drains.

3.13 FIELD QUALITY CONTROL:

A. Piping Tests: Test soil and waste systems in accordance with requirements of Standard Plumbing Code.

3.14 ADJUSTING AND CLEANING:

A. Clean, flush and inspect soil and waste piping in accordance with requirements of Division 15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".

3.15 PROTECTION:

A. Protect drains during remainder of construction period to avoid clogging with construction materials and debris, and to prevent damage from traffic and construction work.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Division 15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of plumbing fixtures work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of plumbing fixtures specified in this section include the following:

1. Lavatories.
2. Service sinks.
3. Urinals.
4. Water closets.
5. Water coolers.

C. Refer to Division 15 sections for potable water systems used in conjunction with plumbing fixtures; not work of this section.

D. Refer to Division 15 sections for soil and waste systems used in conjunction with plumbing fixtures; not work of this section.

E. Refer to Division 16 sections for field installed electrical wiring required for water coolers and other plumbing fixtures; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:

1. Plumbing Fixtures Standards: Comply with applicable portions of Standard Plumbing Code pertaining to materials and installation of plumbing fixtures.
2. ANSI Standards: Comply with applicable ANSI Standards pertaining to plumbing fixtures and systems, and bath tub units.
3. PDI Compliance: Comply with standards established by PDI pertaining

to plumbing fixture supports.

4. Federal Standards: Comply with applicable FS WW-P-541/Series sections pertaining to plumbing fixtures.
5. UL Compliance: Construct water coolers in accordance with UL Standard 399 "Drinking Water Coolers", and provide UL listing and label.
6. ASHRAE Compliance: Test and rate water coolers in accordance with ASHRAE Standard 18 "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems".
7. ARI Compliance: Construct and install water coolers in accordance with ARI Standard 1010 "Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers", and provide Certification Symbol.
8. ANSI Compliance: Construct and install barrier free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People".

    a. Comply with Public Law 90-480, known as the Architectural Barriers Act of 1968.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data including rated capacities of selected model clearly indicated, furnished specialties and accessories; and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, roughing-in requirements, required clearances, and methods of assembly of components and anchorages.

C. Samples: Submit samples of each cabinet finish furnished, and fixture color furnished.

D. Maintenance Data: Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver plumbing fixtures individually wrapped in factory fabricated containers.

B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES:

A. General: Provide factory-fabricated fixtures of type, style and material indicated.

For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed or constructed, or as recommended by manufacturer, and as required for complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

2.02 MATERIALS:

A. General: Unless otherwise specified, comply with applicable Federal Specification WW-P-541/Series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541/- specifications relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps, and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541/-.

B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, decoloration, or other surface imperfections on finished units are not acceptable.

C. Where fittings, trim and accessories are exposed or semi- exposed provide bright chrome plated or polished stainless steel units. Provide copper or brass where not exposed.

D. Stainless Steel Sheets: ASTM A 167, Type 302/304, hardest workable temper.

1. Finish: No.4, bright, directional polish on exposed surfaces.

E. Aluminum: ASTM B 209/B 221 sheet, plate and extrusions, as indicated; alloy, temper and finish as determined by manufacturer, except 0.40 mil natural anodized finish on exposed work unless another finish is indicated.

F. Plastic Laminate: NEMA LD3, general-purpose high-pressure type, 0.050" thick, smooth (non-textured) white unless another texture and color are indicated or selected by Architect/Engineer.

G. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.

H. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.03 PLUMBING FITTINGS, TRIM AND ACCESSORIES:

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type, and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet

servicing without shut-down of water supply piping systems.

1. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.

B. P-Traps: Include removable P-traps where drains are indicated for direct connection to drainage system.

C. Carriers: Provide cast iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron as indicated.

D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated cast brass escutcheons with setscrew.

F. Aerators: Provide aerators of types approved by Health Departments having jurisdiction.

G. Comply with additional fixture requirements contained in fixture schedule attached to this section.

2.04 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plumbing fixtures which may be incorporated in the work include, but are not limited to the following:

1. Plumbing Fixtures:

a. American Standard; US Plumbing Products.
b. Kohler Co.
c. Eljer Plumbingware Div.; Household International Co.

2. Plumbing Trim:

a. American Standard; US Plumbing Products.
b. Chicago Faucet Co.
c. Delta Faucet Co.; Div. of Masco Corp.
d. Eljer Plumbingware Div.; Household International Co.
e. Kohler Co.
f. Speakman Co.
g. T & S Brass and Bronze Works, Inc.

3. Fixture Seats:

a. Bemis Mfg. Co.
b. Beneke Corp.
c. Forbes-Wright Industries, Inc.; Church Products.

e. Olsonite Corp.; Olsonite Seats.
f. Sperzel Industries, Inc.

4. Water Coolers:

a. Ebco Mfg. Co.
b. Elkay Mfg. Co.
c. Halsey Taylor Div.; Household International Co.
d. Haws Drinking Faucet Co.
e. Western Drinking Fountains; Div. of Sunroc Corp.

5. Service Sinks:

a. American Standard; US Plumbing Products.
b. Kohler Co.
c. Eljer Plumbingware Div.; Household International Co.
d. Fiat Products.

6. Fixture Carriers:

a. Josam Mfg. Co.
b. Kohler Co.
c. Tyler Pipe.
d. Zurn Industries, Inc.; Hydromechanics Div.

PART 3 - EXECUTION

3.01 INSPECTIONS:

A. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floor and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF PLUMBING FIXTURES:

A. General: Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of Standard Plumbing Code pertaining to installation of plumbing fixtures.

B. Fasten plumbing fixtures securely to indicated supports or building structures; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

C. Protect installed fixtures from damage during remainder of construction period.

3.03 FIELD QUALITY CONTROL:

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

3.04 ADJUSTING AND CLEANING:

A. Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation.

B. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.

C. Adjust or replace washers to prevent leaks at faucets and stops.

3.05 EXTRA STOCK:

A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every 10 units.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions and Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of plumbing equipment work is indicated on drawings and provisions of this section, including schedules and equipment lists associated with either drawings or this section.

B. Types of plumbing equipment required for project include the following:

1. Domestic Water Heaters - Residential Type

a. Electric water heaters.

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of plumbing equipment of type and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

C. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

D. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.

E. PDI Compliance: Comply with applicable Plumbing and Drainage Institute standards pertaining to grease interceptors.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, and capacity and ratings, with selection points clearly indicated.

B. Shop Drawings: Submit assembly type shop drawings indicating dimensions,

weights, required clearances, and methods of assembly of all components.

C. Wiring Diagrams: Submit ladder type wiring diagrams for all components, clearly indicating all required field electrical connections.

D. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER HEATERS:

A. Residential Electric Water Heaters:

1. General: Provide electric water heaters of size, capacity, and electrical characteristics as indicated on schedule. Comply with ANSI/ASHRAE/IES 90.1-1989 Addendum 90.1b for energy efficiency. Comply with 2001 Florida Energy Efficiency Code. Provide UL listing, and NSF approval.

2. Heater: Working pressure of 150 psi, magnesium anode rod; glass lining on internal surfaces exposed to water.

3. Heating Elements: Zinc plated copper sheath, screw-in design, non-simultaneous operation.

4. Controls: Thermostat with each element and high temperature cut off.

5. Jacket: Equip with full size control compartments with front panel opening. Insulate tank with polyurethane closed cell foam insulation. Provide outer steel jacket with bonderized undercoat and baked enamel finish.

6. Warranty: Furnish 5-year manufacturer's limited warranty for tank leakage.

7. Accessories: Provide brass drain valve; full size temperature and pressure relief valve.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

1. Lochinvar Water Heaters.
2. A.O. Smith, Consumer Products Div.
3. Rheem Industries.

PART 3 - EXECUTION

3.01 INSTALLATION OF DOMESTIC ELECTRIC WATER HEATERS:

A. General: Install electric water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.

B. Support: Set units, orient so controls and devices needing service and maintenance have adequate access. Level and plumb unit.

C. Electrical Supply: Furnish wiring diagram to Electrical Installer. Refer to Division 16 for wiring of units; not work of this section.

D. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union.

E. Start-Up: start-up, test, and adjust electric water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This section pertains to the furnishing of all labor, equipment, material and services necessary to provide complete Fire Protection Systems including:

1. Sprinkler for entire building.

B. Work Included: The work to be included under these specifications and accompanying drawings shall include all pipe, labor, materials, equipment and services and performing all operations necessary for the installation of complete operating Fire Protection Systems, in strict accordance with these specifications and plans, and regulations and standards of the NFPA and in obtaining all certificates of approval from bodies having jurisdiction, including the following:

1. Connection to water main shall be as described in this section of the specifications and as shown on drawings.
2. Pipe sleeves, hangers, supports, etc.
3. Shop drawings
4. Guarantee.
5. Sprinklering of entire building.

C. Work not included: Electrical alarm wiring.

1.02 DESCRIPTION OF WORK:

A. The entire building shall be protected by a complete wet sprinkler system. The system shall comply with all rules and regulations of bodies having jurisdiction and where modifications are required to that shown on the drawings to obtain such approvals, and they shall be provided without extra cost to the Owner. The sprinkler systems shown on the drawing is diagrammatic. It is the responsibility of the Fire Protection Contractor to install a complete system in accordance with NFPA 13 and any additional requirements as required by the local Fire Marshal.

1.03 QUALITY ASSURANCE:

A. Standards: Sprinkler system shall be installed in accordance with NFPA 13, all related pamphlets, all applicable codes and local jurisdiction regulations.

B. Qualifications of Contractor: The Fire Protection Contractor shall be a fully licensed contractor in the State of Florida with no less than five (5) years of previous experience in the fire protection field.

1.04 SUBMITTALS:

A. Shop drawings as listed shall be submitted to the Fire Marshal for approval and to the Architect/Engineer for review:

1. Hydraulic Calculations
2. Sprinkler Heads
3. Sprinkler Piping Layout
4. Point of Service (F.S. 633)

B. Review of shop drawings by Architect/Engineer does not relieve the Contractor for meeting all requirements of the Contract Documents, or approval by the Fire Marshal.

1.05 GUARANTEE:

A. The Fire Protection subcontractor shall furnish a written guarantee that work under this subcontract will be free from defects to materials and workmanship for a period of one (1) year from date of final acceptance of the work, and that he will, at his own expense, repair or replace all such defective work and/or equipment which becomes defective during the term of the guarantee.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Pipe: Black steel, Schedule 40, T & C for interior and above grade use.

B. Fittings for steel pipe shall be cast iron (175 pounds) in accordance with ASA Standard B16.4.

C. Valves 2" and smaller shall be brass (150 pounds), 2-1/2" and larger shall be iron body brass trim (175 pounds). System control valves for each space to be OS&Y type that shall be equipped with supervisory alarm to indicated open position.

D. Hangers shall be adjustable pipe hangers in accordance with NFPA Section 13.

E. Piping for underground use shall be UL Listed PVC water main - John Mansville "Blue Brute" meeting AWWA C-900 Class 150 with Class 250 cast iron water main fittings.

F. Gauges shall be as required by NFPA and shall have a maximum limit not less than twice the normal working pressure at the point installed.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The Contractor shall carefully investigate the structural, electrical, plumbing, air conditioning, ventilation and equipment requirements and coordinate his work.

B. All changes and/or additions required shall be included and work shall proceed accordingly without delay to other trades or progress of job completion.

C. The work shall be carefully laid out in advance and any cutting of construction shall

be done only with the written permission of the Architect. Damage to piping, or wiring, or equipment as a result of cutting shall be repaired by skilled mechanics of the trade involved, at no additional cost above the contract price. Cutting shall be carefully done as instructions of the Architect.

D. Pipe openings shall be closed with caps or plugs during installation. Equipment shall be protected while painting is done.

E. Heads shall be protected from all foreign matter such as plaster, insulation, mastic and paint.

F. At the completion of the work, all materials and equipment shall be thoroughly cleaned and delivered in a satisfactory condition.

G. The Contractor must commence installing piping as soon as the building has sufficiently advanced in construction.

H. Hangers and supports shall be installed at intervals as required by NFPA, and in accordance with their regulations. Hangers and supports shall be secured to the structure in a manner approved by NFPA and the Architect. Expansion bolts shall be installed only as permitted by the Architect.

I. If inspection test show defects, such defective work or materials shall be replaced without delay and inspection and test repeated. Caulking of screw joints or plugging leaks will not be permitted.

J. All valves shall be provided with a brass tag 3/4" long stamped with a designation number. This tag shall be secured to the valve spindle by a chain. Upon completion of the work, and before final acceptance, the subcontractor shall furnish two typewritten lists and diagrams of all tagged valves, giving their locations, functions and numbers. These lists shall be neatly framed in glazed enclosures and hung in the vicinity of sprinkler station.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Requirements of the following Division 15 Sections apply to this section:

1. Basic Mechanical Requirements.
2. Basic Mechanical Materials and Methods.
3. Supports and Anchors.
4. Mechanical Insulation.

1.02 SUMMARY

A. This Section includes refrigerant piping used for air conditioning applications. This Section includes:

1. Pipes, tubing, fittings, and specialties.
2. Special duty valves.
3. Refrigerants.

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

1. Division 2, Section "Earthwork" for trenching and backfilling for installation of underground refrigerant piping.
2. Division 7, Section "Joint Sealers" for materials and methods for sealing pipe penetrations through basement walls and fire/smoke barriers.
3. Division 15, Section "Mechanical Identification" for labeling and identification of refrigerant piping.
4. Division 15, Section "Mechanical Insulation" for pipe insulation.

C. Products installed but not furnished under this Section include pre-charged tubing, refrigerant specialties, and refrigerant accessories furnished as an integral part of or separately with packaged air conditioning equipment.

1.03 SUBMITTALS

A. Product data for the following products:

1. Each type valve specified.
2. Each type refrigerant piping specialty specified.

B. Shop Drawings showing layout of refrigerant piping, specialties, and fittings

including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximate to equipment.

C. Brazer's Certificates signed by Contractor certifying that brazers comply with requirements specified under "Quality Assurance" below.

D. Maintenance data for refrigerant valves and piping specialties, for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 15 Section "Basic Mechanical Requirements."

1.04 QUALITY ASSURANCE

A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".

B. Regulatory Requirements: Comply with provisions of the following codes:

1. ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping.
2. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.
3. BOCA Basic National Mechanical Code.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

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

1. Refrigerant Valves and Specialties:

a. Alco Controls Div, Emerson Electric.
b. Danfoss Electronics, Inc.
c. EATON Corporation, Control Div.
d. Henry Valve Company.
e. Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
f. Sporlan Valve Company.

2.02 PIPE AND TUBING MATERIALS

A. General: Refer to Part 3, Article "PIPE APPLICATION" for identification of systems where the below specified pipe and fitting materials are used.

B. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to

shipping.

C. Copper Tubing: ASTM B 88, Type L, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing.

2.03 FITTINGS

A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

2.04 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

2.05 VALVES

A. General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.

B. Globe: 450 psig maximum operating pressure, 275 deg. F maximum operating temperature; cast bronze body, with cast bronze or forged brass wing cap and bolted bonnet; replaceable resilient seat disc; plated steel stem. Valve shall be capable of being repacked under pressure. Valve shall be straight through or angle pattern, with solder-end connections.

C. Check Valves - Smaller Than 7/8 inch: 500 psig maximum operating pressure, 300 deg. F maximum operating temperature; cast brass body, with removable piston, Teflon seat, and stainless steel spring; straight through globe design. Valve shall be straight through pattern, with solder-end connections.

D. Check Valves - 7/8 inch and Larger: 450 psig maximum operating pressure, 300 deg. F maximum operating temperature; cast bronze body, with cast bronze or forged brass bolted bonnet; floating piston with mechanically retained Teflon seat disc. Valve shall be straight through or angle pattern, with solder-end connections.

E. Solenoid Valves: 250 deg. F temperature rating, 400 psig working pressure; forged brass, with Teflon valve seat, two-way straight through pattern, and solder end connections. Provide manual operator to open valve. Furnish complete with NEMA 1 solenoid enclosure with 1/2-inch conduit adapter, and 24 volt, 60 Hz. normally closed holding coil.

F. Evaporator Pressure Regulating Valves: pilot-operated, forged brass or cast bronze; complete with pilot operator, stainless steel bottom spring, pressure gage tappings, 24 volts DC, 50/60 Hz, standard coil; and wrought copper fittings for solder end connections.

G. Thermal Expansion Valves: thermostatic adjustable, modulating type; size as required for specific evaporator requirements, and factory set for proper evaporator superheat requirements. Valves shall have copper fittings for solder end connections; complete with sensing bulb, a distributor having a side connection for hot gas bypass line, and an external equalizer line.

2.06 REFRIGERANT PIPING SPECIALTIES

A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.

B. Strainers: 500 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.

C. Moisture/liquid Indicators: 500 psig maximum operation pressure, 200 deg. F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.

D. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:

1. Standard capacity desiccant sieves to provide micronic filtration.
2. High capacity desiccant sieves to provide micronic filtration and extra drying capacity.

E. Suction Line Filter-Drier: 350 psig maximum operation pressure, 225 deg. F maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant. for removal of acids and moisture for refrigerant vapor.

F. Suction Line Filters: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter core kit, including gaskets, as follows:

G. Flanged Unions: 400 psig maximum working pressure, 330 deg. F maximum operating temperature; two brass tailpiece adapters for solder end connections to copper tubing; flanges for 7/8 inch through 1-5/8 inch unions shall be forged steel, and for 2-1/8 inch through 3-1/8 inch shall be ductile iron; four plated steel bolts, with silicon bronze nuts and fiber gasket. Flanges and bolts shall have factory-applied rust-resistant coating.

H. Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.

2.07 REFRIGERANT

A. Refrigerant No. 22, in accordance with ASHRAE Standard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.

3.02 PIPE APPLICATIONS

A. Use Type L, or Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Use Type K, annealed temper copper tubing for 2 inch and smaller without joints, below ground and within slabs. Mechanical fittings (crimp or flair) are not permitted.

1. Install annealed temper tubing in pipe duct. Vent pipe duct to the outside.

B. If other than Type ACR tubing is used, clean and protect inside of tubing as specified in Article "CLEANING" below.

3.03 PIPING INSTALLATIONS

A. General: Install refrigerant piping in accordance with ASHRAE Standard 15 - "The Safety Code for Mechanical Refrigeration."

B. Install piping in as short and direct arrangement as possible to minimize pressure drop.

C. Install piping for minimum number of joints using as few elbows and other fitting as possible.

D. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.

E. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.

F. Insulate suction lines. Liquid line are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.

1. Do not install insulation until system testing has been completed and all leaks have been eliminated.

G. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.

H. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

I. Slope refrigerant piping as follows:

1. Install horizontal suction lines with 1/2 inch per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
2. Install traps and double risers where indicated, and where required to

entrain oil in vertical runs.

3. Liquid lines may be install level.

J. Use fittings for all changes in direction and all branch connections.

K. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

L. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

M. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

N. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

O. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

P. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.

Q. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials.

R. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

S. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.

T. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.

1. Install moisture/liquid indicators in lines larger than 2-1/8 inch OD, using a bypass line.

U. Install unions to allow removal of solenoid valves, pressure-regulating valves, expansion valves, and at connections to compressors and evaporators.

V. Install flexible connectors at the inlet and discharge connection of compressors.

3.04 HANGERS AND SUPPORTS

A. General: Hanger, supports, and anchors are specified in Division 15 Section

"SUPPORTS AND ANCHORS." Conform to the table below for maximum spacing of supports:

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe rollers complete supports for multiple horizontal runs, 20 feet or longer supported by a trapeze.
4. Spring hangers to support vertical runs.

C. Install hangers with the following minimum rod sizes and maximum spacing:

NON. PIPE SIZE	MAX. SPAN-FT	MIN. ROD SIZE - INCHES
1	7	3/8
1-1/2	9	3/8
2	10	3/8
3	12	1/2
3-1/2	13	1/2
4	14	5/8
5	16	5/8
6	17	3/4
8	19	7/8
10	22	7/8
12	23	7/8

D. Support vertical runs at each floor.

3.05 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."

1. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
2. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do no apply heat near the bulb of the expansion valve.

B. Fill the pipe and fittings during brazing, with an inert gas (ie., nitrogen or carbon dioxide) to prevent formation of scale.

C. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

3.06 VALVE INSTALLATIONS

A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.

B. Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere as indicated.

C. Install solenoid valves ahead of each expansion valve. Install solenoid valves in horizontal lines with coil at the top.

1. Electrical wiring for solenoid valves is specified in Division 16 but work is to be done under this contractor. Coordinate electrical requirements and connections.

D. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.

1. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.
2. Install the valve in such a location so that the diaphragm case is warmer than the bulb.
3. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount bulb in a trap or at the bottom of the line.
4. Where external equalizer lines are required make the connection where it will clearly reflect the pressure existing in the suction line at the bulb location.

E. Install pressure regulating and relieving valves as required by ASHRAE Standard 15.

3.07 EQUIPMENT CONNECTIONS

A. The Drawings indicate the general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow servicing and maintenance.

3.08 FIELD QUALITY CONTROL

A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.

B. Repair leaking joints using new materials, and retest for leaks.

3.09 CLEANING

A. Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedure:

1. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth

through the tubing by means of a wire or an electrician's tape.

2. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
3. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
4. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

3.10 ADJUSTING AND CLEANING

A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Clean and inspect refrigerant piping systems in accordance with requirements of Division-15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".

C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.11 COMMISSIONING

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.

B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.

C. Review data in Operating and Maintenance Manuals. Refer to Division 1 section "Project Closeout."

D. Schedule training with Owner through the Architect, with at least 7 days advance notice.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 SUMMARY:

A. Section includes:

1. Residential air-cooled heat pump units.

B. Related Sections:

1. Section 15030 - Electrical Provisions for Mechanical Work
2. Section 15530 - Refrigerant Piping
2. Section 16142 - Electrical Connections for Equipment

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories and installation and start-up instructions.

B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation of heat pump units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

C. Operation and Maintenance Data: Submit maintenance data and parts list for each heat pump unit, control, and accessory; including "trouble shooting" maintenance guide; plus servicing, and preventative maintenance procedures and schedule. Include this data and product data in maintenance manual; in accordance with requirements of Division 1.

1.04 QUALITY ASSURANCE:

A. Manufacturers= Qualifications: Firms regularly engaged in manufacture of heat pump 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. Capacity ratings for heat pump units shall be in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".

2. Refrigeration system of heat pump units shall be constructed in accordance with ASHRAE Standard ASHRAE 15 "Safety Code for Mechanical Refrigeration".

3. Heat pump units shall meet or exceed the minimum COP/Efficiency levels as prescribed in ASHRAE 90A "Energy Conservation in New Building Design" and the 2001 Florida Energy Efficiency Code.

4. Heat pump units shall be listed by UL and have UL label affixed.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Handle heat pump units and components carefully to prevent damage. Follow manufacturer's written instructions for rigging. Replace damaged heat pump units or components.

B. Store heat pump units and components in clean dry place off the ground. Protect from weather, water, and physical damage.

1.06 SPECIAL PROJECT WARRANTY:

A. Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate or 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. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.

1. Warranty Period: 5 years from date of substantial completion.

PART 2 - PRODUCTS

2.01 RESIDENTIAL AIR-COOLED HEAT PUMP UNITS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering residential air-cooled heat pump units which may be incorporated in the work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide residential air-cooled heat pump units of one of the following:

1. Lennox Industries
2. Carrier Corporation

3. The Trane Co.

C. General: factory-assembled and tested air-cooled heat pump units, consisting of compressor, condenser coil, fan, motor, refrigerant reservoir, and operating controls. Capacity and electrical characteristics are scheduled on the Drawings.

D. Casing: galvanized steel finished with baked enamel, complete with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Unit shall be complete with brass service valves, fittings, and gage ports on exterior of casing.

E. Compressor: hermetically sealed with built-in overloads and vibration isolation. Compressor motor, shall have thermal and current sensitive overload devices, internal high-pressure protection, high and low pressure cutout switches, start capacitor and relay, 2-pole contactor, crankcase heater, and temperature actuated switch and timer to prevent compressor rapid cycle.

F. Condenser: coil shall have copper tubes and aluminum fins, or aluminum tubes and aluminum fins; complete with liquid accumulator and liquid subcooler. Aluminum propeller fan shall be direct driven, with permanently lubricated fan motor having thermal overload protection.

G. Accessories:

4. Low-voltage thermostat and subbase to control heat pump unit and evaporator fan.

5. Precharged and insulated suction and liquid tubing of length indicated.

6. Head pressure control to modulate condenser fan motor speed for low ambient conditions.

7. Heat reclaim device providing preheating of domestic hot water with hot gas from heat pump unit.

8. Low-voltage control transformer.

6. Factory installed high capacity drier.

7. Factory installed 4 way reversing valve.

8. Factory installed and piped expansion valve with sensing bulb located on suction line.

9. Factory installed solid state time/temperature defrost controller and thermstat.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify surrounding grade drainage, service accessibility and airflow clearance requirements are acceptable. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. General: Install heat pump 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:

1. Install ground-mounted units on 4" thick reinforced concrete pad, 4" larger on each side than heat pump unit. Concrete is specified in other Divisions. Coordinate installation of anchoring devices.
2. Residential Units: Connect pre-charged refrigerant tubing to unit's quick-connect fittings. Run tubing so as not to interfere with access to unit.

a. Install furnished accessories.

3. Air-Cooled Heat Pump Units: Connect refrigerant piping to unit; maintain required access to unit.

a. Low-voltage wiring. All low voltage wiring between air-handling unit, heat pump unit and sensors shall be in metal conduit. Provide flexible conduit at all equipment connections.

3.03 FIELD QUALITY CONTROL:

A. Testing:

1. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

3.04 DEMONSTRATION:

A. Provide services of manufacturer's authorized service representative to provide start-up service and to instruct Owner's personnel in operation and maintenance of heat pump units.

B. Start-up heat pump units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

C. Train Owner's personnel on start-up and shutdown procedures, troubleshooting procedures, servicing, and preventative maintenance schedule and procedures. Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals specified in Division One.

1. Schedule training with Owner, provide at least 7-day prior notice to Architect/Engineer.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

B. Division 15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of air handling unit work is indicated on drawings and schedules, and by requirements of this section.

B. Types of packaged air handling units specified in this section include the following:

1. Indoor draw-through.

C. Refer to other Division 15 sections for vibration control units used in conjunction with air handling units; not work of this section.

D. Vibration control units required for air handling units is specified in other Division 15 sections, and is included as work of this section.

E. Refer to other Division 15 sections for field applied insulation to air-handling units; not work of this section.

F. Refer to other Division 15 sections for refrigerant piping and condensate drain piping required in conjunction with packaged air handling units, not work of this section.

G. Refer to other Division 15 sections for balancing of the factory fabricated air-handling units; not work of this section.

H. Refer to Division 16 sections for the following work; not work of this section.

1. Power supply wiring from power source to power connection on unit. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory installed by manufacturer.
2. Interlock wiring between electrically operated equipment units; and between equipment and field installed control devices.

a. Interlock wiring specified as factory installed is work of this section.

I. Provide the following electrical work as work of this section, complying with

requirements of Division 16 sections.

1. Control wiring between field installed controls, indicating devices, and unit control panels.

    a. Control wiring specified as work of Division 15 for Automatic Temperature Controls is work of that section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged air handling units with characteristics, sizes and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. AMCA Compliance: Test and rate air handling units in accordance with AMCA standards 210 and 500.
2. ARI Compliance: Test and rate air handling units in accordance with Standard 210/240-89, display certification symbol on units of certified models.
3. ASHRAE Compliance: Construct and install refrigerant coils in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
4. NFPA Compliance: Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
5. UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA Standards.
6. NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.
7. Air handling unit shall meet or exceed the requirements of the 2001 Florida Energy Efficiency Code.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for air handling units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, gages and finished of materials, and installation instructions.

B. Shop Drawings: Submit assembly type shop drawings showing unit dimensions, weight loadings, required clearances, construction details, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air handling units. Submit manufacturer's ladder type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are

factory installed and portions to be field installed.

D. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals; in accordance with requirements of Division 1.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air handling units with factory installed shipping skids and lifting lugs; pack components in factory fabricated protective containers.

B. Handle air-handling units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to air handling unit manufacturer.

C. Store air handling units in clean dry place and protect from weather and construction traffic. Do not store air-handling units at exterior.

D. Comply with Manufacturer's rigging and installation instructions for unloading air handling units, and moving them to final location.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering air handling units which may be incorporated in the work include, but are not limited to the following:

1. Carrier Corporation
2. Lennox Industries
3. The Trane Co.

2.02 AIR HANDLING UNITS:

A. General: Provide factory fabricated and factory tested air handling units as indicated, of sizes and capacities as scheduled, and as specified herein.

B. Casings: Construct casing of 18 ga. minimum mill galvanized steel, designed to withstand specified operating pressures. Provide casing panels and/or access doors that are easily and quickly removable for inspection and access to internal parts.

1. Provide single zone units consisting of fan section, coil section, adjustable fan motor mounting, and drain pan.
2. Provide reinforced points of support for either setting or hanging units.
3. Provide drain pan, located under cooling coil section and humidifier section, extensive enough to catch condensate leaving coil at highest catalogued face velocity. Provide at least one drain connection at low point in drain pan.

4. Cover casing and frame with protective finish on both sides.

C. Coils: Provide cooling coils of scheduled capacity, mounted in unit in manner permitting removal.

1. Construct coils with copper tubing primary surface and aluminum secondary surface bonded to tubes by method approved by specified manufacturer. Provide chilled water coils with threaded connections. Provide chilled water coils with drain and vent connections. Provide direct expansion coils with solder connections, liquid refrigerant distributors, and connections for gravity oil drainage. Pitch coils in unit casing for drainage.
2. Provide electric heating coil with automatic reset thermal cutouts for primary over- temperature protection and with load carrying manual reset thermal cutouts, factory wired in series with each heater stage, for secondary protection. Include over-current cutouts and sub-circuiting fusing in assembly, and construct with the following additional construction features:

a. Open-Coil Electric Element: Construct coils with resistance wire of 80% nickel/20% chromium, insulated by floating ceramic bushings. Recess bushings into casing openings and secure on supporting brackets, spaced 4" o.c. maximum.

D. Coil Sections: Provide common or individual casing for heating and cooling coils as required. Design internal structure of coil section to allow for removal of coils, and provide suitable baffles to assure no air bypass around coils. Provide condensate pans and drain connections to cooling coil sections of sufficient size to contain and remove coil condensate. Insulate coil section casings and drain pans as specified in "Insulation" paragraph. Dual circuit coils shall be face split not intertwined.

E. Fan Sections: Provide forward curved fans specifically designed and suitable for class of service indicated. Provide adjustable motor base, adjusted with mounting bolts, to provide variation in center distance. Provide locking nuts, or similar devices, to secure base in proper position. Provide direct-driven variable speed fans. Fans shall be factory statically and dynamically balanced.

F. Filter Boxes: Provide filter boxes with wither hinged access doors or quickly removable panels, at each end. Provide racks to receive filters in either flat or angle type pattern.

G. Insulation: Insulate unit casing from air entrance to coils, to air outlet from unit, including bypass duct if used. Insulate framing angles exposed to air stream. Securely attach insulation, of sufficient thickness and density to prevent condensation from forming on unit casing. Protect insulation against deterioration from air currents.

1. Provide insulation with fire retarding characteristics, complying with NFPA 90A. Insulate drain pans as required to prevent condensate formation on unit exterior at ambient conditions to be encountered.

H. Air Filters: Provide air filters to fit in filter box, of the following type:

1. Disposable Type: Provide disposable type air filters 2" thick, consisting of viscous coated fibers with filtering media encased in fiberboard cell sides having perforated metal grids on each side to provide media support.

   a. Provide filters with clean resistance not exceeding 0.10" w.g. at face velocity of 300 fpm, and ASHRAE weight arrestance efficiency of 70-82% based on final operating resistance of 0.5" w.g.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which air-handling units are to be installed and verify required service clearances are met. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF AIR HANDLING UNITS:

A. General: Install air handling units where indicated, in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

B. Coordination: Coordinate with other work, including ductwork, floor construction, roof decking, and piping, as necessary to interface installation of air handling units with other work.

C. Access: Provide access space around air handling units for service as indicated, but in no case less than that recommended by manufacturer.

D. Mounting: Mount air-handling units on vibration isolators, in accordance with manufacturer's instructions.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

   1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.

F. Piping Connections: Refer to Division 15 HVAC sections. Provide piping, valves, accessories, gages, supports, and flexible connectors as indicated.

G. Duct Connections: Refer to Division 15 Air Distribution sections. Provide ductwork, accessories, and flexible connections as indicated.

H. Grounding: Provide positive equipment ground for air handling unit components.

3.03 FIELD QUALITY CONTROL:

A. Testing: Upon completion of installation of air handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

3.04 EXTRA STOCK:

A. Provide one complete set of filters for each air-handling unit. Install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed.

B. Provide one spare set of belts for each belt-driven air-handling unit, obtain receipt from Owner that belts have been received.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Requirements of the following Division 15 Sections apply to this section:

1. "Basic Mechanical Requirements."
2. "Basic Materials and Methods."

1.02 SUMMARY

A. This Section includes the following types of power ventilators:

1. Ceiling-mounted and inline ventilators.

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

1. Division 15 Section "Vibration Control" for vibration hangers and supports.
2. Division 15 Section "Testing, Adjusting, and Balancing" for air-handling systems testing, adjusting, and balancing requirements and procedures.

C. Products furnished but not installed under this Section include roof curbs for roof-mounted exhaust fans.

1.03 SUBMITTALS

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

1. Product data for selected models, including specialties, accessories, and the following:

a. Certified fan performance curves with system operating conditions indicated.
b. Certified fan sound power ratings.
c. Motor ratings and electrical characteristics plus motor and fan accessories.
d. Materials gages and finishes, including color charts.
e. Dampers, including housings, linkages, and operators.

2. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

3. Coordination drawings, in accordance with Division 15 Section "Basic Mechanical Requirements," for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

   a. Roof framing and support members relative to duct penetrations.
   b. Ceiling suspension members.
   c. Method of attaching hangers to building structure.
   d. Size and location of initial access modules for acoustical tile.
   e. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

4. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
5. Product certificates, signed by manufacturers of air-handling units, certifying that their products comply with specified requirements.
6. Maintenance data for exhaust fans, for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 15 Section "Basic Mechanical Requirements."

1.04 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

B. UL Compliance: Fans and components shall be UL listed and labeled.

C. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Lift and support units with the manufacturer's designated lifting or supporting points.

B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

C. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate the installation of roof curbs, equipment supports, and roof penetrations

specified in Division 7.

B. Coordinate the size and location of structural steel support members.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to, the following:

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

1. Ceiling-Mounted and Inline Ventilators:

a. Cook (Loren) Co.
b. Greenheck Fan Corp.
c. Penn Ventilator Co.
d. Acme Co.

2.02 SOURCE QUALITY CONTROL

A. Testing Requirements: The following factory tests are required:

1. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

2.03 FANS, GENERAL

A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.

B. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

1. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.

C. Shaft Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA L (50)) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

D. Factory Finish: The following finishes are required:

1. Sheet Metal Parts: Prime coating prior to final assembly.
2. Exterior Surfaces: Baked-enamel finish coat after assembly.

2.04 CEILING-MOUNTED AND INLINE VENTILATORS

A. General Description: Centrifugal fan designed for installation in ceiling, wall, or concealed inline applications.

B. Housing: Galvanized steel lined with acoustical insulation. Furnish with back draft damper.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Stainless steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories: Manufacturer's standard wall cap, and transition fittings as indicated.

2.05 MOTORS

A. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.

B. Motor Sizes: Minimum sizes and electrical characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.

C. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).

D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

E. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design B. Provide permanent-split capacitor classification motors for shaft-mounted fans and capacitor start classification for belted fans.

1. Bases: Adjustable.
2. Bearings: The following features are required:

   a. Ball or roller bearings with inner and outer shaft seals.
   b. Grease lubricated.
   c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
3. Enclosure Type: The following features are required:

   a. Open drip-proof motors where satisfactorily housed or remotely

located during operation.

b. Guarded drip-proof motors where exposed to contact by employees or building occupants.

4. Overload protection: Built-in, automatic reset, thermal overload protection.
5. Noise rating: Quiet.
6. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112, Test Method B.
7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.

F. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 16.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, roof curbs, equipment supports, and other conditions affecting performance of fans.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as described below, using the vibration control devices indicated. Vibration control devices are specified in Division 15 Section "Vibration Controls."

1. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.

a. Installation of roof curbs is specified in Division 7.

2. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

3.03 CONNECTIONS

A. Duct installations and connections are specified in other Division 15 sections. Make final duct connections with flexible connections.

B. Electrical Connections: The following requirements apply:

1. Electrical power wiring is specified in Division 16.

2. Temperature control wiring and interlock wiring are specified in Division 15 Section "Electrical Control Systems."
3. Temperature control wiring and interlock wiring are specified in Division 15 Section "Pneumatic Control Systems."
4. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Inspection: Arrange and pay for a factory-authorized service representative to perform the following:

1. Inspect the field assembly of components and installation of fans including ductwork and electrical connections.
2. Prepare a written report on findings and recommended corrective actions.

3.05 ADJUSTING, CLEANING, AND PROTECTING

A. Adjust damper linkages for proper damper operation.

B. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.06 COMMISSIONING

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:

1. Remove shipping blocking and bracing.
2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
5. Lubricate bearings, pulleys, and other moving parts with factory-recommended lubricants.
6. Disable automatic temperature control operators.

B. Starting procedures for fans:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
2. Measure and record motor electrical values for voltage and amperage.

C. Shut unit down and reconnect automatic temperature control operators.

D. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

3.07 DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:

1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 1 Section "Project Closeout" and Division 15 Section "Basic Mechanical Requirements."

B. Schedule training with at least 7 days' advance notice.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

B. Exterior insulation of metal ductwork is specified in other Division-15 sections, and is included as work of this section.

C. Refer to other Division-15 sections for exterior insulation of metal ductwork; not work of this section.

D. Refer to other Division-15 sections for ductwork accessories; not work of this section.

E. Refer to other Division-15 sections for fans and air handling units; not work of this section.

F. Refer to other Division-15 sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Codes and Standards:

1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment

Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.

3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".

D. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.

B. Shop Drawings: Submit 1/4" scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how these modifications ensure that free area, materials, and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 1.

D. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS:

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials that are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.

2.02 MISCELLANEOUS DUCTWORK MATERIALS:

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15-degree change of direction per section. Unless specifically detailed otherwise, use 45-degree laterals and 45-degree elbows for branch takeoff connections. Where 90-degree branches are indicated, provide conical type tees.

C. Duct Liner: Fibrous glass, complying with Thermal Insulation Manufacturers Association (TIMA) AHC-101; of thickness indicated.

D. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation".

E. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.

F. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. As manufactured by RCD Corporation.

G. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork. As manufactured by RCD Corporation.

H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

I. Flexible Ducts: Either spiral-wound spring steel with flameproof vinyl sheathing, or corrugated aluminum; complying with UL 181.

1. Where installed in unconditioned spaces other than return air plenums, provide 1" thick continuous flexible fiberglass sheath with vinyl vapor barrier jacket.

2.03 FABRICATION:

A. Shop fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gages and reinforcement complying with SMACNA

"HVAC Duct Construction Standards".

C. Shop fabricate ductwork of gages and reinforcement complying with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction".

D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-15 section "Ductwork Accessories" for accessory requirements.

F. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

2.04 FACTORY-FABRICATED LOW PRESSURE DUCTWORK:

A. General: At installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

B. Material: Galvanized sheet steel complying with ASTM A 527, lock-forming quality, with ASTM A 525, G90 zinc coating, mill phosphatized.

C. Gage: 28-gage minimum for round and oval ducts and fittings, 4" through 24" diameter.

D. Elbows: One-piece construction for 90 degrees and 45 degree elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

E. Divided Flow Fittings: 90-degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory-fabricated ductwork that may be incorporated in the work include, but are not limited to, the following:

G. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

1. Semco Mfg., Inc.
2. United Sheet Metal Div., United McGill Corp.

2.05 FACTORY-FABRICATED HIGH PRESSURE DUCTWORK:

A. General: At Installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

B. Round Ductwork: Construct of galvanized sheet steel complying with ASTM A 527 by the following methods and in minimum gages listed.

Diameter	Minimum Gage	Method of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam
27" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	16	Longitudinal Seam

1. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.
2. Fittings and Couplings: Construct of minimum gages listed. Provide continuous welds along seams.

Diameter	Minimum Gage
3" to 36"	20
38" to 50"	18
Over 60"	16

C. Flat-Oval Ductwork: Construct of galvanized sheet steel complying with ASTM A 527, of spirl lockseam construction, in minimum gages listed.

Maximum Width	Minimum Gage
Under 25"	24
25" to 48"	22
49" to 70"	20
Over 70"	18

1. Fittings and Coupling: Construct of minimum gages listed. Provide continuous weld along seams.

Maximum Width	Minimum Gage
Under 37"	20
37" to 50"	18
Over 50"	16

D. Double Wall Ductwork: Construct with outer pressure shell, 1" thick insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gages listed.

Nomimal Duct Diameter	Outer Shell	Inner liner
3" to 12"	26 ga.	24 ga.
13" to 24"	24 ga.	24 ga.
25" to 34"	22 ga.	24 ga.
35" to 48"	20 ga.	24 ga.
49" to 58"	18 ga.	24 ga.
Over 59"	16 ga.	20 ga.

1. Fittings and Couplings: Construct of minimum gages listed. Provide continuous weld along seams of outer shell.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20 ga.	20 ga.
36" to 48"	18 ga.	20 ga.
Over 48"	16 ga.	20 ga.

2. Inner Liner: Perforate with 3/32" holes for 22% open area or solid metal. Provide metal spacers welded in position to maintain spacing and concentricity.

E. Optional Ducts and Fittings: At Installer's option, provided that certified tests by Manufacturer show that rigidity and performance is equivalent to SMACNA and/or ASHRAE standard gage ductwork, provide ducts and fittings as follows:

1. Ducts: Construct of Manufacturer's standard gage, with spiral lock seam and intermediate standing rib.
2. Fittings: Construct by fabricating with spot welding and bonding with neoprene-base cement in lieu of continuous weld seams.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory-fabricated ductwork which may be incorporated in the work include, but are not limited to, the following:

G. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

1. Semco Mfg., Inc.
2. United Sheet Metal Div., United McGill Corp.

PART 3 - EXECUTION

3.01 INSPECTION:

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF METAL DUCTWORK:

A. General: 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. Align ductwork accurately at connections, within 1/8" 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.

B. Inserts: Install concrete inserts for support of ductwork in coordination with

formwork, as required to avoid delays in work.

C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

E. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.

F. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.

1. Where ducts pass through fire-rated floors, walls, or partitions, provide fire-stopping between duct and substrate, in accordance with requirements of Division-7 Section "Fire-stopping".

G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

3.03 INSTALLATION OF DUCT LINERS:

A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.

3.04 INSTALLATION OF FLEXIBLE DUCTS:

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 10'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

3.05 FIELD QUALITY CONTROL:

A. Leakage Tests: After each duct system, which is constructed for duct classes over 3", is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Repair leaks and repeat tests until total leakage is less than 1% of system design airflow.

3.06 EQUIPMENT CONNECTIONS:

A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.07 ADJUSTING AND CLEANING:

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances, which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

D. Balancing: Refer to Division-15 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including Division 1 Specification section apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.

B. Types of ductwork accessories required for project include the following:

1. Dampers:

a. Low pressure manual dampers.
b. Control dampers.

2. Fire dampers.
3. Turning vanes.
4. Duct hardware.
5. Duct access doors.
6. Flexible connections.

C. Refer to other Division 15 sections for testing, adjusting and balancing of ductwork accessories; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:

1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction
Standards, Metal and Flexible".
2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".
4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems" pertaining to installation of ductwork accessories.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction and installation instructions.

B. Shop Drawings: Submit manufacturers assembly type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.

C. Maintenance Data: Submit manufacturer's maintenance data including parts list for each type of duct accessory. Include this data, product data, and shop drawing in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS:

2.01 DAMPERS:

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

2.02 FIRE DAMPERS:

A. Fabricated Fire Dampers: Provide dampers constructed in accordance with SMACNA "Fire Dampers and Heat Stop Guide".

B. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casing of 11 ga. galvanized steel with bonded red acrylic enamel finish. Provide fusible link rated at 160 to 165 degrees F. (71 to 74 degrees C) unless otherwise indicated. Provide damper with positive lock in closed position, and with the following additional features.

1. Damper Blade Assembly: Single blade type.
2. Damper Blade Assembly: Multi-blade type.
3. Damper Blade Assembly: Curtain type.
4. Blade Material: Steel, match casing.
5. Blade Material: Stainless steel.

C. Fire/Smoke Dampers: Provide fire dampers, of types and sizes indicated. Construct casing of 11 ga. galvanized steel with bonded red acrylic enamel finish. Provide fusible link rated at 160 to 165 degrees F. (71 to 74 degrees C) unless otherwise indicated. Provide additional flangible link containing explosive charge, connected in series with fusible link. Provide stainless steel spring loaded leakage seals in sides of casing, and 36" long wire leads for connecting smoke link to smoke detector, and the following additional features:

1. Damper Blade Assembly: Single blade type.
2. Damper Blade Assembly: Multi-blade type.
3. Damper Blade Assembly: Curtain type.
4. Blade Material: Steel, match casing.

5. Blade Material: Stainless steel.
6. Factory installed electric damper actuator (normally closed).

2.03 TURNING VANES:

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

B. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" wide curved blades set at 3/4" o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in ductwork.

C. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering turning vanes which may be incorporated in the work include, but are not limited to the following:

1. Aero Dyne Co.
2. Airsan Corp.
3. Anempstat Products Div.; Dynamics Corp. of American
4. Barber -Coleman Co.
5. Duro Dyne Corp.
6. Environmental Elements Corp.; Subs. Koppers Co., Inc.
7. Hart & Cooley Mfg. Co.
8. Register & Grille Mfg. Co., Inc.
9. Souther, Inc.

2.04 DUCT HARDWARE:

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct hardware which may be incorporated in the work include, but are not limited to, the following:

1. Ventfabrics, Inc.
2. Young Regulator Co.

2.05 DUCT ACCESS DOORS:

A. General: Provide where indicated, duct access doors of size indicated.

B. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one size hinged, other side with one handle type latch for doors 12" high and smaller, 2 handle type latches for larger doors.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct access doors which may be incorporated in the work include, but are not limited to the following:

1. Air Balance, Inc.
2. Duro Dyne Corp.
3. Register & Grille Mfg. Co., Inc.
4. Ruskin Mfg. Co.
5. Ventfabrics, Inc.
6. Zurn Industries, Inc.; Air Systems Div.

2.06 FLEXIBLE CONNECTIONS:

A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene coated flameproof fabric crimped into duct flanges for attachment to duct equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse and torsional movement, and also capable of absorbing vibrations of connected equipment.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering flexible connections which may be incorporated in the work include, but are not limited to, the following:

1. American/Elgen Co.; Energy Div.
2. Duro Dyne Corp.
3. Flexaust (The) Co.
4. Ventfabrics, Inc.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION OF DUCTWORK ACCESSORIES:

A. Install ductwork accessories in accordance with manufacturer's installation instruction, with applicable portions of details of construction as shown in SMACNA Standards, and in accordance with recognized industry practices to ensure that products serve intended functions.

B. Install turning vanes in square or rectangular 90 degree elbows in supply and exhaust air systems and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.03 FIELD QUALITY CONTROL:

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.04 ADJUSTING AND CLEANING:

A. Adjusting ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

1. Label access doors in accordance with Division 15 section "Mechanical Identification".
2. Final positioning of manual dampers is specified in Division 15 section 'Testing, Adjusting and Balancing".

B. Cleaning: Clean factory finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch up paint.

3.05 EXTRA STOCK:

A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of air outlets and inlets required for project include the following:

1. Ceiling air diffusers.
2. Wall Registers and grilles.

C. Refer to other Division 15 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.

D. Refer to other Division 15 sections for balancing of air outlets and inlets; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.04 CODES AND STANDARDS:

A. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".

B. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".

C. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".

D. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.

E. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating System".

1.05 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size and accessories furnished.
2. Data sheet for each type of air outlet and inlet and accessory furnished; indicating construction, finish, and mounting details.
3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

B. Samples: Submit 3 samples of each type of finish furnished.

C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air outlets and inlets wrapped in factory fabricated fiberboard type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 CEILING AIR DIFFUSERS:

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffuser where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have as minimum, temperature and velocity traverses, throw and drop, and noise criteria rating for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each

type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Diffuser Faces:

a. Panel (PL): Square or rectangular aluminum housing extended to form panel to fit in ceiling system module, core of square or rectangular concentric louvers, round duct connection.
b. Linear (R): Extruded aluminum continuous slot, single or multiple.

2. Diffuser Mountings:

a. Flush (FL): Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
b. Lay-In (L-I): Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.

3. Diffuser Patterns:

a. Fixed (FX): Fixed position core with concentric rings or louvers for radial airflow around entire perimeter of diffuser.

4. Adjustable (ADJ): Manual adjustable core with concentric rings or louvers, fully adjustable for horizontal to vertical air flow.

E. Diffuser Dampers:

1. Opposed Blade (OBD): Adjustable opposed blade damper assembly, key operated from face of diffuser.

F. Diffuser Accessories:

1. Operating Keys (OP-KY): Tools designed to fit through diffuser face and operate volume control device and/or pattern adjustment.

G. Diffuser Finishes:

1. Aluminum Enamel (A-E): Air-dried aluminum enamel prime finish.

H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, but are not limited to the following:

1. Titus Products Div.; Philips Industries, Inc.
2. Price Companies
3. Metal Air Industries, Inc.

2.02 WALL OR CEILING REGISTERS AND GRILLES:

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall or ceiling systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

E. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Register and Grille Materials:

   a. Aluminum Construction (AL): Manufacturer's standard extruded aluminum frame and adjustable blades.

2. Register and Grille Faces:

   a. ½" x ½" x ½" aluminum egg crate pattern core.
   b. Horizontal Straight Blades (H-S): Horizontal blades, individually adjustable, at manufacturer's standard spacing.

3. Register and Grille Dampers:

   a. Opposed Blade (O-B): Adjustable opposed blade damper assembly, key operated from face of register.

4. Register and Grille Accessories:

   a. Operating Keys (OP-KY): Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.
   b. Filters: 1" frame for mounting 30% efficiency filter media. Provide hinged face grille for filter access.

5. Register and Grille Finishes:

a. Aluminum Enamel (A-E): Air-dried aluminum enamel prime finish.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, but are not limited to the following:

1. Titus Products Div.; Philips Industries, Inc.
2. Price Companies
3. Metal Air Industries, Inc.

2.03 LOUVERS

A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide louvers that have minimum free area, and maximum pressure drop for each type as listed in manufacturer's current data, complying with louver schedule.

C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

D. Materials: Construct of aluminum extrusions, ASTM B 221, Allou 6063-T52. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering louvers which may be incorporated in the work include, but are not limited to the following:

1. Arrow United Industries
2. Airolite Co.
3. Dowco Corp.
4. Industrial Louvers, Inc.
5. Louvers & Dampers, Inc.
6. Penn Ventilator Co., Inc.
7. Ruskin Mfg. Co.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be

installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans" or as shown on HVAC drawings. Unless otherwise indicated, locate unite in center of acoustical ceiling modules.

3.03 SPARE PARTS:

A. Furnish to owner, with receipt, operating keys for each type of air outlet and inlet that require them.

END OF SECTION

PART 1 - GENERAL

1.01 Scope: Provide a complete D.D.C. System with all monitoring capabilities as outlined in the point schedule. System shall be accessible through the internet or dedicated telephone line.

1.02 Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.

1.03 Submittals: Submit manufacturer's technical product data for each control device furnished, including installation and start-up instructions. Submit wiring diagrams, maintenance data, and spare parts lists.

1.04 Acceptable Manufacturers: Delta Controls; Honeywell; Johnson Controls; Carrier; Trane; or approved equal.

PART 2 - MATERIALS AND PRODUCTS

2.01 General: Provide electric control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, clocks, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer. Provide electric control systems with functional construction features as indicated.

2.02 Dampers: Provide automatic control dampers as indicated, with damper frames not less than formed 13-ga galvanized steel. Provide mounting holes for enclosed duct mounting. Provide damper blades not less than formed 16-ga galvanized steel, with maximum blade width of 8". Equip dampers with motors, with proper rating for each application.

A. Secure blades to 1/2" diameter zinc-plated axles using zinc-plated hardware. Seal off against spring stainless steel blade bearings. Provide blade bearings of nylon and provide thrust bearings at each end of every blade. Construct blade linkage hardware of zinc-plated steel and brass. Submit leakage and flow characteristics, plus size schedule for controlled dampers.

B. Operating Temperature Range: From -20 deg. to 200 deg. F (-29 to 93 deg C).

C. Provide parallel or opposed blade design (as selected by manufacturer's sizing techniques) with optional close-cell neoprene edging.

2.03 Damper Motors: Size each motor to operate dampers with sufficient reserve power to provide smooth modulating action or 2-position action as specified.

A. Provide permanent split-capacitor or shaded pole type motors with gear trains completely oil-immersed and sealed. Equip spring-return motors, where indicated on drawings or in operational sequence, with integral spiral-spring mechanism.

Furnish entire spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

B. Equipment motors for outdoor locations and for outside air intakes with "O ring" gaskets designed to make motors completely weatherproof, and equip with internal heaters to permit normal operational -40 deg. F (-40 deg. C).

C. Furnish non-spring return motors for dampers larger than 25 sq. ft., and for valves larger than 2-1/2", sized for running torque rating of 150 in.-lbs., and breakaway torque rating of 300 in.-lbs. Size spring-return motors for running torque rating of 150 in-lbs., and breakaway torque rating of 150 in.-lbs.

2.04 Sensors: Provide wall mounted electronic sensors, automatic changeover, LCD display.

2.05 Relays: Solid state, low voltage type, inline or in control cabinet. Provide single pole, double throw or single pole, single throw as required per sequence of operation.

2.06 Clocks: Provide electronic time clocks specified as part of temperature control sequences, of 7-day, 24-hour type, with weekend of skip-a-day features.

PART 3 - EXECUTION

3.01 Installation: Install system and materials in accordance with manufacturer's instructions roughing-in drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable Division-16 sections of these specifications. Mount controllers at convenient locations and heights.

3.02 Wiring System: Install complete control wiring system for electric control systems. Conceal wiring, except in mechanical rooms and areas where other conduit and piping are exposed. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

3.03 Number-code or color code conductors, excluding those used for local individual room controls, appropriately for future identification and servicing of control system.

3.04 Reset Limit Controls: Install manual reset limit controls to be independent of power controllers; automatic duct heater resets may, at Installer's option, be installed in interlock circuit of power controllers.

3.05 Final Adjustment: After completion of installation, adjust thermostats, control valves, motor and similar equipment provided as work of this section.

A. Final adjustment shall be performed by specifically trained personnel in direct employ of manufacturer of primary temperature control system.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

B. Related Sections:

1. General requirements for testing agencies are specified in the Division-1 Section Quality Control Services.
2. Other Division-15 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.
3. Individual Division-15 system sections specify leak testing requirements and procedures.

1.02 SUMMARY:

A. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems:

1. Supply air systems;
2. Return air systems;
3. Exhaust air systems;
4. Verify temperature control system operation.

C. Test systems for proper sound and vibration levels.

D. This Section does not include:

1. Specifications for materials for patching mechanical systems;
2. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

1.03 DEFINITIONS:

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air distribution;
2. Adjustment of total system to provide design quantities;
3. Electrical measurement;
4. Verification of performance of all equipment and automatic controls;
5. Sound and vibration measurement.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system submains, branches, and terminals according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct serving two or more terminals.

K. Branch: Duct serving a single terminal.

1.04 SUBMITTALS:

A. Agency Data:

1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data:

1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and Section 15010.

E. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC are proposed.

F. Sample Forms: Submit sample forms, if other than those standard forms prepared by the NEBB are proposed.

G. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

    a. General Information and Summary
    b. Air Systems
    c. Temperature Control Systems
    d. Special Systems
    e. Sound and Vibration Systems

4. Report Contents: Provide the following minimum information, forms and data:

    a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the

procedures along with the proof of calibration.

b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

H. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.05 QUALITY ASSURANCE:

A. Test and Balance Engineer's Qualifications: A Professional Engineer (either on the installer's staff or and independent consultant), registered in the State in which the services are to be performed, and having at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

B. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. The independent testing, adjusting, and balancing agency certified by National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by NEBB as a Test and Balance Engineer.

C. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. An independent testing, adjusting, and balancing agency certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC as a Test and Balance Engineer.

D. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
2. AABC: "National Standards For Total System Balance".
3. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

E. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.06 PROJECT CONDITIONS:

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.07 SEQUENCING AND SCHEDULING:

A. Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.

B. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

3.01 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required

fan volumes.

8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
11. Lubricate all motors and bearings.
12. Check fan belt tension.
13. Check fan rotation.

3.02 MEASUREMENTS:

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.03 PERFORMING TESTING, ADJUSTING, AND BALANCING:

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.04 TESTING FOR SOUND AND VIBRATION:

A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

3.05 RECORD AND REPORT DATA:

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.06 DEMONSTRATION:

A. Training:

1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures. Review with the Owner's personnel, the information contained in the Operating and Maintenance Data specified in Division 1 and Section 15010.
2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.

END OF SECTION

Division 16
Electrical

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

A. This section includes Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.

B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.

C. The Division 16 Contract Documents refer to work required in addition to (or above) the minimum requirements of the N.E.C. and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.

D. Only trained, and licensed personnel shall be used by the Contractor to perform work. The Contractor shall not perform work, which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.

E. Refer to other Division 16 Sections for additional work requirements.

F. Coordinate and verify power and telephone company service requirements prior to bid. Bid to include all work required.

G. Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment.

1.4 WORK SEQUENCE

A. Install work in stages and/or phases to accommodate Owner's occupancy requirements. Coordinate electrical schedule and operations with Owner and Architect/Engineer.

1.5 CODES, FEES, AND STANDARDS

A. Conform to all applicable requirements of the Division 1 Section "References.".

B. Obtain permits and request inspections from authority having jurisdiction and applicable utility companies.

C. Pay for all required licenses, fees, and inspections.

D. Contact the Utility Companies to determine if fees, charges or costs are required by the Utility Company for permanent power and for temporary power, installations and hook-ups. These fees, charges or costs shall be included in Contractor's bid.

E. Material shall be new and free of defects with U.L. listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if U.L. Listing is not available for material.

1.6 PROJECT/SITE CONDITIONS

A. Install Work in locations shown or described in the Contract Documents, unless prevented by Project conditions.

B. The Contractor shall install all equipment so that all Code required and Manufacturer recommended servicing clearances are maintained. Contractor shall be responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, he shall submit to the A/E, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required drawings, clarifications, and/or change orders.

C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

1.7 INVESTIGATION OF SITE

A. Check site and existing conditions thoroughly before bidding. Advise A/E of discrepancies or questions noted.

B. Each Bidder shall visit the site and shall thoroughly familiarize himself with existing field conditions and the proposed work as described or implied by the Contract Documents. During the course of his site visit, the electrical bidder shall verify every aspect of the proposed work and the existing field conditions in the areas of construction and demolition which will affect his work. The Contractor will receive no compensation or reimbursement for additional expenses he incurs due to failure to make a thorough investigation of the existing facilities. This shall include rerouting around existing obstructions.

C. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.

1.8 CONTRACT DOCUMENTS

A. These specifications and applicable drawings shall be considered, complimentary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.

B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc which is the most expensive and costly to implement.

C. The drawings are diagrammatic and are not intended to include every detail of construction, materials, methods, and equipment. They indicate the result to be achieved by an assemblage

of various systems. Coordinate equipment locations with Architectural and Structural drawings. Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.

D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.

E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.

F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.

G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.

H. Where the requirements of another Division, section, or part of these specifications exceed the requirements of this Division those requirements shall govern.

1.9 MATERIALS AND EQUIPMENT

A. Material shall be new (except where specifically noted, shown or specified as "Reused") and/or denoted as existing) and shall be U.L. listed and bear U.L. label. Where no U.L. label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

B. Where Contract Documents list design selection or manufacturer, type, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with Division 1 Section "Product Requirements" and requirements in this Division of the Specifications for substitutions.

C. When a product is specified to be in accordance with a trade association or government standard and at the request of A/E the Contractor shall furnish a certificate that the product complies with the referenced standard and supporting test data to substantiate compliance.

D. Where multiple items of the same equipment or materials are required, they shall be the product of a single Manufacturer.

E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 16 methods and materials unless specifically noted otherwise.

F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.

G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.

H. Electrical equipment shall be protected from the weather, during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner.

I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor.

J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.

1.10 MISCELLANEOUS CIRCUITS REQUIRED

A. Provide 120 volt, 20 amp circuit to intercom system panel (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with intercom system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

B. Provide 120 volt, 20 amp circuit to all fire alarm panels, remote panels, etc (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire alarm system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building ahs emergency generator system.

C. Provide 120 volt, 20 amp circuit to fire and smoke dampers (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

D. Provide 120 volt, 20 amp circuit to building control panels for HVAC system (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical

1.11 CARBON MONOXIDE ALARMS

A. In accordance with Rule 9B-3.0472, whether shown on drawings or not, provide a carbon monoxide alarm within 10 feet of each room used for sleeping purposes where the building has a fossil-fuel-burning heater or appliance, a fireplace, or an attached garage. Carbon monoxide alarms shall be hard wired to the building electrical system and receive primary power from the building 120 volt electrical system. Carbon monoxide alarms shall have battery backup. Carbon monoxide alarms shall be interconnected so that when one device detects CO all devices within the building sound alarm. Alarms shall be listed in accordance with UL 2034-96, Standard for Single and Multiple Station CO Alarms. Provide strobe lights in all spaces intended for the

hearing impaired or where required by Federal and/or State regulations.

1.12 SUPERVISION OF THE WORK

A. Reference the General Conditions for additional requirements.

B. The Contractor shall provide experienced, qualified, and responsible supervision for work. A competent foreman shall be in charge of the work in progress at all times. If, in the judgment of the A/E, the foreman is not performing his duties satisfactorily, the Contractor shall immediately replace him upon receipt of a letter of request from the A/E. Once a satisfactory foreman has been assigned to the work, he shall not be withdrawn by the Contractor without the written consent of the A/E.

C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have an active Journeyman's Electrical License.

D. Superintendent shall be employed by a State Registered (Type E.R. License) or State Certified (Type E.C. License) electrical contractor.

1.13 COORDINATION

A. Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:

1. Door Hardware
2. Roll-up doors
3. Mechanical Division of the Specifications
4. Interior design drawings
5. Landscape Architect drawings
6. Kitchen Equipment
7. Millwork design drawings and shop drawings

B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Division 16 Contract Documents or not.

C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment.

D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas determined by the A/E.

E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.

F. Damage from interference caused by inadequate coordination shall be corrected at no additional

cost to the Owner.

G. The Contractor shall maintain an up-to-date set of Contract Documents and Specifications of all trades on project, including Architectural, Structural, Mechanical, Electrical and, where provided Interior Design.

H. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. The Contractor shall adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes shall be made at no additional cost to the Owner.

1.14 PROVISION FOR OPENINGS

A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.

B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void warranty.

C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor.

1.15 SURFACE MOUNTED EQUIPMENT

A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have finish or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of these specifications.

1.16 CUTTING AND PATCHING

A. New Construction:

1. Reference Division 1 - General Requirements.

2. Cutting of work in place shall be cut, drilled, patched and refinished by trade responsible for initial installation.

3. The Contractor shall be responsible for backfilling and matching new grades with adjacent undisturbed surface.

1.17 TRENCHING

A. Trench excavation in excess of 5 feet deep shall comply with OSHA Standard 29 CFRs. 1926. 650 Subpart P.

1.18 INSTALLATION

A. Erect equipment to minimize interferences and delays in execution of the work.

B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.

C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor

shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.

D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E.

E. Plywood material shall not be used as a backboard for mounting panel boards, disconnects, motor starters, and dry type transformers. Provide "cast in place" type inserts or install expansion type anchor bolts. Electrical equipment shall not be mounted directly to dry wall for support without additional channels as anchors. Channels shall be anchored to the floor and structure above. Panelboards and terminal cabinets shall be provided with structural framing located within drywall partitions.

F. The Contractor shall keep the construction site clean of waste materials and rubbish. Upon completion of the work, the Contractor shall remove from the site debris, waste, unused materials, and equipment.

G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished and layout made for setting or embedment thereof so as to cause no delay.

1.19 PROGRESS AND RECORD DRAWINGS

A. Keep two sets of blueline prints on the job, and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.

B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda, from bid set of Contract Documents. Request for information, etc. marked up set of prints are to show:

1. All raceways 1-1/2" and above, exactly as installed.
2. All site raceways exactly as installed.
3. Any combining of circuits (which is only allowed by specific permission) or change in homerun outlet box shall be made on as-builts.
4. Any circuit number changes on plan shall be indicated on as-builts.
5. Any panelboard schedule changes shall be indicated on as-builts.

C. Marked up prints as noted above are to be submitted to A/E for acceptance.

1.20 "OBSERVATION OF WORK" REPORT

A. Reference the General Conditions.

B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in a "Observation of Work" report which will be sent to the Contractor for action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item. The report shall indicate each item noted, and method of correction. Enter the date on which the item was corrected, and return the signed reports so items can be rechecked. Failure to correct the deficiencies in a prompt concise manner or failure to return the signed reports shall be cause for disallowing request for payments.

C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

1.21 SYSTEMS WARRANTY

A. Reference the General Conditions.

B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion. Warranty shall not include light bulbs in service after one month from date of substantial completion.. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.

C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.

D. Where extended Guarantees are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.

E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work which shall not alter the Contractor's warranty.

1.22 WASTE MATERIALS DISPOSAL

A. Contractor shall include in his bid the transport and disposal or recycling of all waste materials generated by this project in accordance with all rules, regulations and guidelines applicable. Contractor shall comply fully with Florida statute 403.7186 regarding mercury containing devices and lamps. Lamps, ballasts and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal. Contractor shall provide owner with written certification of accepted disposal.

1.23 SUBSTANTIAL COMPLETION

A. The Contractor shall be fully responsible for contacting all applicable parties to schedule required observations of the work by Engineer. A minimum of 72 hours notice shall be given for all required observations of the work by Engineer, and minimum of 120 hours for substantial completion observation. Time and date shall be agreed on by all applicable parties.

B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

1.24 PROHIBITION OF ASBESTOS AND PCB

A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.

B. Prior to the Final Review field visit the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 16 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed by a duly authorized agent of the manufacturer.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION 16010

PART 1- GENERAL

1.1 SECTION INCLUDES

A. Requirements for submittals specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

B. See Division 1 Section "Product Requirements" for additional requirements when submittal consists of accepted substitution equipment.

1.2 SUBMITTALS

A. Submittals shall consist of a minimum of hard cover view type 3-ring binder(s) White, sized to hold 8-1/2" x 11" sheets; for "ELECTRICAL SUBMITTALS" (Power and Lighting for "SYSTEMS SUBMITTALS" (Sections 16700 through 16799).

1. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).

2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for Submittals included at end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting, (and if required) "SYSTEMS SUBMITTALS" for Sections 16700 - 16799 submittals.

B. Submittals Binders to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.

2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.

3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.

4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).

5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:

a) Fabrication and erection dimensions.

b) Arrangements and sectional views.

c) Necessary details, including complete information for making connections with other work.

d) Kinds of materials and finishes.

e) Descriptive names of equipment.

f) Modifications and options to standard equipment required by the work.

g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).

h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.

i) Conduit/raceway rough-in drawings.

j) Items requiring shop drawings include (but not limited to):

1. Lightning protection system
2. Each section of 16700 broad section (i.e., fire alarm, television, etc.).
3. Emergency generator systems
4. Special and/or modified equipment

k) See specific sections of Specifications for further requirements.

6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.

a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.

b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.

c) See specific sections of Specifications for further requirements.

1.3 PROCESSING SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the most strict.

B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 1, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:

1. Project Addresses
2. Index
3. Separation Sheets
4. Basic Materials
5. Panelboards
6. Light Fixtures

7. Long Lead Items

8. Systems Product Data

C. Remainder of submittals are to be submitted no later then 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.

D. The Contractor shall review the submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.

1.4 DELAYS

A. Contractor is responsible for delays in job project accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

1.5 RE-SUBMITTALS

A. The A/E shall be reimbursed cost to review resubmittals subsequent to the second submittal. Cost will be billed to Contractor at Engineer's standard hourly rate.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 16012

PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

Matern Professional Engineering, P.A.
130 Candace Drive
Maitland, Florida 32751
Telephone No.: (407) 740-5020
Fax No.: (407) 740-0365

GENERAL CONTRACTOR:

SUBCONTRACTOR:

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Reference Standards and Regulatory Requirements specifically applicable to Division 16 sections.

B. The requirements stated herein are in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

1.3 REFERENCES

A. The following references may or may not be referenced within these specifications:

AASHTO	American Association of State Highway and Transportation Officials
ACA	American Correctional Association
ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects (The)
ANSI	American National Standards Institute
ASC	Ambulatory Surgical Centers. Chapter 59A-5, FAC
ASCE	American Society of Civil Engineers
ASHRAE Engineers	American Society of Heating, Refrigerating and Air Conditioning
ASME	ASME International (American Society of Mechanical Engineers International)
ASTM	American Society for Testing and Materials
BOR	Board of Regents
BICSI	BICSI, Inc.
BOCC	Board of County Commissioners of Orange County
CRSI	Concrete Reinforcing Steel Institute
DSC	Daytona State College Design Standards

D&B	Florida School for the Deaf and Blind
DCA-ADAIA	Department of Community Affairs - Florida Americans with Disabilities Accessibility Implementation Act
DCA-ADAAG	Department of Community Affairs - Florida Americans with Disabilities Act Accessibility Guidelines
DCA-ARM	Department of Community Affairs - Accessibility Requirements Manual
DER Rule 17-761	Department of Environmental Regulation, Chapter 17-761 on Underground Storage Tank Systems
DER Rule 17-762	Department of Environmental Regulation, Chapter 17-762 on Above Ground Storage Tank Systems.
DMS/DOC	Department of Management Services Division of Communications
DOCA or DCA	State of Florida Department of Community Affairs
EIA/TIA	Electronics Industries Alliance/Telecommunications Industry Association (703) 907-7500 - www.eia.org
EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council
FAC	Florida Administrative Code
FBC	Florida Building Code
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FFPC	Florida Fire Prevention Code, Chapter 69A-60, FAC
FGC	Florida Building Code (Fuel Gas)
FLA	State of Florida
FMC	Florida Building Code (Mechanical)
FMG	FM Global (formerly Factory Mutual System)
FPC	Florida Building Code (Plumbing)
FS	Florida Statutes
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)

IES	Illumination Engineering Society of North America
ICPEA	International Power Cable Engineer's Association
LPCR	Local Power Company Requirements
LPI	Lightning Protection Institute
LTCR	Local Telephone Company Requirements
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code (ANSI C2)
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFSRS	Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal
UL	Underwriters Laboratories, Inc.
NEC	National Electrical Code

1.4 REGULATORY REQUIREMENTS

A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc.. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws.

1. Standards and Miscellaneous Codes/Requirements (Comply with latest edition or notice available unless otherwise adopted by Authority having Jurisdiction):

a) American with Disabilities Act (ADA)
b) American National Standards Institute (ANSI)
c) American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
d) American Society of Mechanical Engineers (ASME)
e) American Society for Testing and Materials (ASTM)
f) Concrete Reinforcing Steel Institute (CRSI)
g) Department of Community Affairs (DCA)
h) Electronics Industries Association/ Telecommunications Industry Association (EIA/TIA)
i) Institute of Electrical and Electronics Engineers (IEEE)
j) Illumination Engineering Society (IES)
k) Local Power Company Requirements (LPCR)
l) Lightning Protection Institute (LPI)
m) Local Telephone Company Requirements (LTCR)

n) National Energy Conservation Policy Act (NECPA)
o) National Electrical Safety Code (NESC)
p) National Electrical Manufacturers' Association (NEMA)
q) National Fire Protection Association (NFPA) Codes and Standards as adopted by Authority having Jurisdiction including the National Electrical Code (NEC)
r) The Occupational Safety and Health Act (OSHA)
s) Sheet Metal and Air Conditioning Contractors (SMACNA)
t) Underwriters Laboratories, Inc. (UL)
u) Applicable Florida Statutes and Referenced Codes/Standards.
v) All Federal, State, Local Codes, Laws and Ordinances as applicable.
w) Florida Building Code 2007 Edition with 2009 Supplement

2. ORANGE COUNTY
a) Florida Building Code 2007 with 2009 supplement
b) Florida Mechanical Code 2007 with 2009 supplement
c) Florida Plumbing Code 2007 with 2009 supplement
d) Florida Fuel Gas Code 2007 with 2009 supplement
e) National Electrical Code 2008
f) Florida Fire Prevention Code 2007
g) NFPA 1 Uniform Fire Code 2006 Florida Edition
h) NFPA 101 Life Safety Code 2006 Florida Edition

PART 2- PRODUCTS (Not Applicable)
PART 3 - EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Symbols and abbreviations specifically applicable to all Division 16 sections in addition to those in Division 1 - General Requirements and any supplemental requirements/conditions.

1.2 SYMBOLS

A. In general the symbols used on the drawings conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of special systems or agencies as hereinafter noted.
Corps of Engineers.
Special Symbols as shown in schedules or legends.

1.3 ABBREVIATIONS

A. The following abbreviations or initials are used.
A/C Air Conditioning
AFD Adjustable Frequency Drive
A.C. Alternating Current
ADD # Addendum #
A/E Architect/Engineer (or Engineer when Architect not applicable)
AFF Above Finished Floor
AFG Above Finished Grade
AHU Air Handler Unit
AIC Amps Interrupting Capacity
AL Aluminum
ALT Alternate
AMP Ampere
ANSI American National Standards Institute
AWG American Wire Gauge
@ At
B.C. Bare Copper
BLDG Building
BRKR Breaker
BTU British Thermal Unit
BTUH BTU Per Hour
C. Conduit
C.B. Circuit Breaker
CBM Certified Ballast Manufacturers
CFM Cubic Feet per Minute
CKT. Circuit
CKT BRKR Circuit Breaker
C/L Center Line
Clg. Ceiling
Comp. Compressor
Conn. Connection
Cond. Condenser
Cont. Continuous

C.R.I. Color Rendering Index
C.T. Current Transformer
CU. Copper
C.U. Compressor Condenser Unit
C.W. Cold Water
D.B. Direct Burial
D.C. Direct Current
Disc. Disconnect
DN. Down
DPST Double Pole Single Throw
DWG Drawing
E.C. Electrical Contractor (or General Contractor)
ELEV. Elevator
EMT Electric Metallic Tubing
Equip. Equipment
EST Estimate
FAAP Fire Alarm Annunciator Panel
FACP Fire Alarm Control Panel
FATC Fire Alarm Terminal Cabinet
FCCP Fire Alarm Command Center Panel
FHC Fire Hose Cabinet
FLA Full Load Amperes
FT. Feet
FLR Floor
F.C. Footcandles
FVNR Full Voltage Non-Reversing
GAL. Gallon
Galv. Galvanized
GPH Gallons per Hour
GPM Gallons per Minute
GFI Ground Fault Interrupting
GRS Galvanized Rigid Steel Conduit
GND. Ground
HTG Heaters
HT Height
HZ Hertz (Cycles)
HPF High Power Factor
HPS High Pressure Sodium
HP. Horsepower
HR. Hour
H.S. Heat Strip
IMC Intermediate Metallic Conduit
Incand. Incandescent
in. Inches
J.B. Junction Box
KVA KiloVolt Ampere
KW Kilowatts
KWH Kilowatt Hour
K Kelvin
L.L.D. Lamp Lumen Depreciation
LED Light Emitting Diode
LIU Light Interface Unit (Fiber Optic Patch Panel)

LT. Light
LTG. Lighting
LTS. Lights
L.P.F. Low Power Factor
M.C.B. Main Circuit Breaker
M.L.O. Main Lugs Only
Maint. Maintenance
MH. Manhole; Metal Halide
MFG. Manufacturer
max. Maximum
MCM Thousand Circular Mils
MPH Miles Per Hour
MM Millimeter
Min. Minimum
MCP Motor Circuit Protector
MTD Mounted
N. Neutral
NEC National Electric Code
NEMA National Electrical Manufacturers Association
NFPA National Fire Protection Association
N.P.T. National Pipe Thread
NF Non Fused
N.C. Normally Closed
N.O. Normally Open
NIC. Not in Contract
No. Number
OB Outlet Box
OD Outside Diameter
O.L. Overload
OLS Overloads
OS&Y Outside Screw and Yoke (Sprinkler)
% Percent
/ Phase
P. Pole
PL Compact Fluorescent Lamp
P.T. Potential Transformer
PSF Pounds per Square Foot
PSI Pounds per Square Inch
PB Pullbox
PNL Panel
PR Pair
Pri. Primary
PTZ Pan, Tilt, Zoom
PVC Polyvinyl Chloride
Recept. Receptacle
RPM Revolutions per Minute
R.S. Rapid Start
SCA Short Circuit Amps
Sec. Secondary
SHT Sheet
S/N Solid Neutral
SPST Single Pole Single Throw

SF Square Foot
SW. Switch
SWBD Switchboard
Sys. System
THHN; THWN Nylon Jacketed Wire
TSP Twisted Shielded Pair
TTB Telephone Terminal Board
TTC Telephone Terminal Cabinet
TV Television
TVTC Television Terminal Cabinet
TVEC Television Equip. Cabinet
TYP Typical
Temp. Temperature
U.L. Underwriters Laboratories
UTP Untwisted Shielded Pair
VFD Variable Frequency Drive
VHF Very High Frequency
VHO Very High Output
V Volt
VA Volt Amperes
Vol. Volume
W Wire
W.P. Weatherproof
XFMR Transformer
Y Wye
Yd. Yard
Yr. Year
3R Rainproof
4X Stainless Steel Dustight, Watertight

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 16015

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. This section pertains to the furnishing of all labor, materials, equipment and services necessary to test and prove performance of the electrical system.

B. Operate system for a 3-day period. Do performance verification work as required to show that the System is operating correctly in accordance with design. Supply instruments required to read data. Adjust System to operate at the required performance levels.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION

3.1 TESTS

A. System:

1. General: After installation of all conductors, and before final acceptance, make required tests to determine proper functioning of all circuits. Furnish all necessary instruments required to make tests, and correct any deficiencies found. Prior to energizing, circuits shall be "rung-out" to verify opens, intentional and non-intentional grounds, continuity and detect short circuits by accepted constant "megger".

2. Procedure:

a) All wires in conduit that are shorted or unintentionally grounded shall be replaced.

b) Insulation resistance of all feeder conductors and all conductors AWG #1 and larger shall be tested. This is to include all new conductors and/or all existing conductors that are connected and/or extended. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps, and connections are made except connection to source and point of final termination at distribution or utilization equipment.

c) Insulation resistance of conductors that are to operate at 600 volts or less shall be tested by using AVO Biddle (or accepted equal) Megger at not less than 1000 volts dc. Resistance shall be measured from conductor to conduit (ground). Testing methodology shall conform to short-time or spot-reading procedural recommendations of AVO Biddle Instruments for specific megger being used. Acceptable insulation resistance of conductors rated at 600 volts shall not be less than one (1) megohm.

d) Conductors that do not satisfy test requirements (c.) above shall be removed, replaced, and testing repeated on new cable, at no additional costs to the Owner. All tests shall be performed by licensed electrician trained in the use of test instruments. Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed and complete "CONDUCTOR INSULATION RESISTANCE TEST" Form (found at the end of Section 16098) and submit five (5) copies to Engineer for acceptance. Test shall be witnessed by Owners representative and engineer (if so desired). Final acceptance data is to be submitted in O&M Manual.

e) Test reports shall identify each feeder conductor tested, date, time, and result of test, weather conditions, and range, test voltage, and serial number of the megger

instrument used. Any conductor or splice that is found defective shall be promptly removed and replaced, and additional test shall be performed.

f) Observe all safety instructions set by testing equipment manufacturer. Application of voltage testing involves risk of electric shock and sparking.

3. Take readings of voltage and amperage at building main disconnect switch and at main for each panel, at primary and secondary side of each transformer and at the end of the longest branch circuit at each panel. The above readings shall be taken (1) "no load" conditions and (2) "full load" conditions with all equipment using electricity. Tabulate readings, complete "TABULATED DATA VOLTAGE AND AMPERAGE READINGS" form (found at the end of Section 16098) and submit five (5) copies to the engineer for acceptance. Final accepted data is to be submitted in O & M manual.

B. Motors:

1. Test run each motor via motor's control unit in both manual mode and automatic mode. Verify proper operation, voltage and rotation.

2. Test run each motor furnished under this division of the specifications and all existing motors specifically noted on the drawings and/or specifications to be tested:

a) With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. Should measured values deviate +/- 10% from the nameplate ratings, the condition shall be corrected. Notify the engineer immediately should deviations occur.

b) Record results of existing motors tested and submit values to A/E in writing.

c) Test the insulation resistances of all motor windings to ground with a "megger" before applying line voltage to the motors. If these values are less than one megohm the contractor furnishing the motor shall be responsible for correcting the error.

d) Determine power factor of motor(s) at full load.

e) Tabulate readings, complete "Motor Test Information" form (found at the end of Section 16098) and submit five (5) copies to the engineer for acceptance. Final accepted data is to be submitted in O & M manual.

C. Grounds:

1. Test each raceway for raceway continuity as called for in Section 16170, "GROUNDING AND BONDING."

2. Test each grounding system used in the project as called for in Section 16170, "GROUNDING AND BONDING."

3. Submit "GROUND TEST INFORMATION" form (see form at the end of Section 16098) for each and every grounding system in the project including but not limited to: each ground rod installation; each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment); and each building steel ground connection (test building steel to ground and test building steel to building service equipment).

4. Grounding resistance shall be as called for in Section 16170, "GROUND RESISTANCE".

5. Testing shall be three (3) point method in accordance with IEEE recommended practice.

D. Communications, etc.:

1. See specific sections of these specifications for further requirements.

E. Generator

1. See specific sections of these specifications for further requirements.

F. Switchboard

1. See specific sections of these specifications for further requirements.

3.2 DATA PROCESSING

A. Testing Data.

1. Tabulate data for submission.
2. Submit data on 8 1/2" x 11" sheets with date and name of checker with one copy for each operation and maintenance manual.
3. Where specific performance verification information is called for in the specifications, use copies of the sheets provided for recording readings.
4. Data shall be submitted and accepted before check-out memos are signed or a request for final inspection is made.

B. Equipment Check-out.

1. At completion of construction after all performance verification and testing information has been gathered, submitted, and approved, provide one copy of this information to the authorized manufacturer's representative of the equipment.
   a) Manufacturer's authorized representative must be trained by the manufacturer and authorized to inspect, adjust, test, and repair equipment.
2. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is in operation, and sign a Check Out Memo for a record. Check Out Memo is at end of Section 16098.
   a) Check out of equipment is to include examining performance of equipment and certifying equipment has been installed per manufacturer's recommendations, that all necessary adjustments have been performed and that equipment is operating properly.
3. Submit one (1) copy (for each operation and maintenance manual) of the memo on each major item of equipment. Accepted memos shall be inserted in each O & M manual with the performance verification information and submittal data. Memos shall be submitted and accepted before instruction to owner or a request for final inspection.
4. Items requiring check-out memos are all major items of equipment such as (but not limited to):
   a) Panels, distribution panels, switchboards.
   b) Transformers.
   c) Equipment/system installed per sections 16700 thru 16799.
   d) Any other equipment noted to be checked-out by engineer during construction.
   e) Generators and all controls/annunciation
   f) Main Switchboard
5. Do not submit Check-out Memo form at the time Submittal Brochures are submitted. This form shall be completed and submitted before Instruction in Operation to Owner or a request for final inspection.

CONDUCTOR INSULATION RESISTANCE TEST MEMO

PROJECT NAME:_____

CONDUCTOR FROM _____ TO

SIZE

INSULATION TYPE

INSULATION VOLTAGE RATING

DATE _____ TIME

WEATHER CONDITIONS

TEST VOLTAGE (DC)

RANGE

MEGGER INSTRUMENT/SERIAL NUMBER

TESTING METHODOLOGY

INSULATION RESISTANCE MEASUREMENT (ACCEPTABLE MEASUREMENT NOT TO BE LESS THAN (1) MEGOHM):

PHASE A TO GROUND _____

PHASE B TO GROUND _____

PHASE C TO GROUND _____

NEUTRAL TO GROUND _____

ISOLATED GROUND TO GROUND

CONTRACTOR'S REPRESENTATIVE:
DATE:

OWNER'S REPRESENTATIVE:
DATE:

ENGINEER'S REPRESENTATIVE:
DATE:

GROUND TEST INFORMATION

PROJECT NAME:_____

GROUND TYPE:_____

TEST BY:_____

DATE OF TEST:_____

GROUND LOCATION:_____

GROUND TYPE (Rod, Water pipe, etc.):

PRIOR TO CONNECTION TO SYSTEM

GROUND: _____ (OHMS)

AFTER CONNECTION TO SYSTEM

GROUND: _____ (OHMS)

WEATHER CONDITIONS (Wet/Dry):

SOIL CONDITIONS (Wet/Dry):

CONTRACTOR'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:

OWNER'S REPRESENTATIVE:

DATE:

MOTOR TEST INFORMATION

PROJECT NAME:
DESCRIPTION OF MOTOR:
NAME OF CHECKER:
DATE CHECKED:

(a) Name and identifying mark of motor (indicate at existing)

(b) Manufacturer

(c) Model Number

(d) Serial Number

(e) RPM

(f) Frame Size

(g) Code Letter

(h) Horsepower

(i) Nameplate Voltage and Phase

(j) Nameplate Amps

(k) Actual Voltage

(l) Actual Amps

(m) Starter Manufacturer

(n) Starter Size

(o) Heater Size, Catalog No. and Amp Rating

(p) Manufacturer of dual-element fuse

(q) Amp rating of fuse

(r) Power Factor

CONTRACTOR'S REPRESENTATIVE:
DATE:

SIGNATURE OF CHECKER:
DATE:
OWNER'S AUTHORIZED REPRESENTATIVE:

VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)

PROJECT NAME:_____

SWITCHGEAR/PANELBOARD

FULL LOAD AMPERAGE READINGS:

DATE _____

TIME _____

PHASE A. _____

B. _____

C. _____

N._____

GROUND_____

FULL LOAD VOLTAGE READINGS:

DATE

TIME

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

VOLTAGE AT THE END OF THE LONGEST BRANCH

TYPE OF LOAD

NO LOAD VOLTAGE READINGS:

DATE

TIME

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

_____ ENGINEERS REPRESENTATIVE

_____ OWNER'S AUTHORIZED REPRESENTATIVE

_____ CONTRACTORS REPRESENTATIVE

_____ DATE

END OF SECTION 16090

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification sections apply to this section.

B. All sections of Division 16 of these specifications apply to this section.

C. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

A. This section includes the requirements for demonstration of completed electrical systems:

1.3 DESCRIPTION

A. Demonstrate to Owner the essential features of the following electrical systems:

1. Communications Systems
   a) Each and every system included in Sections 16700 through 16799.
2. Electrical Entrance Equipment
   a) Circuit breakers
   b) Fuses and fuseholders
   c) Meters (where applicable)
3. Miscellaneous Electrical Equipment
   a) Electrical systems controls and equipment
   b) Electrical power equipment
   c) Motor control devices
   d) Relays
   e) Surge suppression equipment
4. Lighting Fixtures (include relamping and replacing lenses)
   a) Exit and safety fixtures
   b) Fixtures, indoor and outdoor
5. Lightning Protection System
6. Distribution Equipment
   a) Lighting and appliance panelboards
   b) Distribution panels
   c) Switchboard
7. Standby Electrical Equipment
   a) Batteries
   b) Battery chargers
   c) Controls and alarms
   d) Emergency generators, transfer switches
8. Wiring Devices
   a) Low-voltage controls
   b) Switches: regular, time

B. Each system shall be demonstrated once only, after completion of testing.

1.4 TIME

A. The demonstration shall be held upon completion of all systems at a date to be agreed upon in writing by the Owner or his representative.

1.5 ATTENDING PARTIES

A. The demonstration shall be held by this Contractor in the presence of the Owner, and the manufacturer's representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMONSTRATION

A. Demonstrate the function and location (in the structure) of each system, and indicate its relationship to the riser diagrams and drawings.

B. Demonstrate by "start-stop operation" how to work the controls, how to reset protective devices, how to replace fuses, and what to do in case of emergency.

C. Performance Verification and Demonstration to Owner

1. Submit one (1) copy of Check Out Memo Form for each O & M Manual. (Form at end of this section.) Form shall be signed by the contractor, subcontractor and Owner's authorized representative for "each" type of equipment and system. Complete an individual form for each item, equipment and system.

END OF SECTION 16095

CHECK OUT MEMO FORM

This form shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name:

Type of equipment checked:
Equipment Number:

Name of manufacturer of equipment:

Signature below by the manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

1. The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.

2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below.*

3. Written operating and maintenance information has been presented to the Contractor, and gone over with him in detail.

4. Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

Checked By: (Print or Type Name of Manufacturer's Representative)

(Address and Phone No. of Representative)

(Signature and Title of Representative)

(Date Checked)

Witnessed By: Signature and Title of Contractor Rep.)

*Exceptions Noted At Time Of Check-Out (use additional page if necessary):

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:

1. Rigid Metallic Conduit (RMC) NEC 344
2. Aluminum Rigid Metallic Conduit (RMC) NEC 344
3. Flexible Metal Conduit (FMC) NEC 348
4. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
5. Electrical Metallic Tubing (EMT) NEC 358
6. Rigid non-metal conduit
7. Fittings and Conduit Bodies
8. Electrical Nonmetallic Tubing

B. Raceways and conduits shall begin at an acceptable enclosure and terminate only in another such enclosure except conduit/raceway stub-outs.

C. A raceway shall be provided for all electrical power and lighting, and electrical systems unless specifically specified otherwise.

1.2 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
C. ANSI C80.5 - Rigid Aluminum Conduit.
D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
E. ANSI/NFPA 70 - National Electrical Code.
F. NECA Standard Practice of Good Workmanship in Electrical Contracting
G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
H. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70. (See drawings and this and other sections of these specifications for additional requirements).

1.4 SUBMITTALS

A. Submit catalog cut sheet showing brand of conduit to be used and showing that conduit is UL listed and labeled, and manufactured in the United States.

B. Submit catalog cut sheet on all types of conduit bodies, and fittings.

C. Product data shall be submitted for acceptance on:

1. Conduits
2. Conduit straps, hangers and fittings
3. PVC solvent(s) and bending box
4. Fitting entering and leaving the ground or pavement

D. Product data shall prove compliance with Specifications, National Electric Code, National Board of Fire Underwriters, manufacturer's specifications and written installation data.

1.5 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual routing of conduits larger than 1.25 inches.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 GENERAL

A. All conduits shall bear UL label or seal and shall be manufactured in the United States.
B. Conduit systems and all related fittings, boxes, supports, and hangers must meet all the requirements of national, state, local and other Federal codes where applicable.

2.2 MINIMUM TRADE SIZE

A. Rigid conduit - 3/4".
B. Non-metallic conduit - 3/4"c.
C. E.M.T. - 3/4".
D. Flexible and seal-tite metallic conduit - 1/2"C. (Maximum 6 ft. long).
E. Homeruns - 3/4"c.
F. Branches - 1/2"c.

2.3 RIGID METALLIC CONDUIT

A. Comply with:
   1. ANSI C80.1
   2. UL Spec - No. 6
   3. N.E.C. 344

B. Conduit material:
   1. Zinc coated or hot dipped galvanized steel.

C. Fittings:
   1. Threaded.

2. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.

3. Zinc plated or hot dipped galvanized malleable iron or steel.

D. Conduit Bodies:
1. Comply with ANSI/NEMA FB 1.
2. Threaded hubs.
3. Zinc plated or hot-dipped galvanized malleable iron.

2.4 RIGID ALUMINUM CONDUIT

A. Comply with:
1. ANSI C80.5
2. UL6
3. NEC 344

B. Conduit material: Aluminum.

C. Fittings:
1. Threaded.
2. Aluminum.
3. Insulated bushings on terminations.

D. Conduit bodies:
1. Comply with ANSI/NEMA FB 1.
2. Threaded hubs.
3. Aluminum.

2.5 INTERMEDIATE METAL CONDUIT

A. Comply with:
1. ULStandard 1242.
2. NEC 342.

B. Conduit material: Zinc coated steel.

C. Fittings:
1. Threaded.
2. Zinc plated malleable iron.
3. Insulated bushings on terminations.

D. Conduit bodies:
1. Comply with ANSI/NEMA FB 1.
2. Threaded hubs.
3. Zinc plated or hot-dipped galvanized malleable iron.

2.6 FLEXIBLE METAL CONDUIT

A. Comply with:
1. NEC 348
2. ANSI/UL 1

B. Conduit material: Steel, interlocked.

C. Fittings:
1. ANSI/NEMA FB 1
2. ANSI/UL 514B

3. Malleable iron, zinc plated.
4. Threaded rigid and IMC conduit to flexible conduit coupling.
5. Direct flexible conduit bearing set screw type not acceptable.

2.7 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Comply with:
1. N.E.C. 350
2. ANSI/UL 360

B. Conduit material:
1. Flexible hot-dipped galvanized steel core, interlocked.
2. Continuous copper ground built into core up to 1-1/4" size.
3. Extruded polyvinyl gray jacket.

C. Fittings:
1. Threaded for IMC/rigid conduit connections.
2. Accepted for hazardous locations where so installed.
3. Provide sealing washer in wet/damp locations.
4. Compression type.
5. ANSI/NEMA FB 1.
6. ANSI/UL 5148.
7. Zinc plated malleable iron or steel.

2.8 ELECTRICAL METAL CONDUIT

A. Comply with:
1. U.L 797
2. ANSI C80.3
3. N.E.C. 358
4. ANSI/UL797

B. Conduit material: Galvanized steel tubing.

C. Fittings:
1. ANSI/NEMA FB 1
2. Set screw
3. Zinc plated malleable iron or steel.
4. Concrete tight.
5. T&B Series 5031/5030.

2.9 RIGID NON-METALLIC CONDUIT (PVC)

A. Comply with:
1. NEMA TC-2
2. UL 651
3. NEC 352

B. Conduit material:
1. Shall be high impact PVC - tensile strength 55 PSI, flexural strength 11000 PSI.

C. Fittings:
1. Comply with: NEMA TC-3 and UL 514.

D. General:
1. Shall be UL listed and identified.
2. Shall conform to all national, state and local codes.
3. Manufacturer shall have five years experience in manufacturing PVC conduits.

2.10 EXPANSION FITTINGS

A. Expansion fittings shall be:
   1. UL Listed, hot dipped galvanized inside and outside providing a 4" expansion chamber - when used with rigid conduit, intermediate metal conduit and electrical metallic conduit, or:
   2. Be polyvinyl chloride and shall meet the requirements of and as specified elsewhere for non-metallic conduit and shall provide a 6" expansion chamber.
   3. Hot dipped galvanized expansion fitting shall be provided with an external braided grounding and bonding jumper with accepted clamps, UL Listed for the application.
   4. Expansion fitting, UL Listed for the application and in compliance with the National Electrical Code without the necessity of an external bonding jumper may be considered. Submit fitting with manufacturer's data and UL Listing for acceptance prior to installation.

PART 3 - EXECUTION

3.1 LOCATION REQUIREMENTS

A. Underground Installations:
   1. Use rigid non-metallic conduit (PVC) only unless local authority having jurisdiction or applicable codes/utility requirements, etc. require rigid steel conduit.
   2. Use galvanized rigid conduit, or PVC encased in steel-reinforced concrete.
   3. All conduits or elbows entering, or leaving the ground shall be rigid steel conduit coated with asphaltic paint.
   4. All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with Section 300-5 of the NEC except that the minimum cover for any conduit shall be two feet. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.
   5. Where rigid metallic conduit is installed underground as noted above it shall be coated with waterproofing black mastic before installation, and all joints shall be re-coated after installation.
   6. PVC runs over 150 feet in length shall utilize rigid steel 90° elbows at each riser and at each change in direction. Elbows shall be coated with black mastic or PVC coating. Bond all metal elbows per NEC 250.80 and 300-5.
   7. All underground service lateral raceways shall be protected as required by Section 300-5 of the NEC including requirements for installation of warning tape.

B. In Slab Above or on Grade:
   1. Use coated rigid steel conduit, coated intermediate metal conduit (if accepted) or rigid non-metallic conduit.
   2. Coating of metallic conduit to be black asphaltic or PVC.

C. Penetration of Slab:
   1. Exposed Location:
      a) Where penetrating a floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
   2. Concealed Location:
      a) Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, rigid non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 40" above finished floor.
      b) Where penetrating a floor in location other then that above use a black mastic coated or PVC coated galvanized rigid steel conduit.

D. Outdoor Location:
   1. Above Grade:
      a) Where penetrating the finished grade, black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
      b) In general all exterior conduit runs shall be rigid conduit (with PVC coating if within 10 miles of ocean or gulf) and threaded connectors as specified elsewhere.
      c) Electrical metallic tubing (thin wall) is permitted under roof, overhangs, etc. provided it is not subjected to physical damage and is not in direct contact or directly subject to exterior elements including sunlight.
      d) Exterior conduits not on roof and not subject to damage (i.e. 6 ft. above grade/floor or higher) may be rigid non-metallic PVC conduit as specified elsewhere. (Schedule 40 for low voltage Class II wiring, Schedule 80 for power wiring.)
      e) Exterior conduits from grade level to 6 ft. above grade may be rigid non-metallic Schedule 40 PVC for low voltage Class II wiring provided rigid metal conduit is used at transition from below grade to twelve (12) inches above grade (due to weed eater damage, etc.).

   2. Roofs:
      a) Conduit is not to be installed on roofs, without written authorization by A/E for specific conditions.
      b) When accepted by written authorization conduit shall comply with the following:
         1. Be PVC coated rigid galvanized metal conduit.
         2. All fittings, etc. are to be PVC coated.
         3. Conduit shall be supported above roof at least 6 inches using accepted conduit supporting devices. Refer to applicable sections of specifications on roofing, etc.
         4. Supports to be fastened to roof using roofing adhesive or means as accepted by roofing contractor.

E. Interior Dry Locations:

   1. Concealed: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, and electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" A.F.F. except where prohibited by the N.E.C. (places of assembly, etc.).

   2. Exposed: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing. EMT may only be used where not subject to damage, which is interpreted by this specification to be above 90" AFF.

   3. Concealed or exposed flexible conduit:

      a) Concealed flexible steel conduit or seal tight flexible steel conduit in lengths not longer than six (6) feet in length with a ground conductor installed in the conduit or an equipment ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Exposed flexible steel conduit or seal tight flexible steel conduit shall not exceed two (2) feet in length, unless written authorization by A/E for specific conditions is granted.

F. Interior Wet and Damp Locations:

   1. Use rigid galvanized steel or intermediate metal conduit.

G. Concrete Columns or Poured in-place Concrete Wall Locations:

   1. Use rigid non-metallic conduit. Penetration shall be by accepted metal raceway (i.e. metal conduit as required elsewhere in these specifications).

3.2 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT

A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.

1. Accepted pipe vise.
2. Roller/bade type cutter or band saw.
3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.

B. Hangers shall be installed 8 ft. apart.

C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.

3.3 ADDITIONAL REQUIREMENTS FOR EMT

A. Electric metallic tubing (thin wall) may be installed inside buildings above ground floor where not subject to mechanical injury.

B. All cuts shall be reamed smooth and free of sharp and abrasive areas by use of an accepted reamer.

3.4 ADDITIONAL REQUIREMENTS FOR FLEXIBLE STEEL CONDUIT AND SEAL-TITE FLEXIBLE STEEL CONDUIT

A. Shall be properly grounded.

B. Shall be installed with accepted fittings.

3.5 ADDITIONAL REQUIREMENTS FOR RIGID NON-METALLIC CONDUIT (PVC CONDUIT)

A. Rigid non-metallic PVC conduit is not allowed anywhere inside building(s) except underground, in slab, in poured in place concrete, and in block wall up to first outlet box (if not over 40" AFF) if allowed by codes. Rigid non-metallic PVC conduit may be used exterior to building as stated elsewhere in these specifications.

B. Join rigid non-metallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

C. Threads will not be permitted on rigid non-metallic PVC conduit and fittings, except for rigid steel to rigid non-metallic PVC couplings.

D. Installation of rigid non-metallic PVC conduit shall be in accordance with manufacturer's recommendations.

E. Rigid non-metallic PVC conduit shall not be used to support fixture or equipment.

F. Field bends shall be made with accepted hotbox. Heating with flame and hand held dryers are prohibited.

3.6 SUPPORTS

A. Arrange supports to prevent misalignment during wiring installation.

B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24", increase distance as required) provide space on each for 25 percent additional

conduits.

D. Fasten conduit supports to building structure and surfaces under provisions of Section 16190.

E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach conduit to ceiling support wires.

G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.

H. Non-bolted conduit clamps, as manufactured Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

3.7 EXPANSION FITTINGS

A. Provide expansion fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

B. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than one hundred feet long and interval between expansion fittings in such runs shall not be greater than 100 feet.

3.8 GROUNDING

A. All raceways shall have a copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC codes.

B. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings.

C. Grounding conductors run with exterior/ underground feeders shall be bare only.

D. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by accepted ground bushings.

E. See other sections of these specifications for additional requirements.

F. Grounding conductors (including lightning protection down conductors) run in metal conduit shall be bonded to metal conduit at both ends.

3.9 GENERAL

A. Install conduit in accordance with NECA "Standard of Installation." Contractor shall layout all work prior to rough-in.

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange conduit to maintain headroom and present neat appearance.

D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.

E. Route conduit in and under slab from point-to-point.

F. Do not cross conduits in slab.

G. Maintain adequate clearance between conduit and piping.

H. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

I. Cut conduit square using saw or pipecutter; de-burr cut ends.

J. Bring conduit to shoulder of fittings; fasten securely.

K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

L. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

M. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

N. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC Article 300, whether shown on drawings or not.

O. Provide continuous fiber polyline 1000 lb. minimum tensile strength pull string in each empty conduit except sleeves and nipples. This includes all raceways which do not have conductors furnished under this Division of the specifications. Pullcord must be fastened to prevent accidental removal. A phenolic or brass nameplate shall be attached to each end indicating the location of both ends of conduit as follows: THIS END = "LOCATION," OTHER END = "LOCATION."

P. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

Q. Ground and bond conduit under provisions of Section 16170.

R. Identify conduit under provisions of Section 16195.

S. Install all conduits concealed from view unless specifically shown otherwise on drawings

T. Rigid steel box connections shall be made with double locknuts and bushings.

U. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

V. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.

W. All raceways shall be run from outlet to outlet as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.

X. Spare conduit stubs shall be capped and location and use marked with concrete marker set flush with finish grade. Marker shall be 6" round x 6" deep with appropriate symbol embedded into top to indicate use. Also, tag conduits in panels where originating.

Y. All conduit stubbed above floor shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel. Spare conduit stubs shall be capped with a U.L. listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."

Z. All connections to motors or other vibrating equipment including dry type transformers or at other locations where required shall be made with not less than 12" of flexible steel conduit. Use angle connectors wherever necessary to relieve angle strain on flex conduit.

END OF SECTION 16111

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide all equipment, labor, material, accessories, and mounting hardware to properly install all conductors and cables rated 600 volts and less for a complete and operating system for the following:

1. Building wire and cable.

2. Wiring connectors and connections.

B. No aluminum wiring shall be permitted.

C. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM).

1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Product Data: Submit catalog cut sheet showing, type and U.L. listing of each type of conductor, connector and termination.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.7 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70, Type THHN/THWN and XHHW.

PART 3 - EXECUTION

3.1 GENERAL

A. Install products in accordance with manufacturers instructions.

B. Conductors #10 AWG or #12 AWG shall be 600 volt type THWN/THHN unless noted otherwise, rated 90 degrees C. dry.

C. Use solid conductor for feeders and branch circuits 10 AWG and smaller (except for control circuits).

D. Use conductor not smaller than 12 AWG for power and lighting circuits.

E. Neatly train and lace wiring inside boxes, equipment, and panelboards.

F. All conductors shall be installed in raceway.

G. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit unless noted otherwise on the drawings or in these specifications.

H. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).

I. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.

J. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.

3.2 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire has been completed.

3.3 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.4 WIRING METHODS

A. Use only building wire, Type THHN/THWN insulation, in raceway unless noted otherwise.

B. Wiring in vicinity of heat producing equipment: Use only XHHW insulation, in raceway.

C. Conductors installed within fluorescent fixture channels shall be Type THHN or XHHW, rated 90 degrees C dry. Conductors for all other light fixtures shall have temperature ratings as required to meet the U.L. listing of the fixture; however, in no case shall the temperature rating be less than 90 degrees Centigrade. Remove incorrect insulation types in new work.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 16195.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

C. Identify neutrals with its associated circuit number(s).

3.6 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of the General Requirements of the Contract Documents and 16090.

B. Inspect wire for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

3.7 PULLING

A. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.

B. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.

C. Use only powdered soapstone or other pulling lubricant acceptable to the A/E. Compound or lubricant shall not cause the conductor or insulation to deteriorate.

D. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.

E. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.

F. Where communications type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.

3.8 CONTROL AND SIGNAL CIRCUITS

A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, Type XHHW or THWN-THHN as permitted by NFPA 70, within voltage drop limits, increased to #12 AWG as necessary for proper operation.

B. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300 volt rated, PVC insulated, except where specifically noted otherwise in the contract documents.

C. Conductor insulation for Fire Alarm Systems shall be as accepted by Code Inspection Authority only. Wire acceptance by the A/E shall not supersede this final Acceptance for conditions of this specific project.

D. Install circuit conductors in conduit.

E. Circuit conductors to be stranded.

3.9 COLOR CODING

A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.

B. Unless otherwise accepted or required by A/E to match existing, color-code shall be as follows: Neutrals to be white for 120/208V system, ground wire green, bare, isolated ground wire green with yellow strips. 120/208V, Phase A - black; Phase B - red; Phase C - blue. All switchlegs, other voltage system wiring, control and interlock wiring shall be color-coded other than those

above.

3.10 TAPS/SPLICES/CONNECTORS/TERMINATIONS

A. Clean conductor surfaces before installing lugs and connectors.

B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

C. Power and lighting conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).

D. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum, pull conductors through to equipment, terminal cabinets, and devices.

E. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.

F. No splices shall be made in communications outlet boxes, pull boxes or wireways (i.e., fire alarm, computer, telephone, intercom, sound system, etc.) without written acceptance of Engineer. Pull cables through to equipment cabinets, terminal cabinets and devices.

G. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the providing by the Contractor of sleeve type vertical cable supports in vertical raceway installations provided in pullboxes at proper vertical spacings.

H. A calibrated torque wrench shall be used for all bolt tightening.

I. Interior Locations:

1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire.

J. Exterior Locations:

1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.

2. All taps and splices shall be made with compression type connectors and covered with Raychem heavywall cable sleeves (type CRSM-CT, WCSM or MCK) with type "S" sealant coating with sleeve kits as per manufacturer's installation instructions or be terminated/connected to terminal strips in above grade terminal boxes suitable for use.

3. Provide and install above grade termination cabinets sized to meet applicable codes and standards, where required for splicing.

END OF SECTION 16123

PART 1 - GENERAL

1.1 DESCRIPTION OF THE WORK

A. Provide and install all outlet boxes (flush or surface) complete with all accessories as required to facilitate installation of electrical system and as required by the NEC.

B. Section includes: Wall and ceiling outlet boxes (and/or small junction/pullboxes).

1.2 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NFPA 70 - National Electrical Code.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Submit catalog cut sheet/product data on:

1. Surface cast boxes.

B. For pullboxes and junction boxes not covered in Section 16133, submit product data showing dimensions, covers, and construction.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of outlets in offices and work areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 GENERAL

A. All boxes and fittings shall be labeled by Underwriters Laboratories.

B. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.

C. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.

D. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.

E. Handy boxes shall not be used.

F. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan.

2.2 SHEET METAL OUTLET BOXES: ANSI/NEMA OS 1, GALVANIZED STEEL

A. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.

B. Concrete Ceiling Boxes: Concrete type.

C. Interior flush outlet boxes shall be galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box coverplates or wiring devices. T & B, Steel City, Raco or accepted substitution.

D. Ceiling outlet boxes shall be 4" octagonal or 4" square X 1 1/2" deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.

E. Switch, wall receptacle, telephone and other recessed wall outlet boxes in drywall shall be 4" square X 1 1/2" deep. For recessing in exposed masonry, provide one piece 4" square x 1 1/2" deep wall boxes with appropriate 4" square cut tile wall covers Steel City series #52-C-49/52-C-52 or accepted substitution. For recessing in furred-out block walls, provide 4" square box with required extension for block depth and required extension for drywall depth.

2.3 CAST BOXES: NEMA FB 1

A. Interior surface outlet boxes and conduit bodies installed from 0" AFF to 90" AFF (including fire alarm device backbox) shall be the heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices - Appleton, Crouse Hinds or accepted substitution. Trim rings shall also be of one-piece construction.

B. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast metal suited to each application and having threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitable configured, gasket, and corrosion-proof fasteners.

C. Boxes to be Type FD unless otherwise noted on drawings.

D. Freestanding cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

E. Utilize cast box and fittings for 911 phone mounted on the exterior.

PART 3 - EXECUTION

3.1 GENERAL

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

D. Install boxes to preserve fire resistance rating of partitions and other elements.

E. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

F. Outlets for 120V clocks shall be recessed so that the clock will hang flush with the finished surface of the wall.

G. Use flush mounting outlet boxes in finished areas.

H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.

I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

J. Use stamped steel bridges to fasten flush mounting outlet box between studs.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Support all outlet boxes from structure with minimum of one (1) 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two (2) all-thread rod hangers, minimum.

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit.

O. Use gang box where more than one device is mounted together. Do not use sectional box.

P. Use gang box with plaster ring for single device outlets.

Q. Use cast outlet box in exterior locations and wet locations.

R. Comply with applicable portions of the National Electrical Contractor's Association's (NECA) "Standard of Installation".

S. Install outlets in the locations shown on the drawings; however, the Owner shall have the right to make, prior to rough-in, slight changes in locations to reflect room furniture layouts.

T. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.

U. The Contractor shall relocate electrical boxes as required so that electrical devices, once installed, will be symmetrically located with respect to the room layout.

V. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.

W. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.

X. As a minimum, provide pull boxes in all raceways over 150 feet long. The pull box shall be located near the midpoint of the raceway length.

Y. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.

Z. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.

AA. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.

BB. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.

CC. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose.

Add-a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.

DD. Outlet boxes mounted in metal stud walls, are to be supported to studs with two (2) screws inside of outlet box to a horizontal stud brace between vertical studs or one side of outlet box supported to stud with opposite side mounted to section of stud or device to prevent movement of outlet box after wall finished.

EE. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

FF. Mount Height.

1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural plans and shop drawings for installing.

Switches	4'-0" AFF to top
Receptacles	1'-4" AFF to bottom
Lighting Panels	6'-6" AFF to centerline of highest breaker/fuse
Phone outlets	1'-4" AFF to bottom
Fire Alarm Pull Stations	4'-0" AFF to top
Fire Alarm Strobe Lights	80" AFF to bottom

2. Bottoms of outlets above counter tops or base cabinets shall be minimum 2" above counter top or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Division to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural plans, prior to rough-in, regardless of height shown on Division 16 drawings.

3. Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural plans and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

GG. Special Purpose Outlets.

1. Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications. Provide plug for each outlet.

HH. Outlets in Fire/Smoke and Smoke Partitions/Walls.

1. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 sq. inches. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound or other accepted materials. The wall must be built around outlets of larger size so as not to interfere with the integrity of the wall rating.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under all Sections of these

specifications.

B. Coordinate locations and sizes of required access doors with applicable sections in these specifications.

C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

D. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closure in unused box opening.

END OF SECTION 16131

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install pull and junction boxes as shown on drawings or as required by the National Electric Code (NEC).

B. Provide and install pull and junction boxes wherever required for a complete and operating distribution system whether shown on drawings or not.

C. Where outlet boxes are used for pull and/or junction boxes, they shall meet the requirements of the outlet box section of these specifications.

1.2 - REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

D. ANSI/NFPA 70 - National Electrical Code.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Submit actual shop drawings on all pull boxes showing.

1. Covers.
2. Dimensions - inside and out.
3. Rating of concrete or gauge of metal.
4. Manufacturer.

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of pull and junction boxes.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of pull and junction boxes prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose and to maintain required access.

PART 2 - PRODUCTS

2.1 GENERAL

A. Dimensions of pull and junction boxes shall meet dimensions shown on drawings or dimensions

required by NEC, whichever is largest.

B. Pull and junction boxes shall meet all requirements of UL and NEC.

C. Small pull boxes (i.e. 4" x 4") shall meet the requirements of these specifications for outlet boxes as a minimum.

D. All boxes (above ground) of 100 cubic inches or more shall be constructed of 14 gauge steel with hot dip galvanized coating.

2.2 SHEET METAL BOXES:

A. NEMA OS 1, galvanized steel.

B. Box to be fully weatherproof and watertight where installed outside.

2.3 SURFACE-MOUNTED CAST METAL BOX: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.

A. Material: Cast aluminum.

B. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. Provide all hubs as required for conduit connections.

2.4 IN-GROUND PULL BOXES:

A. Material: Precast concrete, or composolite.

B. Bottom: Open with 6" of gravel for drainage.

C. Cover: Meet Florida Dept. of Transportation requirements for installed location. (Pedestrian, heavy traffic, light traffic).

D. Solid sides constructed to facilitate conduit entries.

PART 3- EXECUTION

3.1 GENERAL

A. Install per NEC.

B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.

F. Install boxes to preserve fire resistance rating of partitions and other elements.

G. Align adjacent wall-mounted boxes with each other.

H. Use flush mounting boxes in finished areas.

I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.

J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Pull and junction boxes larger than 25 square inches shall be supported with two (2) 3/8" all-thread rod hangers minimum.

M. Pull and junction boxes used for systems (Section 16700-16799) larger than 25 square inches shall be hinged cover type.

N. Do not fasten boxes to ceiling support wires.

O. Support boxes independently of conduit.

P. Large Pull Boxes: Boxes larger than 100 cubic inches (1600 cubic centimeters) in volume or 12 inches (300 mm) in any dimension.

1. Interior Dry Locations: Per NEC, with screw covers.

2. Other Locations: Use hinged enclosure.

Q. Outdoor Locations: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.

3.2 IN GROUND PULL BOXES

A. Provide and install ground rod in each pull box. Connect #2 copper ground wires (counterpoise) to ground rod, run out pullbox 6" over conduits to next pull box; tie to respective building electrical ground rod at each building.

B. Install pull boxes flush with finished grade. Provide extensions as required.

C. In ground pullboxes to have interior watertight pull box mounted inside in-ground pull box as required by Local Authority Having Jurisdiction.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations and sizes of required access doors with applicable sections in these specifications.

B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

3.4 ADJUSTING

A. Install knockout closure in unused box opening.

END OF SECTION 16133

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:

1. Wall switches.
2. Receptacles.
3. Device plates and decorative box covers.

1.2 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 5 - Wiring Devices, Special Purpose

C. NEMA WD 6 - Wiring Device Configurations.

1.3 SUBMITTALS

A. Submit Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Submit product data on all types of wiring devices including plates and engraving.

B. Submit Manufacturer's Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
2. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 EXTRA MATERIALS

A. Provide a minimum of two (2) screw drivers of each type of tamper proof screw used on project.

B. Turn over to owner. Submit receipt in O&M manual.

PART 2 - PRODUCTS

2.1 GENERAL

A. All devices shall be Specification Grade as minimum.

B. General purpose wiring devices shall meet NEMA standard WD-1, Wiring Devices, General Purpose. Special purpose devices shall conform to the requirements of NEMA standard WD-5,

Wiring Devices, Special Purpose.

C. All wiring devices shall bear U.L. labels.

D. All devices of one type (i.e. all snap switches, all duplex receptacles, etc.) shall be by the same Manufacturer. "Hazardous Location" and special purpose devices as may not be available from the same manufacturer, shall constitute the only exception to this requirement of single source.

E. Corrosion resistant devices shall be as specified for normal usages, and fabricated of yellow color melamine plastic. Where "Weatherproof" type is indicated for exterior or wet locations, provide matching self-closing cover, with gasketed seals at plate/wall junctions and for cover.

F. Provide factory packaged wiring devices having high impact strength molded plastic bodies.

G. Except where specifically required in these specifications use of interchangeable type or combination switch-receptacle-pilot devices is not acceptable, and shall be removed.

H. Switches and receptacles connected to life safety branch of the emergency power system shall be red. Plates shall be as specified for devices connected to normal circuits, but shall be engraved reading "Emergency", see drawings for other engraving requirements.

2.2 WALL SWITCHES

A. Manufacturers:

1. See drawings.

B. General:

1. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.

2. Switches shall be toggle or key-operated types, as indicated on the drawings. All key-operated switches shall be keyed alike.

3. Where switches are denoted as having pilot lights, pilot lights shall glow when the switches are "On". Provide pilot light switch with lamp and miniature step-down transformer. The pilot light shall have a red lens, and the lamp shall be long-life type.

4. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be amber. All units shall be front relampable.

5. Snap switches installed in hazardous locations shall be U.L. listed for the type of location (class and division).

6. Switches connected to the life safety or critical branch of the emergency distribution system emergency power shall have red lighted handles which shall illuminate when the switches are "Off".

7. Voltage and ampere rating of switches shall be marked on switch, and shall conform to voltage of system to which applied.

C. Description: NEMA WD 1, heavy-duty, AC only general-use snap switch.

D. Voltage Rating: 120-277 volts, AC.

E. Current Rating: 20 amperes minimum.

F. Ratings: Match branch circuit and load characteristics.

2.3 WALL DIMMERS

A. Manufacturers:

1. See drawings.

B. Description: NEMA WD 1, semiconductor dimmer for incandescent lamps, type as indicated on Drawings.

C. Device Body: Plastic with rotary knob or linear slide as called for on drawings.

D. Voltage: 120 volts or as required to match application.

E. Power Rating: Match load shown on Drawings; 600 Watts minimum.

F. Accessory Wall Switch: Match dimmer appearance.

1. Same manufacturer and style as dimmer switch.

2.4 RECEPTACLES

A. General:

1. All receptacles shall be of standard NEMA configuration, as indicated on the drawings, and shall comply with the respective ANSI C73 series standard for the NEMA configuration. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.

2. Duplex receptacles shall have integral U.L. listed self-grounding clips. Similar, single receptacles shall be provided for plug-in connections of Industrial Fluorescent light fixtures on the same switching circuit. Receptacle face to be impact resistant nylon.

3. Weatherproof duplex receptacles shall be provided in all exterior locations, and shall be Ground Fault Circuit Interrupting (GFCI) types, with weatherproof stainless steel cover plates allowing use of receptacle with cover in closed position.

4. Special purpose receptacles for specific equipment shall be grounding types, having the number of poles, voltage and ampere ratings, and NEMA configurations required by the equipment. For each special purpose receptacle, provide an identical mating plug equipped with cord grip, secured to cord.

5. Duplex receptacles shall have back and side wired screw pressure terminals.

B. Description: NEMA WD 1; heavy-duty general use receptacle.

C. Configuration: NEMA WD 6; heavy-duty, general use type as specified and indicated.

D. Convenience Receptacle: Type 5-20.

E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

F. Manufacturers:

1. See drawings.

2.5 COVER PLATES

A. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered.

B. Metallic cover plates shall be used in interior spaces, except as noted below, and shall be fabricated of corrosion-resistant #302 stainless steel, having a nominal thickness of .04", and a brushed finish. Screws securing the plates shall have flush (when installed) heads with finish to

match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications.

C. Where so directed by the A/E (either by Contract Documents or direction after the bid) substitute nylon plates of quality as specified below, without increase in Contract Price. Coordinate prior to securing plates for Project. Where nylon cover plates are required in finished interior spaces, these shall be fabricated of either non-combustible mar-proof high impact resistant fiberglass or nylon reinforced thermosetting material or nylon, having a minimum thickness of .10", with smooth finish. Screws securing the plates shall have flush (when installed) heads of color to match plates. Nylon cover plates shall conform to Federal Specification QP-455A and all other NEC, U.L., and NEMA requirements. Where required by A/E nylon plates shall be fitted with nylon screws for totally nonmetallic surface installation.

D. Cover plates for switches located in corrosive atmospheres (where vaporproof is not indicated) shall be equal to Hubbell #17CM81/#17CM82/#17CM83/#17CM84 one piece neoprene with matching presswitch.

E. Cover plates for exterior receptacles shall be gasketed #302 stainless steel lift covers with hinge allowing plug and cord to be plugged in and activated with cover closed..

F. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the drawings. Metallic plates and nylon plates in ivory, beige, gray, and white shall be engraved with black fill. Red, brown, and black nylon plates shall be engraved with white fill.

G. Unless specifically noted otherwise in specs or on drawings all outlets for telephone and other communications and data systems shall be provided with standard size one-piece cover plates having a minimum 3/4 inch diameter bushed hole in the center unless specifically noted otherwise in specs and/or on drawings. Where telephone conductors are installed, plates shall contain telephone type, polarized plug-in receptacles.

2.6 COLOR

A. Wiring devices connected to normal power and located in unfinished spaces shall be grey color. Devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the following list of standard colors: ivory, beige, gray, white, brown, and black.

B. Cover plates for devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the above list of standard colors or #302 S.S.

C. All devices and coverplates in paneled walls shall have finish to match paneling.

D. Devices connected to [the life safety or critical branch of the emergency distribution system] emergency power shall be red color, except where established building standards and/or isolated ground devices require otherwise. Coordinate before purchase.

E. Contractor shall modify any given catalog numbers as required to procure devices and plates of the proper color.

PART 3- EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Division 1 - General Requirements and any other applicable supplemental requirements/conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on bottom.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.

I. Where 2 or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang box and combination multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems.

J. Provide device coverplates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch.

K. In finished areas, provide same type of plate for all surface mounted devices as for recessed mounted devices.

L. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.

M. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.

N. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.

O. All devices shall be installed so that only one wire is connected to each terminal.

P. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.

Q. Connect wiring devices by wrapping conductor around screw terminal.

R. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

S. Install protective rings and split nozzle on active flush cover service fittings.

T. Install local room area wall switches at door locations on the lock side of the door, approximately four inches from the jamb. Where locations shown on the drawings are in question, provide

written request for information to A/E prior to roughin.

3.4 NEUTRAL CONDUCTOR CONNECTIONS

A. At each receptacle "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under other Sections of these specs to obtain mounting heights specified and indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION 16141

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes

1. Grounding electrodes and conductors.
2. Equipment grounding conductors.
3. Bonding.
4. Ground Ring.

B. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable codes as accepted by the Authorities Having Jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.

C. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of NEC 250, and state codes. Bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.

D. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed with-in conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors that run with feeders in PVC conduit outside of building(s) shall be bare only.

E. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to NEC 250.

1.3 REFERENCES

A. ANSI/NFPA 70 National Electrical Code
B. NFPA 780 Standard for the Installation of Lightning Protection Systems
C. UL 467 Grounding and Bonding Equipment

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

A. Submit catalog cut sheets/product data on:

1. Ground rods and couplings.

2. Mechanical connectors.
3. Ground wells.
4. Ground bus bars and associated components.
5. Ground ring conductor.
6. Counterpoise conductor.
7. Exothermic welding materials and molds.
8. Testing equipment and procedures.

B. Product data shall prove compliance with specifications, National Electrical Code, manufacturers' specifications, and written installation data.

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual locations of grounding electrodes.

B. Submit test results of each ground rod. See Section 16090 Tests and Performance Verification.

PART 2- PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: 5/8".

C. Length: 30' (minimum). Increase lengths as required to meet and achieve specified resistance.

2.2 MECHANICAL CONNECTORS

A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.

B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. Specified items of designated manufacturers indicate required criteria. Equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:

1. Lugs: Substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy QQA Series or T&B equal. Lightweight and "competitive" devices shall be rejected.
2. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or equal.
3. Piping Clamps: Burndy GAR-TC Series with two hole compression terminal or T&B equal.
4. Grounding Screw and Pigtail: Raco No. 983 or equal.
5. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp.

C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

2.3 WIRE

A. Material: Stranded copper.

B. Size: Size to meet NFPA 70 requirements as a minimum, increase size if called for on Drawings, in these specifications, or as required for voltage drop.

C. Insulated THWN (or bare as noted elsewhere).

2.4 GROUNDING WELL COMPONENTS

A. Grass Non-Traffic Areas:

1. Well: Sleeve 18" long, diameter 12" (minimum).
2. Well Cover: High-density plastic, composolite, or cast iron with legend "GROUND" embossed on cover.
3. Material: Structural Plastic, composolite, or concrete.
4. Manufacturer: Carson 2200 Series or equal by Quazite.
5. Increase depth, diameter or size as required to provide proper access at installed location.

B. Paving and Low Traffic Areas:

1. Well: Minimum 12" long by 12" wide by 18" deep with open bottom.
2. Well Cover: Traffic rated for use with "GROUND" embossed on cover.
3. Material: Composolite.
4. Manufacturer: Quazite.
5. Increase depth, diameter or size as required to provide proper access at installed location.

2.5 GROUNDING BARS/GROUND BUS (INCLUDING SYSTEMS GROUND BUS/BARS AND GROUND BUS BARS)

A. Ground bars shall be copper of the size and description as shown on the Drawings. If not sized on Drawings, bus bar shall be minimum 1/4" x 2" bus grade copper, spaced from wall on insulating 2" polyester molded insulator standoff/supports, and be 12" or greater minimum overall length, allowing 2" length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2" spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4" high and 24" long.

B. Provide bolt-tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2" on center spacing. Lugs to be manufactured by Burndy or T&B.

C. Standoff supports to be 2" polyester as manufactured by Glastic No. 2015-4C.

PART 3 - EXECUTION

3.1 GENERAL

A. Install products in accordance with manufacturer's instructions.

B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.

C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the NEC, the NFPA, and applicable standards of IEEE.

D. Where there is a conflict between these specifications and the above applicable codes/standards, or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the code/standard requirements shall be complied with.

E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

3.2 GROUNDING ELECTRODES

A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic welding or by braising or clamping with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on Drawings.

B. Each rod shall be die stamped with identification of manufacturer and rod length.

C. Install rod electrodes at locations indicated and/or as called for in these Specifications.

D. Ground Resistance:

1. Main Electrical Service (to each building) and Generator Locations:

a) Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 5 ohms.

2. Other Locations:

a) Resistance to ground of all non-current carrying metal parts shall not exceed 25 ohms measured at motors, panels, buses, cabinets, equipment racks, light poles, transformers, and other equipment.

b) Lightning Protection system ground locations shall not exceed 25 ohms for the Franklin system measured at ground electrode.

3. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two or more rods connected together but not connected to the grounding electrode conductor.

E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor). Depending on soil condition, etc. of ground rod locations, it has been found that the ground rod lengths required to achieve the specified resistance may range from the minimum specified length to up to 80' or more in length.

F. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.

G. Verify that final backfill and compaction has been completed before driving rod electrodes.

H. Install ground rods not less than 1' below grade level and not less than 2' from structure foundation.

3.3 GROUNDING ELECTRODE CONDUCTOR

A. Conductor shall be sized to meet (or exceed as required to meet these Specifications and/or Drawings) the requirements of NEC 250.

3.4 EQUIPMENT GROUNDING CONDUCTORS

A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these Specifications and/or Drawings) the requirements of NEC 250.

B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in

supply panelboard.

C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the Grounding Bus in all motor control centers, and as specified, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.

E. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.

F. All plugstrips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.

G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.

H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.5 MAIN ELECTRICAL SERVICE

A. Complete installation shall meet and exceed the requirements of the NEC 250.

B. Artificial electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.

C. Provide and bond to all of the following:

1. Ground rods.
2. Metal water pipe (interior and exterior to building).
3. Building metal frame, structural steel and/or reinforced structural concrete.
4. All piping entering or leaving all buildings (including chilled water piping).
5. Encased Electrodes.
6. Ground ring.
7. Lightning protection system.

D. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to the building steel in respective building. This ground conductor shall also be run individually from the main

switchgear and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length and location as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe. Also required is the same size ground wire to ground rod electrode as called for below:

1. Three 30' ground rods in a delta configuration at no less than 30' spacing driven to a minimum depth of 30' plus 1' below grade.
2. Bond ground rod electrodes together with a bare copper ground conductor that matches size required by applicable table in NEC 250, but in no case less than #2/0.
3. Provide additional rod electrodes as required to achieve specified ground resistance.

E. Ground/bond neutral per NEC 250.

F. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to a concrete encased electrode per NEC 250.52(A)(3).

G. Bond grounding electrodes to site counterpoise grounding system and lightning protection system where provided.

H. Provide and install ground bus bar on wall near main service disconnect/switchboard. Connect to ground bar in disconnect/switchboard bonded to switchboard/disconnect enclosure/neutral with copper grounding conductor sized per applicable table in NEC 250.

3.6 TRANSFORMER GROUNDING

A. Ground all transformers and enclosures of 120/208V and 277/480V "separately derived systems" as specified herein.

1. Ground per NEC 250 and these Specifications.
2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC 250.
3. Connect transformer neutral/ground to grounding electrode per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.
4. In addition to connection to grounding electrode conductor called for above (i.e. per NEC 250) provide, install and connect supplemental grounding electrode as follows:
   a) Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
   b) Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection to building steel/structure in addition to any other available electrode specified in NEC 250.
   c) Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
5. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
6. Where transformer is mounted exterior to building, one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system (wherever counterpoise system is available).

7. Ground to water system service pipe as required by NEC 250.

B. Provide additional ground electrodes as required to achieve specified ground resistance.

C. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC 250, but in no case less than #2/0.

D. Complete installation shall exceed the minimum requirements of NEC 250.

E. Equipment ground conductors shall be provided in addition to above grounding. See 'Equipment Grounding Conductors.'

F. Provide and install ground bus bar on wall near transformer (or in associated electrical room for exterior mounted transformers). Connect to ground lug in transformer bonded to transformer enclosure/neutral with copper ground conductor sized per applicable table in NEC 250.

G. Multiple separately derived systems may be grounded as allowed in NEC 250.30(A)(4).

3.7 GENERATOR GROUNDING

A. Separately derived systems (i.e. systems where generator neutral is not solidly interconnected to service supplied system neutral such as 4-pole switched neutral transfer switch systems).

1. Ground per NEC 250 and these specifications.

2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC 250.

3. Connect generator neutral/ground to grounding electrodes per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.

4. In addition to connection to grounding electrode conductor called for above (i.e. per NEC 250) provide, install and connect supplemental grounding electrode as follows:

a) Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.

b) Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection with connection to other electrodes specified in NEC 250.

c) Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or mote 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.

5. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.

6. Where generator is mounted exterior to building, one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system.

B. Non separately derived systems (i.e. systems where generator neutral is solidly interconnected to service supplied system neutral such as 3-pole non-switched neutral transfer switch systems).

1. Ground per NEC 250 and these specifications.

2. Do not bond neutral to transformer frame/enclosure or the equipment grounding conductors of the derived system.

3. Connect generator frame/enclosures ground to grounding electrode per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.

4. In addition to connection to grounding electrode conductor called for above (i.e. per NEC 250) provide, install and connect supplemental grounding electrode as follows:

   a) Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.

   b) Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection to other electrodes specified in NEC 250.

   c) Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.

5. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two ground connections each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.

6. Where generator is mounted exterior to building, one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system.

C. Provide additional ground electrodes as required to achieve specified ground resistance.

D. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC 250, but in no case less than #2/0.

E. Complete installation shall exceed the minimum requirements of NEC 250.

F. Equipment ground conductors shall be provided in addition to above grounding. See 'Equipment Grounding Conductors."

3.8 LIGHTNING PROTECTION SYSTEMS

A. Ground per applicable section on lightning protection system, NFPA 780, and as specified herein. The most stringent requirements shall govern.

B. Bond lightning protection system grounds to electrical service system ground, all piping entering or leaving all buildings, and counterpoise system ground where provided.

C. See Section 16671 Lightning Protection System.

3.9 ROOF MOUNTED EQUIPMENT

A. Bond all roof mounted electrical equipment to lightning protection system (when provided) per NFPA 780.

3.10 LIGHTING FIXTURES

A. All new fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.

B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.

3.11 GROUND RING

A. Provide complete underground building perimeter ground ring system, completely encircling each building.

B. Conductor shall be minimum of Class II lightning protection copper conductor (bare).

C. Install at not less than 2-1/2' depth into earth.

D. Install ground rods (minimum 30' long) every 150' section of ground ring conductor.

E. Bond ground ring to building foundation steel every 150' around building perimeter, bond to any and all electrical and piping systems that cross the ground ring system, bond to lightning protection down conductors and to any lightning or other earth grounding electrodes that may be present on the premises.

F. Bond to building service and counterpoise ground systems.

3.12 MISCELLANEOUS GROUNDING CONNECTIONS

A. Provide bonding to meet regulatory requirements.

B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded to steel or bolted to steel in locations where weld will affect the structural properties of the steel. Required connections to existing building structural steel purlins/I beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.

C. Grounding conductors shall: be so installed as to permit shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed (or bolted) to the equipment or to be grounded; in NO case be a current carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.

D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rustproofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.

E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.

F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.

I. Grounding provisions shall include double locknuts on all heavywall conduits.

J. Bond all metal parts of pole light fixtures to ground rod at base.

3.13 GROUNDING BAR/GROUND BUS (INCLUDING SYSTEMS GROUND BUS/BAR ON GROUND BUS/BAR) INSTALLATION

A. Where indicated on the Drawings, provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.

B. Mount bolt tapping lugs with hex head bolts to bus bar at 2" o.c. spacing, one for each ground conductor.

C. Mount bus bar to wall using 2" polyester molded insulator stand-off.

D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by NEC for service ground, etc.) in PVC conduit to accepted service ground installation or ground bus/bar in main service equipment enclosure.

E. Extend #6 insulated copper ground wire from respective bus/bar to each 'local' ground bus/bar in each cabinet for Section 16700-16799 system.

F. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC 800.100(B).

3.14 COMMUNICATIONS SYSTEMS

A. Provide and install all grounding as required by NEC Article 800 and where available on project: Articles 810 (Radio and Television Equipment); 820 (Community Antenna Television and Radio Distribution Systems); and 830 (Network-Powered Broadband Communications Systems.

B. Provide and install grounding electrode at point of entry of communication cables and bond to service entrance grounding electrodes per NEC 800. Install ground bus bar at point of entry of communications cable and connect electrode to ground bus. Connect communications cable metal sheath and surge protection devices to ground bar.

3.15 TESTING AND REPORTS

A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.

B. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than twenty-four hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.

C. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted to the Architect/Engineer as called for in Section 16090 Test and Performance Verification.

3.16 INTERFACE WITH OTHER PRODUCTS

A. Interface with site grounding system.

B. Interface with lightning protection system installed under Section 16671 Lightning Protection System.

C. Interface with communications system installed under 16700 series specification sections.

3.17 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pullboxes and other equipment furnished under this Division.

B. Section Includes:

1. Conduit and equipment supports.

2. Anchors and fasteners.

1.2 REFERENCES

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not use spring steel clips and clamps.

E. Obtain permission from Architect/Engineer before using powder-actuated anchors.

F. Obtain permission from Architect/Engineer before drilling or cutting structural members.

G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

I. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.

J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed

in hollow partitions.

K. All items shall be supported from the structural portion of the building, except standard ceiling-mounted lighting fixtures, and small devices may be supported from ceiling system where permitted by Ceiling Contractor, however, no sagging of the ceiling will be permitted. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels.

L. This Contractor shall lay out and install his work in advance of the laying of floors or walls, and shall furnish and install all sleeves that may be required for openings through floors, wall, etc. Where plans call for conduit to be run exposed, this Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If this Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching, later at his own expense, to the satisfaction of the Architect.

M. All conduits shall be securely fastened in place per NEC; and hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.

N. Where two or more conduits are run parallel or in a similar direction, they shall be grouped together and supported by means of Kindorf type trapeze hanger system (racking) consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or accepted clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.

O. Hanger assemblies shall be protected after fabrication by galvanizing. Hangers for PVC coated conduit shall be PVC coated galvanized conduit.

P. On concrete or brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Fasteners similar to "TAP-CON" self tapping power driven type are acceptable. Plastic anchors are not acceptable.

Q. Conduit supporting devices such as spring type conduit clips manufactured by Caddy Corporation may not be used.

R. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter.

S. Concrete/insert anchors, threaded rods, or similar fasteners installed on side or bottom of pre-stressed beams are not acceptable.

END OF SECTION 16190

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all equipment, labor and material for a complete identification system, including but not limited to:

1. Nameplates and labels.
2. Wire and cable markers.
3. Conduit markers.

B. Identify all new and existing conduits, boxes, equipment, etc. as specified herein.

1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. Americans with Disabilities Act - 1990

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Nameplates shall be laminated phenolic plastic, chamfer edges.

1. 120/208 Volt System:
   a) Black front and back with white core, with lettering etched through the outer covering. White engraved letters on black background.
2. Emergency System:
   a) Red with white letters.
3. Emergency Power:
   a) Red front and back, white core, lettering etched through outer covering, white engraved letters on red background.

B. Letter Size:

1. 1/8 inch letters for identifying individual equipment and loads.
2. 1/4 inch letters for identifying grouped equipment and loads.

C. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for acceptance. Nameplates for panelboards, switchboards, motor control centers, disconnects and enclosed breakers shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire". In addition, provide phenolic label in panel to describe where the panel is fed from and location. Nameplates for equipment listed below shall describe particular equipment name and associated panel/ckt (if

applicable). The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine.

D. The following items shall be equipped with nameplates:

1. All motors, motor starters, pushbutton stations, control panels, time switches, disconnect switches, panelboards, circuit breakers (i.e., all 2 pole, 3 pole C.B's.), contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical, and electrical systems (Systems Sections 16700 through 16799), junction and pull boxes (larger than 4-11/16"), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number (if applicable).

2.2 WIRE MARKERS

A. Description: Cloth, tape, split sleeve, or tubing type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings including neutral conductor.

2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on shop drawings.

2.3 CONDUIT/JUNCTION BOX COLOR CODE

A. All conduit system junction boxes (except those subject to view in public areas) shall be color coded as listed below:

COLOR CODE FOR JUNCTION BOXES	KRYLON PAINT NUMBER
Fire Alarm	Popsicle Orange K02410
Normal Power 120/208 volt	Glossy Black K01601
Sound System	Daisy Yellow K01813
Computer/Data	Gold K01701
TV	Glossy White K01501
Security/CCTV	John Deere Green K01817
Telephone	Clover Green K02012
Grounding	Fluorescent Green K03106

B. Conduits (not subject to public view) longer then 20 feet shall be painted with above color paint band 20 ft. on center. Paint band shall be 4" in length, applied around entire conduit. Where conduit are parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniformed. Paint boxes and raceways prior to installation or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.

C. Junction boxes and conduit located in public areas (i.e. areas that can be seen by the public) shall be painted to match surface attached to. Provide written request to A/E for interpretation of those public areas, which may be in question.

2.4 CONDUIT/JUNCTION BOX MARKER

A. All new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) shall adequately describe its associated panel and circuit reference number(s) within, (i.e. ELRW-2, 4, 6) or systems within (i.e. fire alarm, intercom, etc.).

Identification shall be neatly written by means of black permanent marker. (Paint 1/2 cover plate with appropriate color above, and 1/2 with associated panel/circuit or system as described above.) Junction box cover plates located in public areas shall be identified with small phenolic labels securely attached. Label colors to be determined by A/E. Large pull/junction boxes (8" x 8" or larger) shall be color identified by painting the corners of box cover plate with specified colors at 45° angles and phenolic labels as specified herein.

B. Identify conduit not installed in public areas with corresponding panel/circuit numbers or corresponding system type as described above. Spacing: 20 ft. on center adjacent to color identification bands.

2.5 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using stainless steel pop rivets.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Nameplates installed inside on dead front cover shall be self adhesive tape. (Do not drill or install screws in dead front.)

E. Identify new and existing conduit, junction boxes, and outlet boxes using field painting.

F. Identify new underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

G. Install wire markers at all new connections and terminations and existing connections and terminations, modified or altered.

END OF SECTION 16195

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications sections apply to this section.

B. All sections of Division 16 of these specifications apply to this section.

C. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

A. This section includes the requirements for performing and submitting a system study on the complete power system.

1.3 DESCRIPTION

A. Provide all labor, materials, and equipment necessary to properly and completely perform a Power System Study for the electrical distribution and control equipment and submit results in a report.

B. The contractor shall be responsible for obtaining all required data of all equipment.

C. The Power System Study shall include a coordination and short circuit study.

D. The study shall verify adequacy of all equipment implemented under these specifications and to verify the correct application of circuit protective devices and other system components specified.

E. The study shall address the case when the system is being powered from the normal source as well as from the on-site generating source.

F. Minimum as well as maximum possible fault conditions shall be covered in the study.

G. Fault conditions of all motors shall be considered.

1.4 SUBMITTALS

A. A summary of the short circuit analysis shall be submitted at the time shop drawings for all of the new equipment is submitted for approval.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit copy of study (in separate binder) with Operation and Maintenance Manual.

1.6 QUALITY ASSURANCE

A. Study shall be performed by a Florida Registered Professional Engineer.

1.7 REFERENCES AND REGULATORY REQUIREMENTS

A. Conform to the requirements of the following:

1. ANSI/NFPA 70 - National Electrical Code.

2. Applicable ANSI/IEEE standards.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. The manufacturer/contractor shall provide data necessary to perform the study. This includes feeder cable sizes, approximate feeder lengths, motor data, generator data, all overcurrent protective device data (including branches and main), protective relay settings, and any other information relevant to study.

B. All back-up calculations shall become part of the final report. The calculations shall be in sufficient detail to allow easy review.

3.2 CONTENTS

A. The Study shall include representation of the power company's system, the base quantities selected, impedance source data, calculation methods and tabulations, one-line diagram, impedance diagram, conclusions and recommendations.

B. Short circuit momentary duties shall be calculated on the basis of an assumed bolted three-phase short circuit at each 480 volt bus, low voltage switchboard bus, switchboard, distribution panelboard, branch circuit panelboard, and other significant locations throughout the system.

C. A protective device time current coordination study shall be included with coordination plots of key and/or limiting devices, tabulated data, rating, and/or settings selected. The study shall present an engineering balance between the competing objectives of protection and continuity of service for the system specified, taking into account the basic factors of sensitivity, selectivity, and speed.

D. Separate plots shall be provided for each mode of "normal" and "stand-by" operation. Maximum fault values shall be shown in each case. Both power sources shown in one plot will not be accepted.

E. Generator short circuit decrement curves and thermal limit curves shall be included.

F. Required settings for breakers and relays shall be maximized to provide the most effective protection possible whether the system is fed from normal or emergency source.

G. Tabulations indicating recommended set points for all protective devices shall be provided. This shall include the normal as well as the emergency source.

3.3 GENERATOR PROTECTIVE DEVICES

A. The study shall address all of the protective devices provided for generator protection.

B. Protection relays requiring settings shall include, but not be limited to:

1. Differential
2. Overcurrent With Voltage Restraint
3. Ground
4. Undervoltage
5. Reverse Power
6. Unbalances Loading and Open Phase
7. Loss of Excitation

3.4 TIME-CURRENT CURVE PRESENTATION

A. The coordination plots shall include complete titles, representative one-line diagrams, legends, associated power company's relay or system characteristics, significant motor staring characteristics, complete parameters for power and substation transformers, and complete operating bands for low-voltage circuit breaker trip devices.

B. The coordination plots shall define the types of protective devices selected, together with the

proposed coil taps, time-dial settings and pick-up settings required.

C. The short-time region shall indicate the magnetizing in-rush, and ANSI withstand transformer parameters, the low-voltage circuit breaker instantaneous trip devices, fuse manufacturing tolerance bands, and significant symmetrical and asymmetrical fault currents.

D. Each primary protective device required for a delta-to-wye connected transformer shall be selected so that the characteristic or operating band is within the transformer parameters; which, where feasible shall include a parameter equivalent to 58 percent of the ANSI withstand point to afford protection for secondary line-to-ground faults.

E. Low-voltage power circuit breakers shall be separated from each other and the associated primary protective device, where feasible, by a 16 percent current margin for coordination and protection in the event of secondary line-to-line faults.

F. Protective relays shall be separated, where feasible, by a 0.3-second time margin when the maximum three-phase fault flows, to assure proper selectivity.

3.5 SUBMITTAL

A. The Study shall be submitted in a bound 8 ½" x 11" size report. Three (3) copies.

B. The final selection of all protective devices shall be based on preliminary draft of the coordination study, which shall be submitted with the equipment shop drawings for review.

C. The completed study shall be submitted to and accepted prior to shipping of any equipment.

D. All protective devices shall be adjusted, tested, and calibrated in the field prior to energizing the equipment, per the settings listed in the accepted study. This work shall be performed by the manufacturer prior to final acceptance by owner.

E. All protective devices shall be calibrated and tested as recommended by and under the supervision of the equipment manufacturer's representative.

END OF SECTION 16410

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Arrangement with Utility Company for permanent electric service, including payment of Utility Company charges for service.

B. Underground service entrance.

C. Metering equipment.

D. Temporary Service.

1.2 DESCRIPTION OF WORK

A. Furnish, install, or otherwise provide all equipment, and/or coordination, and supervision necessary to furnish a new electrical service to the facility. This shall include all necessary temporary services and connections.

B. Assessments by the Utility for permanent electrical service shall be paid by the Owner.

C. Assessments for temporary electrical service shall be paid by the Contractor who shall contact the Utility Company prior to bid for inclusion of these charges.

D. Assessments by the utility for permanent electrical service shall be paid by the Owner.

E. Assessments for temporary electrical services shall be paid by the Contractor who shall contact the utility company prior to bid for inclusion of these charges.

1.3 COORDINATION

A. Fully coordinate with the local Utility Company to provide electrical service to the facility. Provide underground raceways, trenching, backfilling, etc. where required. Coordinate easement requirements for temporary service.

1.4 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.5 SUBMITTALS

A. Submit under provisions of Section 16012.

B. Submit Utility Company prepared drawings.

C. Submit product data on:

1. Surge protection.

2. Lightning arresters.

3. Meter/C.T. cabinet if applicable.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose

specified and shown.

C. The rules and regulations of the local Utility Company shall govern all service and metering requirements.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to appropriate sections contained within these specifications for standards concerning materials used.

2.2 UTILITY METERS

A. Meters will be furnished by Utility Company.

2.3 UTILITY METER BASE

A. Provide meter base that complies with utility company's requirements.

2.4 LIGHTNING ARRESTER

A. Unit shall be Tranquell type as manufactured by General Electric.

2.5 SURGE SUPPRESSION

A. Surge protective devices shall meet the following criteria:

1. Lead configuration: Lines 18" black, neutral 18" white, ground 18" green. Leads shall be #10 AWG copper and shall not be extended to more than 18" factory installed length.

2. Protectors shall be connected to load side of circuit breaker in order to remove them from the circuit on failure and an indicator light should verify component failure. Provide circuit breaker sized as recommended by manufacturer in main panel and connect surge suppressor.

3. Surge suppressor shall be Atlantic Scientific "Zonemaster 75 Series", unless otherwise specified in other sections of these specifications (i.e. section 16289, 16691,etc as applicable to project).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

A. Make arrangements with Utility Company to obtain permanent electric service to the Project.

B. Coordinate location of Utility Company's facilities to ensure proper access is available.

C. This Contractor shall notify the Utility Company in writing, with two copies to the Engineer, no later than ten (10) days after signing contracts as to when this Contractor anticipates the building power service will be required.

D. Contact power company within 15 days of award of contract. Provide power company copies of contract documents needed and/or required by power company within 30 days of contract Notice to Proceed.

3.3 TEMPORARY SERVICES

A. Throughout the period of construction, provide all temporary services and connections necessary to maintain without interruption all electrical services in support of construction and Owner activities.

B. The facilities and equipment required to provide all electrical power for construction, lighting and balancing and testing consumed prior to final acceptance of the project shall be provided under this section of the specifications. All wiring, outlets and other work required to provide this power at the site and within the building for all trades shall be arranged for, furnished and installed under this section of the specifications including any fee, charge or cost due the utility company for temporary power installation or hook-ups.

C. Facilities shall be furnished in a neat and safe manner in compliance with governing codes, good working practices and OSHA regulations.

3.4 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall furnish all labor, materials, etc., necessary for a complete accepted electrical service as required for this project, including inspection and acceptance by the Utility and local Inspection Departments (if any) and inform the Engineer prior to energizing power lines within the structure.

3.5 UNDERGROUND ELECTRICAL SERVICE

A. Furnish and install underground 120/208 volt, 3 phase, 4 wire service from power company transformer to main service equipment. Seal conduit with duc-seal where entering building.

B. The underground service shall comply with all the requirements of the NEC, local Utility Company and State enforcing authority.

C. Install service entrance conduits from Utility Company's transformer to building service entrance equipment. Utility Company will connect service lateral conductors to service entrance conductors.

3.6 METERING

A. Meters and metering equipment shall be furnished and installed under this Division of the specifications.

3.7 LIGHTNING ARRESTERS OR SURGE SUPPRESSION

A. Both lightning arrestor and surge suppressor shall be provided on the line side of each main service from transformer. Units shall match service voltage.

B. Installation including mounting connections, grounding and length of leads shall conform to manufacturers' recommendations.

END OF SECTION 16421

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, and equipment necessary to properly install switches as shown on the drawings and as required by codes.

B. Coordinate with Div. 15 contractor and specifications as to who is to provide disconnect switches for mechanical equipment. Provide all disconnect switches not being provided by Div. 15 contractor.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver switches in factory wrapped packaging to the site. Handle switches carefully to prevent damage. Store in a clean, dry space protected from dirt, water, and physical damage. Do not install damaged switches.

1.3 QUALITY ASSURANCE

A. The manufacturer of switches shall be the same as that of the panelboards.

1.4 SUBMITTALS

A. Submit catalog cut sheet on each type of disconnect switch to be used on this project.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

A. Switches shall be general duty types with visible, quick-make, quick-break blades.

B. Units for 2-speed motors shall be 6-pole in a single enclosure. Use of two 3-pole units will not be acceptable.

C. Provide ground bus and where required, a solid neutral bus.

D. Switches shall be fusible or nonfusible as denoted on the drawings or as required by the equipment served from the switch. Fusible switches shall have rejection type fuse holders.

E. Terminal lugs shall be rated for 75 degrees Centigrade.

F. Enclosures, unless otherwise noted, shall be NEMA 1 for indoor locations and NEMA 4X stainless steel for outdoor locations as a minimum. Krydon or fiberglass material may be used in a NEMA 4X application. All switches mounted outdoors including those noted to be NEMA 3R on drawings shall be heavy duty type 4X, watertight, corrosion resistant. In lieu of NEMA 4X, contractor may provide NEMA 3R disconnects if all surfaces of enclosure are coated with epoxy paint that will not scratch off.

G. The enclosure shall be interlocked with the switch handle such that the enclosure door or cover cannot be opened with the switch in the "ON" position. The switch handle shall be capable of being padlocked in the "OFF" position but not in the "ON" position.

H. Finish for NEMA I units shall be standard baked gray enamel finish over a rust inhibiting phosphate primer.

I. Each disconnect switch shall be provided with a Homac #ELB-2 or similar enclosure lock. Homac #ELB-2 is available from Graybar Electric.

J. Disconnect switches installed between any variable speed drive type of unit (VFD, AFD, USD,

etc.) and its respective motor(s), shall have auxiliary break before break (open) interlock control contact.

K. Disconnect switches installed to disconnect HVAC equipment are to be fusible type with fuses as recommended by HVAC manufacturer.

2.2 RATING

A. The size, number of poles, and fusing for each switch shall be as denoted on the drawings. As a minimum, no less than one pole for each ungrounded conductor shall be provided. Switches shall be rated 250 VAC or 600 VAC as required by the circuit to which it is connected.

B. Switches serving motors with more than one set of windings shall have the number of poles necessary to disconnect all conductors to all windings in a single switch. Switches serving motor loads shall be horsepower rated of sufficient size to handle the load.

2.3 SERVICE ENTRANCE EQUIPMENT

A. Switches used as service entrance equipment shall be listed and labeled by U.L. for use as service equipment.

2.4 ENCLOSED CIRCUIT BREAKERS

A. Molded Case Circuit Breakers: NEMA AB1, plug-on type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Breakers shall be HID rated. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

B. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all switches in accordance with the manufacturer's written instructions, NECA's "Standard of Installation", the applicable requirements of the National Electrical Code, and recognized industry practice.

B. All switches shall be firmly anchored to walls and supporting structures (where used) using appropriate installation. Switches shall be installed with the turning axis of their handles approximately 5'-0" above finished floor unless otherwise indicated. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.

C. Switches shall be mounted in accessible locations chosen where the passageway to the switch is not likely to become obstructed. Where a switch serves as the disconnecting means for a load, the switch shall be located as close as practical to the load with the switch handle within sight of the load.

D. Provide and install lugs on disconnect switch as required to accept conductors called for on drawings.

E. Disconnect switches shall not be mounted on equipment, unless specifically noted or required and meet all applicable codes, etc. If switches are noted or required to be mounted on equipment they shall have vibrator clips on fuses and be connected to conduit system with liquid tight flexible conduit.

F. Provide and install enclosure lock on each disconnect switch. Enclosure lock bolt shall be tightened firmly but not tight enough to break bolt.

G. Coordinate all requirements for controls between variable speed drive units and its respective motor with drive specification, manufacturer, provider and installer. Provide auxiliary contacts, relays, etc. as required.

END OF SECTION 16441

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, and equipment necessary to properly and completely install panelboards as scheduled on the drawings and as required by this section.

1.2 REFERENCES

A. NECA (National Electrical Contractors Association) "Standard of Installation."

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA PB 1 - Panelboards.

D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

E. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Product data shall be submitted on:

1. Panel
2. Cabinet
3. Bus
4. Construction
5. Dimensions

B. Shop drawing shall be submitted for each and every panel for this project, each and every panel drawing shall clearly indicate the following information:

1. U.L. Label
2. Each circuit breaker amperage rating, circuit number and position/location in panel
3. Electrical characteristics of panel
4. Mains rating
5. Main device rating
6. Mounting
7. Dimension, width, depth, height
8. Bus material
9. Interrupting capacity of minimum rated breaker
10. Panel type
11. Series AIC rating with upstream breakers.

1.4 PROJECT RECORD DOCUMENTS

A. Submit record documents to record actual locations of Products; indicate actual branch circuit arrangement.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

B. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by manufacturer.

1.9 MAINTENANCE MATERIALS

A. Provide two of each panelboard key.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle panelboards and enclosures carefully to prevent damage.

B. Store equipment indoors and protect from weather.

C. Deliver tubs and internal assemblies sufficiently in advance of installation period as necessary to prevent delay of work. This time, shall be established by a CPM provided by the Contractor, and accepted by the supervising authorities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design: Square "D".

B. Manufacturers (including accepted substitutions) must provide equipment equal to or superior than the basis of design used on this project.

1. Panels or circuit breakers with an A.I.C. rating less then that shown on the drawings will not be approved.

2. Where basis of design panelboard can accept a certain type, frame, and/or A.I.C. rated breaker, then the accepted substitution manufacturer must also be able to accept all equal breaker type, frame, and/or A.I.C. rating.

2.2 GENERAL

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type, dead front.

B. Panelboard Bus: Copper ratings as indicated. Provide copper ground bus in each panelboard. Provide isolated full size neutral bus where neutral is applicable.

C. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:

1. Individual C.B. AIC Rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.

2. Panel Series AIC rating shown is the required rating of panel and its circuit breakers based on series rating of individual panel circuit breakers with panel main circuit breaker or upstream feeder breaker.

3. Circuit breaker types are not shown or called for. The contractor must provide breakers in panel or feeder breakers in upstream breakers to comply with the required AIC ratings given including providing current limiting breakers where required to achieve all ratings given.

D. Enclosure: NEMA PB 1, Type 1 or Type 3R as indicated on drawings. Use only type 3R for units to be installed outdoors.

E. Cabinet box: 6 inches (153 mm) deep; width: 20 inches (508 mm). Constructed of code gauge steel, galvanized or bonderized to prevent rust.

F. Cabinet Front: Flush or surface (as indicated on drawings) cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard baked enamel finish for interior panels. Exterior panels to be painted with rust inhibit primer painted over on all surfaces with epoxy paint.

G. Panels and breakers shall be rated for voltage and class of service to which applied.

H. Spaces:

1. Space provisions or spaces for future breakers shall be located at the bottom of the panel and be fully bussed complete with all necessary mounting hardware less the breaker.

I. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

2.3 MAINS

A. Provide main lug only (MLO) or main circuit breaker (MCB) as noted on drawings either by riser diagram or by schedule. Where conflict exists, provide MCB.

B. Regardless of what is shown on drawings provide the following minimum requirements.

1. Main circuit breaker on each panel serving building main if required by applicable codes.

2. Main circuit breaker on each panel fed directly from a transformer (unless disconnect with overcurrent devices is installed in feeder between transformer and panel).

C. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

2.4 CIRCUIT BREAKERS

A. General

1. Molded Case Circuit Breakers: NEMA AB 1, plug-on type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

2. Current Limiting Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with

automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

B. Main Breakers:

1. Main breakers shall be individually mounted separate from branch breakers.
2. Covered by a metal plate, except for operating handle.
3. Connection from the load's side to the panel bus shall be bus bar. Insulated wire not permitted.

C. Branch Breakers:

1. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.
2. Quick-make, quick-break, with tripped indication clearly shown by breaker handle taking a position between ON and OFF.
3. Multi-pole breakers shall have common internal trip. No handle ties between single pole breakers are acceptable for this Project.
4. Single pole 15 and 20 ampere circuit breakers shall be rated for switching duty and shall be labeled as "SWD".
5. A.I.C. rating shall be as called for under "2.2 GENERAL".
6. Ground Fault Circuit Interrupters (GFI):
   a) Provide UL Class (5 milliamp sensitivity) ground fault circuit protection on 120 VAC branch circuits for exterior location receptacles and for interior locations where required by NEC. (These may not be indicated on Panel Schedule.) This protection shall be an integral part of the branch circuit breaker, which also provides overload, and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. Provide separate neutral for circuits on GFI breakers whether indicated on drawings or otherwise.

D. All breakers are to have lugs sized to match conductors called for on drawings.

2.5 SERVICE ENTRANCE EQUIPMENT

A. Panelboards used as service entrance equipment shall be listed and labeled by U.L. for use as service equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1. Install all panelboards and panelboard enclosures in accordance with the manufacturer's written instructions, NECA's "Standard of Installation", the applicable requirements of the National Electrical Code, and recognized industry practices.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 16190.

C. Height: 6 ft (2 M) to top of panelboard; install panelboards taller than 6 ft (2 M) with bottom no more than 4 inches (10 cm) above housekeeping curb.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Mount a typewritten directory showing the actual circuit numbers, type of load and room names on inside of door. Room names shall be actual names or numbers used, not necessarily shown on the drawings. Progress Drawings shall show same arrangements as the Directory. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 16195.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 4 empty 1 inch. Identify each as SPARE.

H. Proper working clearances shall be maintained at every panelboard location. The working space in front of a panelboard shall be as a minimum, 30 inches wide extending 3 feet, 3.5 feet, or 4 feet (per NEC Article 110-16) out perpendicular to the panelboard.

I. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Enclosures shall be installed so that the top is 6'-6" above finished floor. Where the size of the enclosure is such that the top cannot be installed at 6'-6", the top of the enclosure shall be kept as low as possible.

J. Clean the interior of each panelboard before installing conductors. At all times, keep the interior trim and exterior surfaces of the panelboard free of rust and debris. Repaint finishes if necessary.

K. Coordinate all raceways and conductors with their respective panelboards so that all connections and conductors routing present an orderly appearance. Conductors in the panelboards shall be laced and arranged in orderly manner.

L. Collect all keys upon delivery of panelboard. Store keys on one ring to be kept by project superintendent. Forward key ring with keys to Owner upon substantial completion.

M. Provide a separate neutral conductor for each GFI breaker. These shall not be combined to serve more than 1 circuit, even where on different phases. Increase plan indications of conductors for neutral wires required, as necessary.

3.2 IDENTIFICATION

A. Refer to Section 16195 for products and content.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

D. Feeder conductors shall be checked by accepted means to establish the absence of shorts to ground; insulation value etc. and the result recorded and submitted to the Engineer.

E. All circuits shall be operated to establish a good working order and checked for shorts.

F. All panel directory circuit numbers shall be checked to verify accuracy of the number.

G. Where and when requested by engineer provide:

1. Inspection of equipment by authorized equipment manufacturer technician complete with submittal of statement of findings by technician, and providing any adjustments deemed necessary for a complete and operating system.
2. Ground, voltage, and/or load readings complete with submittal on legible form with applicable data.

END OF SECTION 16471

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Factory-assembled, metal-enclosed panelboard for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.

B. Distribution panelboard shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation.

1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

C. NEMA KS 1 - Enclosed Switches.

D. NEMA PB 2 - Deadfront Distribution Switchboards.

E. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

1.3 SUBMITTALS

A. Submit under provisions of Section 16012.

B. Submit Shop Drawings: Indicate:

1. Front and side views of enclosures with overall dimensions shown.
2. Conduit entrance locations and requirements.
3. Nameplate legends.
4. Size and number of bus bars per phase, neutral, and ground.
5. Frame sizes and Interrupting Capacity of each breaker, and total assembly.
6. Horsepower ratings at rated voltage of fused switches and/or breakers.
7. Type of labels and labeling for every device and what it feeds.
8. Nameplate on main panelboard only giving name of project; Architect, Engineer and Contractor.
9. Bus bar size, arrangement and spacing.

C. Submit Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.

D. Submit Test Reports: Indicate results of factory production tests.

E. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 10 years experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Deliver in sections as required to fit equipment through doors, individually wrapped for protection and mounted on shipping skids.

C. Accept switchboards on site. Inspect for damage.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated and comply with instructions by manufacturer.

1.10 MAINTENANCE MATERIALS

A. Provide two of each key (where applicable).

B. Provide two fuse pullers (where applicable).

PART 2 - PRODUCTS

2.1 GENERAL

A. Panelboards with circuit breaker, or fusible switch, branch protective devices shall comply with NEMA PB2 as a minimum requirement. Panelboards shall be NEMA I and shall meet Underwriter's Laboratories enclosure requirements for service conditions.

B. Each cubicle shall have U.L. Label affixed, unless special construction prohibits and no labeling or listing is available.

C. See drawings for acceptable manufacturers. Basis of design is Square D.

D. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 volt; 14,000 amperes rms symmetrical for 480 volt. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:

1. Individual C.B. AIC Rating shown on panel schedules indicate lowest AIC rating allowed

for individual circuit breaker in panel.

2. Panel Series AIC rating shown is the required rating of panel and its circuit breakers based on series rating of individual panel circuit breakers with panel main circuit breaker or upstream feeder breaker.

3. Circuit breaker types are not shown or called for. The contractor must provide breakers in panel or feeder breakers in upstream breakers to comply with the required AIC ratings given including providing current limiting breakers where required to achieve all ratings given.

E. Provide lugs on bus, distribution panelboard and circuit breakers as required to match conductors being connected/terminated.

2.2 MANUFACTURERS

A. Basis of Design: Square D

B. Manufacturers (including accepted substitutions) must provide equipment equal to or superior than the basis of design used on this project.

2.3 DISTRIBUTION PANELBOARDS

A. Description: NEMA PB 2 with electrical ratings and configurations as indicated.

B. Main Section Devices: Panel mounted.

C. Distribution Section Devices: Panel mounted.

D. Bus Material: Aluminum with tin plating standard size.

E. Bus Connections: Bolted, accessible from front for maintenance.

F. Ground Bus: Extend length of board.

G. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

H. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1, molded case circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

I. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, molded case circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 rms amperes symmetrical let-through current and energy level less than permitted for same size Class RK-5 fuse.

J. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.

K. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

L. Enclosure: Type 1 - General Purpose for interior locations and 2 - Raintight for exterior locations.

1. Align sections at front and rear.

2. Finish:

a) Interior: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

b) Exterior: Coat interior and exterior of enclosure with rust inhibiting primer and paint over with epoxy paint

M. Breakers

1. All breakers are to have lugs sized to match conductors called for on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for distribution panelboard installation.

3.2 PREPARATION

A. Provide concrete housekeeping pad.

3.3 INSTALLATION

A. Install distribution panelboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install fuses in each switch (where applicable).

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 16090.

B. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

C. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance is 2 megohms.

D. Check tightness of accessible bolted bus joints using calibrated torque wrench.

E. Physically test key interlock systems to insure proper function.

3.5 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values as instructed by the Architect/Engineer or (if so directed by A/E) as manufacturer's recommendation.

3.6 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

3.7 LABELING

A. Provide nameplate/label at each protective device.

END OF SECTION 16472

PART 1 - GENERAL

1.1 DESCRIPTION

A. Automatic transfer switches shall be provided as described herein and shown on plans. The transfer switch shall be capable of switching all classes of load, and shall be rated for continuous duty when installed in a nonventilated enclosure.

B. Transfer switches shall be a true four (4) pole type. The normal and emergency full load current and voltage ratings at 60 cycles shall be as called for on drawings.

1.2 QUALITY ASSURANCE/TESTS

A. As a precondition for approval, transfer switch, complete with timers relays and accessories shall be listed by Underwriters' Laboratories, Inc. in their Electrical Construction Materials Catalog under Standard UL-1008 (automatic transfer switches) and accepted for use on emergency systems.

B. When conducting temperature rise tests to paragraph 99 of UL-1008 the manufacturer shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.

C. The switch shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard 472-1974 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

1.3 SHOP DRAWINGS

A. Submit shop drawings and product data clearly indicating:

1. Cabinet dimensions.
2. All applicable options and accessories.
3. Wiring diagrams.
4. Interrupting or withstanding current rating.
5. All electrical characteristics and data as required to show compliance with these specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. The transfer switch shall be double throw, actuated by two electrical operators, momentarily energized and connected to the transfer mechanism by a simple overcenter linkage with time delay relays to control contact transition time on transfer to either source, adjustable 0-300 seconds. Time delay between the opening of the closed contacts and the closing of the open contacts shall be adjusted to allow for voltage decay before transfer as required to allow re-energization of motor and transformer loads at normal in rush currents. Single throw, actuated by single electric operator shall be allowed in lieu of double throw operator if in phase monitor is used which allows for re-energization as noted above.

B. The transfer switch shall be capable of transferring successfully in either direction with 70% of the rated voltage applied to the switch terminals. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in position in both the normal and emergency positions

without the use of hooks, latches, magnet, or springs and shall be silver-tungsten alloy protected by arcing contacts, with magnetic blowouts on each pole. Parallel main contacts are not acceptable.

C. The transfer switch shall be equipped with a safe manual operator designed to be operated in the loaded condition and to prevent injury to operating personnel. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.

D. Engine starting contacts shall be provided in transfer switch to start the generating plant if any phase of the normal source drops below 80% of rated voltage, after an adjustable time delay period of 0.5-3 seconds, to allow for momentary dips. The transfer switch shall not transfer to emergency until the generator source voltage and frequency have reached 90% of rated. After restoration of normal power on all phases to 90% of rated voltage, adjustable time delay period of 0-25 minutes shall delay transfer to normal power until it has had time to stabilize. If the emergency power source should fail during the time delay period, the time delay shall be by-passed, and the switch shall return immediately to the normal source. Whenever the switch has retransferred to normal, the engine-generator shall be allowed to operate at no load for a fixed period of time (5 minutes) to allow it to cool before shut-down. The transfer switch shall include a test switch to simulate normal power failure with actual load transfer. Pilot lights shall be included on the cabinet door to indicate the main switch closed on normal or emergency, and two auxiliary contacts on the main shaft; one closed on normal, the other closed on emergency. In addition, two sets of relay contacts shall be provided to open and close upon loss of the normal power supply. All relays, timers, control wiring and accessories to be front accessible and be rated for the load and voltage as required for auxiliary control functions.

E. The transfer switch shall be U.L. listed for withstand and close-in values at least equal to the interrupting rating of the circuit breaker and/or fuse that is specified to protect the circuit, and available short circuit amps from the generator set.

F. The transfer switch shall include an exerciser with 7-day dial to automatically exercise the generating plant in the loaded condition. Exerciser shall be adjustable in 15 minute increments and shall be set for 20 minutes minimum each week unless otherwise noted.

G. Transfer switches shall transfer to emergency within the time limits as required by the National Electrical Code for each branch of emergency (10 seconds for life safety, 60 seconds for critical).

H. Transfer switch maximum dimensions shall be as shown on drawings.

I. Acceptable Manufacturers:

1. The automatic transfer switches shall be manufactured by the generator manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The transfer switch shall be installed as shown on the plans, in accordance with the manufacturer's recommendations and all applicable codes. Provide all associated control wiring to generator as required.

B. Provide all interface control wiring and conduit as required to provide required emergency operation of equipment on project as applicable.

3.2 SITE TEST

A. An installation check and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators and the maintenance staff shall be notified of

the time and date of the site test. The tests shall include Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination.

3.3 LOAD BANK TEST

A. After the building load test, a load bank test will be performed. This test shall be done with resistive dry load banks, in the presence of the engineer and owner. Test shall be performed during regular county hours and days only - Monday - Friday, 8:00 AM to 5:00 PM.

1. 1 hour 50%
2. 1 hour 75%
3. 3 hours 100%
4. 10 minutes cooldown

B. During test a written log shall be maintained at 15-minute intervals with the following:

1. Ambient Air Temperature
2. Amperes
3. Hertz
4. Oil Pressure
5. Water Temperature
6. Battery Charging
7. Exhaust Stack Temperature
8. Noise Level in dba (each side)
9. Fuel for load test to be included in bid.

END OF SECTION 16491

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Interior luminaires and accessories
2. Ballasts
3. Lamps
4. Luminaire accessories

B. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the Drawings.

C. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures.

D. Lamps shall be included in the system guarantee for a period of thirty days after final acceptance of the building.

1.3 REFERENCES

A. ANSI C78.379 Classification of Beam Patterns of Reflector Lamps

B. ANSI C82.1 Lamp Ballast – Line Frequency Fluorescent Lamp Ballast

C. ANSI C82.4 Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type)

D. ANSI/NFPA 70 National Electrical Code

E. ANSI/NFPA 101 Life Safety Code

F. NEMA WD 6 Wiring Devices - Dimensional Requirements

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of:

1. ANSI/NFPA 70
2. NFPA 101
3. ADA
4. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

A. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

1. Shop drawings shall be submitted for all fixtures that require modifications, either as specified or as required to fit architectural field conditions of this project (i.e., luminous

ceiling, wall/slot fixtures, special fixtures).

2. Shop drawings shall be complete showing all dimensions and installation instructions required for conditions on this project.

B. Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:

1. Dimensions
2. UL label
3. Fusing
4. Luminaire disconnect
5. Metal gauge
6. Lens/louvre thickness
7. Finish
8. Voltage
9. Lamps

1.6 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data and include replacement parts list.

1.7 MANUFACTURER'S QUALIFICATIONS

A. Company specializing in manufacturing products specified in this Section with minimum five years experience.

1.8 PRODUCT STORAGE AND HANDLING

A. Physically protect fixtures against damage as recommended by manufacturer.

1.9 MAINTENANCE MATERIALS

A. Provide to Owner:

1. Ten of each size/type of fuses.
2. Six of each type of lamps.

1.10 WARRANTY

A. All ballasts furnished under this Division shall be covered by a warranty against defects. Warranty shall include payment for normal labor costs of replacement of inoperative in-warranty ballasts.

PART 2 - PRODUCTS

2.1 LUMINAIRES/FIXTURES

A. Furnish products as specified in schedule on Drawings.

B. Install ballasts, lamps, and specified accessories at factory.

C. All light fixtures shall adhere to UL Test Standard 1598 and NEC 410.115(C). All manufacturers shall provide the required thermal protection as required.

2.2 LAMPS

A. Manufacturers:

1. Sylvania, G.E., or Phillips.

B. Incandescent:

1. Lamps to be rated and stamped for 130 volts.
2. Provide type specified for luminaire/fixture on drawings.
3. Reflector lamp beam patterns: ANSI C78.379.

C. Fluorescent:

1. Fluorescent lamps to be Octron type, T8 bulb with medium bi-pin base.
2. Correlated color temperature shall be 4100K with color rendering index of 80 minimum

D. Compact Fluorescent:

1. General:
   a) Provide complete with starter, ballast, etc.
   b) Suitable for low starting temperatures 32 degree F. and below.
2. Twin Tube Type:
   a) T4 bulb.
   b) 5, 7, 9, or 13 watt lamps as called for on Drawings.
   c) 4100K temperature.
   d) Color rendering index: 80 minimum.
3. Double Twin (quad) Tube Type:
   a) T4 bulb.
   b) 9, 13, 18 or 26 watt lamps as called of on drawings.
   c) 4100K temperature.
   d) Color rendering index: 75 minimum.

2.3 BALLASTS

A. Manufacturers:

1. Magnetek, Advance, or accepted substitution.

B. Fluorescent Ballast:

1. Provide ballast suitable for lamps specified.
2. Voltage: Match luminaire voltage and voltage of system to which applied.
3. Ballast to be protected with in-line fuse/fuseholder.
4. Provide disconnecting means for ballast that simultaneously disconnects all supply conductors to the ballast, including the grounded conductor.
5. Ballasts installed outdoors or in cool temperatures to be 0 degree ballasts.

C. Electronic Ballasts:

1. Fluorescent lamp ballasts shall be high frequency electronic type, operating lamps at a frequency of 20 kHz or higher with no detectable flicker.

2. Ballasts shall not be affected by lamp failure and shall yield normal lamp life.
3. Lamp current crest factor shall not exceed 1.6.
4. Ballasts shall operate at an input frequency of 60 Hz and an input voltage of 108 to 132 (120V models) or 249 to 305 (277V models).
5. Ballasts shall have power factor above 95 percent.
6. Ballasts that operate as a parallel circuit shall allow remaining lamp(s) to maintain full output if companion lamp(s) fail.
7. Ballasts shall carry five-year warranty, including labor allowance.
8. Ballast manufacturers shall have been producing electronic ballasts in the US for more than ten years with a low failure rate.
9. Ballasts shall be accepted and listed by Underwriters Laboratories.
10. Ballasts shall comply with all applicable state and federal efficiency standards.
11. Ballasts shall comply with FCC and NEMA limits governing electromagnetic and radio frequency interference and shall not interfere with operation of other normal electrical equipment.
12. Ballasts shall meet all applicable ANSI and IEEE standards regarding harmonic distortion and surge protection.
13. Total harmonic distortion (THD) to be less then 20 percent and shall have a passive power factor corrective front end.
14. Ballasts to be in 1, 2, 3 or 4 lamp configuration as required to facilitate switching/circuitry shown on Drawings or as called for on Drawings. If not specifically called for or noted on Drawings provide minimum of one ballast per 2-lamp fixture, two ballasts per 3-lamp or 4-lamp fixture.

D. Dimming Ballast:

1. Furnish dimming ballasts in specified luminaires.
2. Use ballast selected by dimming system manufacturer as suitable for operation with control unit.
3. Lamps: Suitable for lamp type and quantity specified for luminaire.

2.4 EXIT SIGNS (See Section 16535 Emergency Lighting Equipment for self-contained emergency power exit signs).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate and supporting grids for luminaires.

B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and NEC.

B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

C. Support luminaires larger than 2' x 4' size independent of ceiling framing.

D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

F. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.

G. Install recessed luminaires to permit removal from below.

H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Recessed luminaires not rated for contact with insulation (Type IC) shall not be installed within 3" of any insulation or as required by the NEC. All recessed luminaires installed within three inches of insulation shall be identified for contact with insulation and bear the UL Type IC label.

J. Install wall mounted luminaires and exit signs at height as indicated on Drawings, or as required by ADA, local codes and state codes. Where conflict exists between what is shown on drawings and what is required by codes, install fixture as required by codes.

K. Install accessories furnished with each luminaire.

L. Connect emergency lighting fixtures per Section 16535 Emergency Lighting Equipment.

M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

N. Bond products and metal accessories to branch circuit equipment grounding conductor.

O. Install specified lamps in each luminaire.

P. Where ceiling mounted fixtures are called for in the Light Fixtures Schedule and on the Drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type.

Q. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means such as bolts, screws, or rivets. Clips identified and listed for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted. Ceiling framing members must be securely attached to each other and to the building structure as requred by all applicable codes and standards.

R. All interior and exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer's labels and UL labels. All labels shall be concealed within the body of the fixture and/or luminaire. Manufacturers name or logo shall not appear on the exterior of any light fixtures unless accepted in writing by the Engineer.

S. Miscellaneous (provide and install complete):

1. Dimming ballasts for all fluorescent lights connected to dimming circuits as required to match dimmer unit/system.
2. Low voltage transformers for all low voltage light fixtures.
3. Tents as required for fixtures in fire rated ceilings as per applicable codes.
4. Thermal protection for all fixtures with tents or fixtures surrounded by insulation as per applicable codes.
5. Zero degree ballast for outdoor lighting fixtures.

6. Heat removal or air supply slot covers for all fixtures requiring them as determined by Mechanical Engineer.

T. Ceiling surface mounted fluorescent fixtures installed in exposed ceiling areas are to be suspended from ceiling structure with minimum 3/8" all-thread rods and 1-1/2" x 1-1/2" Kindorf channels, full length of fixture/row. Mount outlet box at structure with flexible connection to fixture.

U. Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and access.

V. Electrical Contractor shall remotely locate all transformers called for in these Specifications in a well ventilated and easily accessible space to comply with all codes. Revise circuitry as shown on plans as required to facilitate transformer/fixture location.

W. Voltage for all fixtures shall match the voltage of the lighting circuit fixture is connected to. Coordinate with Electrical Drawings.

X. All light fixtures shall have label near lamp socket, out of view of public stating maximum wattage of lamp allowed in fixture. Maximum wattage to be stated is wattage as shown on schedule of lighting equipment herein. Circuits are based on these wattages, circuitry, etc. Any failure to comply with this requirement shall be responsibility of contractor. Location of labels must meet acceptance of Lighting Designer, Architect and Engineer.

Y. Verify all fluorescent fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaires where factory failed to install luminaire disconnect.

3.3 ADJUSTING

A. Aim and adjust luminaires as directed.

B. Adjust exit sign directional arrows as indicated.

C. Relamp luminaires that have failed lamps at Substantial Completion.

3.4 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.5 DEMONSTRATION

A. Provide demonstration of luminaire operation.

3.6 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.7 CLEAN-UP

A. Luminaires:

1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as Windex and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection may not require cleaning. Clean Alzak aluminum surfaces (reflectors, fixture cones) per manufacturer's recommendations being careful to remove finger prints and smudges.

2. It is the Contractor's responsibility to remove any UL labels or manufacturers labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION 16510

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the drawings.

B. Light fixtures shall be neatly and firmly mounted.

C. Lamps shall be included in the system guarantee for a period of thirty (30) days after final acceptance of the project.

1.2 SECTION INCLUDES

A. Exterior luminaires and accessories.

B. Poles.

1.3 REFERENCES

A. ANSI C78.379 - Electric Lamps - Incandescent and High- Intensity Discharge Reflector Lamps - Classification of Beam Patterns

B. ANSI C82.1 - Fluorescent Lamp Ballast

C. ANSI C82.4 - Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

D. ANSI O5.1 - Wood Poles, Specifications and Dimensions

E. ANSI/NFPA 70 - National Electrical Code.

F. IES RP-8 - Roadway Lighting.

G. IES RP-20 - Lighting for Parking Facilities.

H. ASCE 7-98 - Minimum Design Loads for Buildings and Other Structures

I. I.E.S. - Illumination Engineering Society.

J. NESC - National Electrical Safety Code.

K. FBC - Florida Building Code.

1.4 SUBMITTALS

A. Submit point to point photometric analysis of the entire job site to the property line. Utilize photometric data obtained from submitted fixtures only. Verify that all submitted fixture types and light levels are compliant with all local codes, ordinances, and the authority having jurisdiction. Submittal will not be reviewed by the A/E without this narrative data.

B. Submit Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:

1. dimensions
2. U.L. Label
3. fusing
4. lens thickness

5. finish
6. voltage
7. lamps
8. Lightning arrestor, surge arrestor/, and/or surge protection device.

C. Submit drawings on concrete base complete with rebars, etc.

1.5 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual locations of each luminaire.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include instructions for maintaining luminaires.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Conform to requirements of FBC and ASCE 7-98.

C. Conform to requirements of IES.

D. Conform to requirements of NESC.

E. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Accept products on site. Inspect for damage.

C. Protect poles from finish damage by handling carefully.

D. Store and handle solid wood poles in accordance with ANSI O5.1.

1.10 COORDINATION

A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 - PRODUCTS

2.1 GENERAL

A. All lighting fixtures mounted outdoors subject to dampness and insects shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixtures housing shall be closed and sealed. All fixtures shall be complete with lamps, shielding, brackets, concrete bases, anchor bolts and all necessary fittings and accessories for a complete installation.

B. Furnish products as specified on Drawings.

C. All exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and U.L. labels. All labels shall be concealed within the body of the fixture and/or luminaire. No manufacturers name or logo shall appear on the exterior of any light fixtures unless accepted in writing by the engineer.

D. All light fixtures shall adhere to U.L. Test Standard #1571 and Section #410-65C of the National Electric Code. All manufacturers shall provide the required thermal protection as required.

E. Pole luminaires, poles, and concrete bases shall comply with applicable requirements of IES, NESC, and including but not limited to their requirements for illumination, uniformity, construction, wind loading, pole setback, breakaway, installation, glare criteria.

F. All site lighting fixtures/luminaries that may spill light onto adjacent properties shall have glare control shield installed on all fixtures/luminaries as required to meet the glare control requirements of applicable codes and standards. Add required glare control shield to order/model number of all site lighting fixtures.

2.2 BALLASTS

A. Fluorescent Ballast:

1. Description: ANSI C82.1, electronic ballast, rated for 0°F.
2. Provide ballast suitable for lamps specified.
3. Voltage: Match luminaire voltage and voltage of system to which applied.
4. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc.
5. Ballast to be protected with in-line fuse/fuseholder.

B. High Intensity Discharge (HID) Ballast:

1. Description: ANSI C82.4, lamp ballast to match lamp.
2. Provide ballast suitable for lamp specified.
3. Voltage: Match luminaire voltage and voltage of system to which applied.
4. Ballast to be protected with in-line fuse/fuseholder.

2.3 LAMPS

A. Provide lamp type specified for luminaire.

B. All lamps shall match those specified in Section 16510.

2.4 LIGHTNING ARRESTOR

A. Provide lightning arrestor for each pole light.

B. Lightning arrestor to be UL listed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine excavation and concrete foundation for lighting poles.

B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Install all fixtures in accordance with manufacturers' written instructions, NEC, IES and NESC.

B. Install lighting poles at locations indicated.

C. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base.

D. Install lamps in each luminaire.

E. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrodes at each pole. See Section 16170.

F. Where ceiling mounted fixtures are called for in the Light Fixtures Schedule and on the drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Clips identified for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted.

G. Pole installation shall comply with windloading criteria stated in ASCE 7-05 and Florida Building Code. Use V velocity = 120 mph; I Importance Factor = 1.15 and the formulas and tables presented in ASCE 7-05.

H. Provide soil compacting and/or treatment to assure windloading can be achieved for direct buried poles.

I. Ducseal shall be installed to seal all conduits entering exterior light fixtures from underground.

J. Lightning arrestor and in-line fusing to be located at handhole location of pole for easy access.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.4 ADJUSTING

A. Aim and adjust luminaires to provide illumination levels and distribution as directed.

B. Re-lamp luminaires which have failed lamps at Date of Substantial Completion.

3.5 GLARE CONTROL

A. Provide, install and adjust glare control shields to prevent light glare on adjacent properties.

3.6 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

E. Luminaires:

1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as "Windex" and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection may not require cleaning. Clean "Alzak" aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges.

2. It is the contractors' responsibility to remove any U.L. labels or manufacturers labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION 16530

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Emergency exit signs.
2. Emergency fluorescent lamp power supplies.

1.3 REFERENCES

A. Americans with Disabilities Act of 1990 (ADA)

B. ANSI C78.379 Classification of the Beam Patterns of Reflector Lamps

C. ANSI C82.1 Lamp Ballast – Line Frequency Fluorescent Lamp Ballast

D. ANSI/NFPA 70 National Electrical Code

E. Fed. Spec. W-L-305D Light Set, General Illumination (Emergency or Auxiliary)

F. Florida Building Code (FBC)

G. NFPA 101 Life Safety Code

H. NEMA WD 1 General Requirements for Wiring Devices

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of the following:

1. ADA
2. ANSI/NFPA 70
3. FBC
4. NFPA 101

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 DESCRIPTION

A. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the Drawings.

B. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures.

C. Lamps shall be included in the system guarantee for a period of thirty days after final acceptance of the building.

1.6 SUBMITTALS

A. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

1. Shop drawings shall be submitted for all fixtures that require modifications either as

specified or as required to fit architectural field conditions of this project; (i.e., specialty exit signs).

2. Shop drawings shall be complete showing all dimensions and installation instructions required for conditions on this project.

B. Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all fixtures showing:

1. Dimensions
2. UL label
3. Fusing
4. Metal gauge
5. Lens/louver thickness
6. Finish
7. Voltage
8. Lamps
9. Batteries

1.7 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data including replacement parts list.

1.8 MANUFACTURER'S QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years experience.

1.9 PRODUCT STORAGE AND HANDLING

A. Physically protect fixtures against damage as recommended by manufacturer.

1.10 MAINTENANCE MATERIALS

A. Provide to Owner:

1. Ten of each size/type of fuses.
2. Six of each type of lamps.

1.11 WARRANY

A. All ballasts furnished under this Division shall be covered by a warranty against defects. Warranty shall include payment for normal labor costs of replacement of inoperative in-warranty ballasts.

PART 2 - PRODUCTS

2.1 LUMINAIRES/FIXTURES

A. Furnish products as specified in schedule on Drawings.

B. Install ballasts, lamps, and specified accessories at factory.

C. All light fixtures shall adhere to UL Test Standard 1598 and NEC 410.115(C). All manufacturers shall provide the required thermal protection as required.

2.2 SELF-CONTAINED EMERGENCY POWER EXIT SIGNS

A. Type: Exit signs with integral battery-operated emergency power supply, including power failure

relay, test switch, AC ON pilot light, battery, and fully-automatic two-rate charger.

B. Battery: Sealed nickel cadmium cell, requiring no maintenance or replacement for ten years under normal conditions. Batteries to have a nine year warranty and provide for ninety minute capacity.

C. Exit sign fixture shall be suitable for use as emergency lighting unit.

D. Exit sign shall be die-cast with universal mount, universal arrows, down light, stencil face. Arrows shall be as shown on Drawings.

E. Exit signs to have long life LED lamps for normal and emergency operation, integral battery, battery charger, transformer, test switch, and LED charge monitor light.

F. Transformer shall be dual rated for 120 or 277 volts.

G. Furnish all lamps required.

H. Charger shall comply with UL 924.

2.3 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

A. Manufacturers:

1. Bodine Model B50 Series
2. Chloride Model CFP60 Series
3. Prescolite Model EFP5 Series
4. Lithonia PS1100 Series
5. Lightolier FBP50

B. Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.

C. Lamp Ratings: One or two FO32 T8 lamps providing a total of 900-1100 lumens for 90 minutes minimum.

D. Battery: Sealed nickel cadmium type, rated for seven year life.

E. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled luminaire.

F. Inverter/charger unit shall be completely solid state with automatic transfer in case of power failure and automatic cutout to prevent deep discharge of batteries. Recharge time shall be twenty-four hours maximum.

G. Units to be installed in fixtures utilizing energy saving lamps and/or ballast shall be a type compatible for use with this equipment.

H. Connect unit to local lighting circuit ahead of all switches. Provide and install wiring to accomplish this.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units plumb and level.

B. Aim directional lampheads as directed.

C. Adjust units as required to align with building lines and with each other. Secure to prohibit movement.

D. Adjust exit sign directional arrows as indicated. Re-adjust at project completion as required by Authority Having Jurisdiction.

E. Install illuminated exit signs as shown on Drawings, as herein specified, or as required by applicable codes.

F. Connect exit signs, inverter/battery units to local lighting circuit ahead of all switches.

G. Install suspended exit signs using pendants supported from swivel hangers.

H. Mount all exit signs at 7'-6" AFF to bottom of fixture or as required to meet ADA requirements. Provide all mounting accessories/hardware as required for proper mounting including pendant/swivel hangers.

I. Evenly space all emergency egress lighting units and provide proper lumen output of units as required to provide lighting levels and uniformity ratios required by applicable codes.

1. FBC Section 1006.2.3.1 Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of 1 footcandle and a minimum at ay point of 0.1 footcandle measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 footcandle average and a minimum at any point of 0.06 footcandle at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40:1 shall not be exceeded.

END OF SECTION 16535

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. It is the intent of these specifications to secure, for the purchaser, a diesel engine driven generator set of the latest commercial type and design as specified herein. All material and equipment shall be new and undamaged. System with all components must meet or exceed requirements of NFPA 110 for Level 1 loads, UL 2200 Stationary Engine Generator Assemblies and UL 1004 Electric Motors..

B. It is the essential that the engine-generator supplier maintain a local parts and service facility. The supplier shall furnish all installation and test supervision necessary for final acceptance. The generator set supplier shall furnish and install all equipment except underground fuel storage tanks and underground fuel piping. All power feeders and service entrance conductors and conduit shall be furnished and completely installed by electrical contractor. All generator control alarm and interlock wiring including conduit shall be completely furnished and installed by generator set supplier.

C. The use of a brand name in this specification is not intended to limit competition but rather is used as a standard of quality. Warranty-Equipment furnished under this section shall be guaranteed against defective parts or workmanship under terms of the manufacturer's and dealer's standard warranty. but, in no event shall it be for a period of less than one (1) year from date of initial acceptance of the system.

D. For system coordination, startup and single source service responsibility, the automatic transfer switches shall be provided by the generator set supplier. The transfer switch manufacturer shall be as specified in Section 16491. Installation drawings, job site installation recommendation as required by the installing contractor and system operation and maintenance manuals three (3) sets complete for the generator set accessories and automatic transfer switches shall be provided by the system supplier. A minimum of four (4) hours of operating and maintenance instruction for the system shall be provided after startup and testing.

1.2 EXPERIENCE

A. The units must be manufactured in the U.S.A. and shall be the product of a firm regularly engaged in the manufacture of engine sets and shall meet the requirements of specifications set forth herein. It must be a standard model in regular production at the manufacturer's place of business. Engine, generator and control panels are to be serviced by the same supplier so that there shall be one source and one responsibility.

1.3 SHOP DRAWINGS AND PRODUCT DATA

A. Submit shop drawings and product data on the following showing compliance with the specifications:

1. Generator/Engine
2. Exhaust muffler
3. Flexible exhaust piping
4. Base and spring vibration isolators
5. Base fuel tank
6. Control panel

7. Annunciator panel
8. Main line circuit breaker
9. Copy of service contract
10. Weatherproof housing
11. Batteries and rack
12. Battery charger
13. Complete load data sheet showing compliance with specified ratings.

B. Submittals shall clearly indicate:

1. Dimensions of unit complete with radiator, generator, engine, base, housing, etc.
2. All pertinent data/ratings as required to show equipment meets specifications.
3. Amperage of main line breakers and their interrupting capacity.
4. Dimensions, etc. of exhaust muffler, piping, base, isolator, day tank, control panel, annunciator panel batteries, rack, etc.
5. Weatherproof housing with location of batteries and day tank.

PART 2 - MATERIALS/PRODUCTS/INSTALLATION

2.1 GENERATING SYSTEM

A. The effective site rating of the electric power generating system shall be as noted on drawings.

B. The above ratings shall be based on site conditions as follows:

1. Generator shall be used for standby emergency service to provide continuous electrical service during interruption of normal power.
2. Generator installation as shown on plans.
3. Altitude of less than 200 ft. above sea level.
4. Maximum ambient temperature of 100° F.
5. Minimum ambient temperature of 20° F.

C. Ratings of the diesel electric set shall be based on operation of the unit at rated generator RPM, when supplied with all necessary operating accessories such as radiator, the air cleaners, lubricating oil pump, fuel transfer pump, fuel injection pumps, jacket water pump, alternating current generator, exciter, and other accessories necessary to the unit.

D. Diesel engines shall be able to deliver rated power when operating on No. 2 diesel fuel having 35 degree API (16°C or 60°) specific gravity.

E. Fuel consumption rates shall be based on fuel having a low heating value (LHV) of 42,780 kJ/kg (18,390 Btu/lb) when used at 29° (85°F) and weighing 838.9 g/l (7.001 lbs/U.S.). The maximum fuel consumption shall be:

Percent load	25%	50%	75%	100%
Fuel consumption(GPH)	4.91	7.43	9.8	13.6

F. Sound Level - Mechanical sound level where all generator sets are fully loaded shall be not greater than 75 dBA at 7 m (23 ft.).

G. Start Time and Load Acceptance - Engines shall start, achieve rated voltage and frequency, and

be capable of accepting load within ten seconds when properly equipped and maintained.

H. Block Load Acceptance - Transient response shall conform to ISO 8528 requirements.

2.2 ENGINE

A. The diesel engine shall be watercooled 2 or 4-cycle compression ignition diesel turbo-charged for maximum efficiency. Engine speed shall not exceed 1800 RPM. No dual speed or multi-speed engines will be considered.

B. The engine shall be equipped with air filters, fuel filters and fuel pressure gauge, lubricating oil cooler, filters, and oil pressure gauge, water pump and temperature gauge, service hour meter, flywheel, and flywheel housing.

2.3 DUTY CYCLE

A. The engine shall be capable of operation at light loads for extended periods of time and shall provide for precombustion of fuel or a similar means for the prevention of carbonization.

2.4 GOVERNOR

A. The engine governor shall be an Electronic Speed Control with 24 volt DC Electric Actuator. Speed droop shall be 0 (isochronous) from no load to full rated load. Steady state frequency regulation shall be +\- 0.25%. Speed shall be sensed by a magnetic pickup off the engine flywheel ring gear. A provision for remote speed adjustment shall be included.

2.5 COOLING SYSTEM - RADIATOR

A. The engine jacket water cooling system shall be a closed circuit design with provision for filling, expansion, and deration. The cooling pump shall be driven by the engine. Coolant temperature shall be internally regulated to disconnect cooling systems until operating temperature is achieved.

B. Heat rejected to the engine jacket water shall be discharged to the atmosphere through a close coupled engine mounted radiator. The radiator shall be sized to cool the engine continuously while operating at full rated load and at site conditions.

C. The fan, fan drive, and fan belts shall be covered with 14 gauge punched steel mesh guarding for personnel protection. The guarding shall conform to IEC 34-5, ISO and OSHA standards.

2.6 HEATER AND ANTIFREEZE

A. The engines shall be provided with antifreeze (a solution of 25% ethylene glycol) and suitable unit mounted thermal circulation type water heaters incorporating a thermostatic switch to maintain engine jacket water to 90°F in an ambient temperature of 30°. The heaters shall be sized as recommended by manufacturer, single phase, 60 hertz, voltage to match that shown on drawings. Heaters shall be Kim-Hotstart, Chromalox or accepted substitution.

2.7 LUBRICATION SYSTEM

A. The lubrication oil pump shall be a positive displacement type that is integral with the engine and gear driven from the engine gear train. The system shall incorporate full flow filtration with bypass valve to continue lubrication in the event of filter clogging.

B. The bypass valve must be integral with the engine filter base or receptacle. Systems where bypass valves are located in the replaceable oil filter are not acceptable.

2.8 FUEL SYSTEM

A. Injection pumps and injection valves shall not require adjustment in service. The engine shall have an individual mechanical injection pump and injection valve for each cylinder, any one of

which may be removed and replaced from parts stock.

B. Fuel injection pumps shall be positive action, constant-stroke pumps, actuated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be heavy seamless tubing, and to eliminate irregularity of fuel injections, shall be of the same length for all cylinders.

C. Fuel system shall be equipped with replaceable fuel filter elements which may be easily removed without breaking any fuel line connections or disturbing the fuel pumps or any other parts of the engine.

D. All fuel filters shall be conveniently located in one accessible housing, ahead of injection pumps so that fuel will have been thoroughly filtered before it reaches the pumps. No screens or filters requiring cleaning or replacement shall be used in injection pump or injection valve assemblies.

E. Engine shall be equipped with a built-in gear-type engine-driven fuel transfer pump, capable of lifting fuel against a head of twelve fee, for supplying fuel through the filters to the injection pump at constant pressure.

F. In addition to the standard filter, the fuel system shall include a primary fuel filter between the fuel tank and transfer pump to screen large contaminants.

G. A fuel/water separator shall protect the fuel system from water damage.

H. Tanks. Provide (complete with all piping, etc):

1. Skid Mounted. Provide complete under this Division.

   a) Mount under/in W.P. housing.

   b) Tank to meet all requirements of Department of Environmental Regulation Chapter 17-762 Above Ground Storage Tank Systems (for systems over 500 gallons).

   c) Tank to be of double wall construction.

2. Size. Size of tank shall be the larger of the following (submit calculations):

   a) Size as required by NFPA 110.

   b) Sized for 16 hours of full load operation.

   c) Sized for 300 gallons.

3. Annunciation. Provide low-level annunciation as required by NFPA 110.

4. All generator fuel tanks shall be installed by a Florida certified pollutant storage contractor. Installer shall obtain required permits for the installation of the fuel tank. Installer shall meet all applicable codes for the installation of fuel tanks and shall provide all required containment/monitor systems

5. Provide and install complete electric solenoid fuel shut-off valve with connections, etc., with control switch. Locate switch near building shunt-trip switches, and label "Gen. Fuel Shut-Off".

2.9 STARTING

A. Starting Motor - A DC electric starting system with positive engagement drive shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

B. Automatic Control - Fully automatic generator set start stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed, overcrank, and two auxiliary contacts for activating accessory items.

Controls shall include a 30 second single cranking cycle limit with lockout.

C. Batteries - A nickel-cadmium storage battery to be used in conjunction with the electric starting system shall be provided. The battery shall be rated by the battery manufacturer in accordance with requirements set forth by the engine manufacturer. A battery rack and necessary cables and clamps shall be provided. Batteries shall be mounted as shown. Wiring shall be sized as required by manufacturer for distance involved.

D. Battery Charger - Current limiting battery charger shall be furnished to automatically recharge batteries. Charger shall float at 1.4 volts per cell and equalize at 1.6 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC Voltmeter and fused AC input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than 6 amperes. Charger shall be Lamarche A46 or equal. Charger shall have an auxiliary contact to close on charger failure. Provide and install 2 #12, 1/2"C. from contact to remote annunciator.

2.10 GENERATOR

A. The generator shall be a three-phase, 60 hertz, single bearing, rotating field, synchronous, brushless type built to NEMA Standards. A voltage regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be +/- 2% from no load to full rated load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of +/- 5%. Generator and exciter shall be inherently capable of parallel operation with other power sources of equivalent electrical characteristics.

2.11 MAIN LINE CIRCUIT BREAKER(S)

A. A mainline molded case circuit breaker(s) sized to the output of the generator shall be installed as a load circuit interrupting and protective device. It shall operate both manually for normal switching function and automatically during overload and short circuit conditions. Breaker(s) shall be mounted on generator terminal box.

B. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters' Laboratories, National Electric Manufacturer's Association, and National Electrical Code.

C. Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protection.

2.12 EXHAUST AND MUFFLER

A. A critical exhaust silencer shall be provided in accordance to the Engine manufacturer's recommendations for silencing. The silencer shall provide extreme noise attenuation for environments with low background noise and slight noise emissions would be objectionable.

B. A flexible stainless steel exhaust adapter, 12-inch minimum length should be furnished for mounting between the engine and exhaust piping. The muffler will be of side (or end) inlet design for horizontal mounting with flange(s) for connection to exhaust pipe(s) provided by Div. 15 contractor. Mount the silencer above the generator horizontally, pitch silencer away from engine and make provisions for draining moisture. Provide and install insulation (calcium silicate) complete on silencer.

2.13 BASE AND ISOLATORS

A. The engine-generator shall be mounted on a welded steel base and spring type vibration isolators shall be provided which will effectively isolate engine vibration from the foundation. A concrete base shall be provided as specified by the manufacturer. A rubber pad type isolator will

be acceptable for outdoor installations only.

2.14 HOUSING

A. Furnish and install a weatherproof housing for complete engine generator set.

B. Enclosures shall be weatherproof. All openings shall have hinged doors for total access with fixed air intake louvers, as required, and padlock-type door handles.

C. Enclosure shall be constructed of formed, prepunched, 14 gauge steel parts with expanded metal radiator guard complete with cadmium plated bolts, nuts, washers, hinges and screws for assembly. All surfaces shall be primed and painted to customer's preferred color.

D. Enclosure shall be complete with all required accessories such as exhaust mounting brackets, exhaust hole dress cap and radiator access cover, etc.

E. Enclosure shall be sized as required to house all accessories such as batteries, battery charger, day tank, suction pumps, etc.

F. Enclosure shall be Type G manufactured by Electric Specialty, Inc. or equal of same manufacturer as Generator Set.

2.15 GENERATOR CONTROL PANEL (AND CONTROLS)

A. A generator mounted NEMA 1 type vibration isolated 14 gauge steel control panel shall be provided to meet requirements of NFPA 110 for Level 1 systems.

B. Equipment - Panel shall contain, but not be limited to the following equipment:

1. Voltmeter, 1% accuracy (digital type)
2. Ammeter, 1% accuracy (digital type)
3. Ammeter-Voltmeter phase selector switch
4. (Remote) Automatic starting controls as specified (with remote control)
5. Voltage level adjustment rheostat (+/-5% voltage adjustment)
6. Frequency meter, 1% accuracy (digital type)
7. Dry contacts for remote alarms wire to terminal strips
8. Three position function switch marked "run" "off" "auto"
9. Equipment for shutdown required by NFPA 110
   a) Overcrank
   b) High engine temperature
   c) Low lube oil pressure
   d) Overspeed
   e) Remote emergency stop
10. Equipment for Alarms required by NFPA 110
    a) Control panel-mounted visual indication:
    -overcrank
    -low water temp. less then 70°F (21°C)
    -high engine temperature prealarm
    -high engine temperature
    -low lube oil pressure prealarm

-low lube oil pressure
-overspeed
-low fuel main tank
-EPS supplying load
-control switch not in auto. position
-battery charger malfunctioning
-low voltage in battery
-lamp test
-contacts for local and remote common alarm
-low starting air pressure
-low starting hydraulic pressure
-air shutdown damper when used

b) Remote Audible:
-overcrank
-low water temp. less then 70°F (21°C)
-high engine temperature prealarm
-high engine temperature
-low lube oil pressure prealarm
-low lube oil pressure
-overspeed
-low fuel main tank
-control switch not in auto. position
-contacts for local and remote switch
-air shutdown damper when used

11. Equipment for Controls required by NFPA 110

a) Manual Emergency shutdown.

C. Any additional safeties as recommended by the manufacturer or as required by applicable codes shall be provided. A mechanical overspeed system shall back up to the electric overspeed. Auxiliary relays and or contacts shall be provided to operate a remote annunciator panel as shown on drawings.

D. Provide all lock-out functions required by NFPA 110.

2.16 ANNUNCIATION PANEL

A. A panel shall be provided for remote mounting as shown to give audible and visual warning of fault or alarm conditions in the generator set, battery charger and levelometer. The panel shall conform with the requirements of the National Electrical Code, Section 700-12 and the National Fire Protection Association publication, NFPA 110. Panel shall be flush mounted at location shown in drawings. Where no location is shown, locate per NFPA 110 and Authority Having Jurisdiction. Simplex model or accepted substitution.

B. Annunciator shall be powered by generator battery and:

1. Have individual visual signals for:

a) When the emergency generator set is operating to supply power to load.

b) When the battery charger is malfunctioning.

2. Have individual visual signals plus common audible signal for:

a) Low lubricating oil pressure.

b) Low water temperature.

c) Excessive water temperature.

d) Low main tank fuel level (less then three-hour supply).

e) Overcrank.

f) Overspeed.

C. Provide and install all wiring and conduit to generator control panel, battery charger, and levelometer as required to perform the above annunciation.

2.17 REMOTE MANUAL STOP STATION

A. Locate at location acceptable to authority having jurisdiction.

2.18 SYSTEM SERVICE CONTRACT

A. The supplier of the standby power system must provide a copy of and make available to the Owner his standard service contract which, at the Owner's option may be accepted or refused. This contract will accompany any documents, drawings, catalog cuts, specifications sheet, wiring or outline drawings, etc. submitted for acceptance to the designing engineer.

2.19 ACCEPTABLE MANUFACTURERS

A. Caterpillar

B. Onan

C. Kohler

D. Cummins

PART 3 - EXECUTION

3.1 INSTALLATION

A. The emergency generator shall be installed as shown on the plans, in accordance with the manufacturer's recommendations and all applicable codes. Provide all associated control wiring to generator, annunciator, transfer switches, etc. as required.

B. Provide all interface control wiring and conduit as required to provide complete emergency operation of equipment on project.

3.2 SITE TEST

A. See section of these specifications on Automatic Transfer Switches.

3.3 LOAD BANK TEST

A. After the building load test, a load bank test will be performed. This test shall be done with resistive dry load banks, in the presence of the Engineer and Owner. Test shall be performed during regular county hours and days only - Monday - Friday, 8:00 A.M. to 5:00 P.M.

1. 1 hour 50%.

2. 2 hours 75%.

3. 3 hours 100%.

4. 10 minutes cooldown.

B. During test, a written log shall be maintained at 15-minute intervals with the following:

1. Ambient Air Temperature

2. Amperes

3. Hertz
4. Oil Pressure
5. Water Temperature
6. Battery Charging
7. Exhaust Stack Temperature
8. Noise Level in dba (each side)
9. Fuel for load test to be included in bid

3.4 FUEL TANK INSTALLATION

A. Install fuel tanks as required by all applicable codes, regulations, authorities, etc.

3.5 ANNUNCIATION

A. Install remote annunciator complete with all wiring/conduit in location per NFPA 110 and local Authority Having Jurisdiction.

END OF SECTION 16621

PART 1 - GENERAL

1.1 DESCRIPTION

A. Description of Systems:

1. A Lightning Protection System shall be provided and installed on the structure even though not shown on drawings, by experienced installers in compliance with provisions of Code for Lightning Protection Systems as adopted by the National Fire Protection Association and Underwriters' Laboratories. All equipment to that result shall be included whether or not specifically called for herein with the additional requirement that the system shall meet all the requirements of LPI.

2. Bond/ground all building mounted and/or grade mounted antennae and satellite systems/dishes.

3. Provide complete lightning protection system for all pavilions and/or structures, including but not limited to all shelters and play ground pavilions.

4. Materials shall comply in weight, size and composition with the requirements of Underwriters Laboratories and the National Fire Protection Code relating to this type of installation, and shall be UL Labeled.

5. All materials, where available by any one manufacturer, shall be cast.

6. System shall comply with the following:

a) ANSI/NFPA 780; Class I

b) UL 96A; Master Label for:

1. New installation

1.2 SECTION INCLUDES

A. Air terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

1.3 REFERENCES

A. ANSI/NFPA 780 - Lightning Protection Code.

B. ANSI/UL 96 - Lightning Protection Components.

C. LPI - Lightning Protection Institute.

D. UL 96A - Installation Requirements for Lightning Protection Systems.

E. Section 16170 - 'Grounding and Bonding.'

F. Section 16090 - 'Tests and Performance Verification.'

1.4 SUBMITTALS

A. Submit shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details. Drawings shall include full layout of cabling and points, and connections.

B. Submit product data showing dimensions and materials of each component, and include

indication of listing in accordance with ANSI/UL 96.

C. Submit manufacturer's installation instructions.

D. Submittal shall include ground wells as called for in Section 16170.

1.5 PROJECT RECORD DOCUMENTS

A. Submit project record documents.

B. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum five (5) years documented experience and member of the Lightning Protection Institute.

B. Installer: Authorized installer of manufacturer with minimum five (5) years documented experience and member of the Lightning Protection Institute.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference one (1) week prior to commencing work of this Section.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with roofing and exterior and interior finish installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Thompson Lightning Protection, Inc.: Premium Line.

B. Independent Protection Company, Inc.: Premium Line.

C. Heary Bros. Lightning Protection: Premium Lines.

D. Harger Lightning Protection, Inc.: Premium Line

E. National Lightning Protection Corp.

2.2 MATERIALS

A. Components: In accordance with ANSI/UL 96 and LPI.

B. Air Terminals:

1. Air Terminals shall be solid (copper) as required to match roof conductors, and shall have proper base support for surface on which they are attached, and shall be securely anchored to this surface.

2. Terminals shall be of such length as to comply with NFPA 780.

C. Roof penetrations shall be Harger 230 Series assemblies, or equal.

D. Conductors:

1. Roof conductors shall consist of (copper) complying with the weight and construction requirements of the Code. Roof conductor material shall match and/or be compatible with roof flashing material.

2. Down conductors shall be copper, and shall be provided where shown installed in PVC conduit and hidden within the structure.

3. If routing of down conductor raceway is in location where PVC is not allowed per code, install in metal conduit to meet code and bond both ends.

E. Fastener:

1. Conductor fasteners shall be of the same material as the conductor, having ample strength to support conductor. Do not penetrate metal roof.

F. Connectors and Splicers:

1. Above grade and accessible: They shall be bronze or aluminum as required to be compatible with conductor being connected.

2. Below grade or concealed: exothermic connections

G. Ground Rods:

1. Ground rods shall comply with all requirements of Sections 16170 and 16090.

2. Install in ground wells in accessible area (not in sidewalks, unless specifically accepted by engineer).

H. Ground Plate: Copper.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as shown on shop drawings.

C. Beginning of installation means installer accepts existing conditions.

3.2 PROTECTION OF SURROUNDING ELEMENTS

A. Protect elements surrounding work of this Section from damage or disfiguration.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with UL 96A, ANSI/NFPA 780, and LPI.

C. Install ground rods in accordance with Section 16170. Where conflict exists between the requirements of Section 16170 and this Section, the most stringent shall govern.

D. Installation shall be made in an inconspicuous manner with conductors coursed to conceal equipment as much as possible. Down conductors shall be concealed within structure, and shall be run in 1" conduit complying with NEC. See Paragraph 'F' below and NFPA 780-4.15.1.

E. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.

F. Conductors concealed in steel reinforced concrete shall be installed, bonded, etc. per NFPA 780-4.15.3. Specific attention is brought to the requirements of NFPA 780-4.9.13 requiring down conductors to be connected to reinforced steel at its upper and lower extremities.

G. Lightning protection system shall be bonded to metal bodies as required by NFPA 780-4.21.

1. The Contractor shall provide proper connection of the lightning protection system to all grounded media in and around the protected structure (see NFPA 780-4.20 'Potential Equalization').

2. The Contractor shall provide proper grounding of all grounding media in, on and around

structure to provide common ground potential per NFPA 780-4.14, including electric service, telephone and antenna system grounds, underground metallic piping systems, underground metal conduits.

3. All fences, gates, handrails, metal flagpoles, metal bleacher seats, metal playground equipment shall be grounded and bonded to the grid.

4. Bond/ground all building mounted and/or grade mounted antennae and satellite systems/dishes.

H. Provide proper connections of lightning protection system to all grounded media in and around the protected structure per NFPA 780 4.20 "Potential Equalization".

I. Provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 4.14 including electric service, telephone and antenna system grounds as well as underground metallic piping systems, underground metal conduits, etc.

J. Ground Rods: Bond to ground ring system. See Section 16170 Grounding and Bonding. Items required to be bonded/connected in "H" and "I" above shall be bonded/connected via ground ring system where applicable and available.

K. All exposed conductors located 6 ft. or less above finished floor or finished grade is to be suitably protected/shielded as well as other exposed locations where conductor is subject to mechanical damage.

L. Coordinate and receive acceptance of all penetrations of roofing system and mounting to roofing system with Architect and Roofing Contractor prior to submittal of shop drawings.

M. Coordinate and receive acceptance of all connections to structural steel, rebar, etc. with Structural Engineer prior to submittal of shop drawings.

N. Submittal of shop drawing by Contractor is evidence that the Contractor has received acceptance of penetrations, connections, etc. by all parties and that Contractor assumes responsibility for such penetrations, connections, etc.

O. Ground Terminals:

1. Ground connections shall be made in accordance with requirements of all applicable codes and Section 16170 (including but not limited to requirements for testing, ground rods, materials, wells, etc.).

2. Ground rods shall be placed outside, a minimum of two (2) feet from building foundations. Top of rod shall be at least one (1) foot deep into earth (i.e. with minimum earth cover of one (1) foot). Install in ground well. Install gravel/rock in base of all ground well, from well bottom to minimum of 6 inches below well bottom.

3. Each and every ground rod location shall consist of:

   a) Two or more 30 ft. ground rods (5/8" copper) at no less than 30 ft. spacing shall be driven vertically to a depth resulting in one (1) foot earth cover.

   b) Bond the two or more ground rods together with a cable size that meets the applicable requirements of NFPA 780 for Class I or II locations as applicable.

   c) Provide additional rod electrodes as required to achieve specified ground resistance.

   d) Complete installation shall exceed the minimum requirements of NFPA 780.

   e) Provide grounding well enclosure at each ground rod location in accordance with Section 16170.

P. Install in accordance with Federal OSHA standards 29CFR 1910.23©(3), 1910.212, 1926.501(b), and the intent of 1926.701(b) "Guarded Requirements".

3.4 FIELD QUALITY CONTROL

A. Test grounds per Section 16170 and 16090.

B. Obtain the service of Underwriters Laboratories, Inc. to provide inspection and certification of the lightning protection system under provisions of UL 96A.

C. Obtain UL Master Label and attached to building at location directed by Owner.

D. Obtain UL Letter of Findings and submit to Architect/Engineer.

E. Submit test results on each ground location including final length of each ground rod and final distance between each installed ground rod at each ground rod location.

END OF SECTION 16671

PART 1- GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge protection for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section for systems with voltages between 120VAC and 208VAC.

B. Equipment specified herein covers Transient Voltage Surge Suppressors (TVSS) and Surge Protective Devices (SPD).

C. Provide surge protective device equipment for the following equipment:

1. On distribution and branch panels as called for on drawings or in these specifications.
2. All electronic communications equipment installed as per all section of 16700 including but not limited to: fire alarm, television, premis distribution, and sound systems.
3. All or any electronic equipment installed under Division 16 including electronic time clocks, controls systems, etc.
4. All or any electronic equipment installed under Division 15 including: electronic time clocks, control systems, etc.
5. Additional locations as required by NFPA 780.
6. On all ATS (automatic transfer switches).

1.2 REFERENCES

A. The latest edition of the following references shall apply to the work of this section:

1. ANSI/IEEE C62.33 Standard Test Specifications for Varistor Surge Protective Devices
2. ANSI/IEEE C62.41 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
3. ANSI/IEEE C62.45 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
4. NFPA 70 National Electrical Code
5. NFPA 780 Standard for Installation of Lightning Protection Systems
6. UL 1363 Standard for Safety Relocatable Power Taps
7. UL 1449 3rd Edition, Standard for Safety for Surge Protective Devices

1.3 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 16012.

B. Submit Product Data for each type of suppressor:

1. Dimensions.
2. Means of mounting.
3. Compliance with U.L Standards referenced.
4. Compliance with IEEE Standards referenced.

5. Design type (Hybrid, MOV).
6. Internal fusing.
7. Recommended overcurrent protection.
8. Size of wire leads.
9. Visual failure indicator.
10. Warrantee.
11. Performance data showing compliance with performance as specified herein.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance (O&M) data as called for in Section 16098.

B. O&M data to include:

1. All accepted shop drawings, product data, and/or cutsheets.
2. Installation, connection, and maintenance information on each type of surge protective device.
3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.

1.5 QUALITY ASSURANCE

A. All surge protective devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.

B. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor. Factory representatives are to accept installation prior to Substantial Completion.

1.6 REGULATORY REQUIREMENTS

A. Equipment Certification: Surge protective equipment shall be listed by Underwriters' Laboratories, shall bear the U.L. seal and be marked in accordance with referenced standard. Surge protective equipment shall be U.L. listed and labeled for intended use.

B. Surge protective devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 780 and NFPA 70).

C. Comply with all standards and guides as listed under "References" above.

1.7 COORDINATION/PROJECT CONDITIONS

A. Verify proper grounding is in place.

B. Verify proper clearances, space, etc. is available for surge suppressor.

C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge protective device.

1.8 WARRANTY

A. All surge protective devices shall be warranted to be free from defects in materials and workmanship for a period of five (5) years.

B. Any suppressor which shows evidence of failure or incorrect operation during the warranty

period shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.

1.9 DEFINITIONS/ABBREVIATIONS

A. SVR. UL Protective Voltage Rating

B. MCOV. Maximum Continuous Operating Voltage.

C. MSCWR. Minimum Short Circuit Withstand Rating

PART 2 - PRODUCTS

2.1 GENERAL

A. Suppressors shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (N-G) mode protection.

B. Suppressors shall be of a Hybrid design, and include circuitry with tight, wave-tracking clamping characteristics.

C. Suppressors shall be designed to withstand a maximum continuous operating voltage of not less than 115% of nominal RMS line voltage.

D. Suppressors shall contain internal safety fusing to disconnect the suppressor from the electrical source if the suppressor fails, in order to prevent catastrophic failure modes.

E. Suppressors shall be fail safe, shall allow no follow-through current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.

F. Suppressors shall be UL 1449 listed and shall be accepted for the location in which they are installed.

2.2 SERVICE ENTRANCE PROTECTIVE DEVICES

A. General: Provide Service Entrance Suppressors on each main electrical service panel at each building and/or structure. Suppressors shall meet or exceed the following (in addition to requirements under 'General' above):

1. Suppressors shall be tested as per IEEE C62.41 to determine clamping voltage using Cat. C3 test criteria and UL 1449 requirements.

2. Suppressors shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 10KA, Cat. C3 test criteria.

3. Enclosure:

a) UL listed.

b) Fire retardant.

c) NEMA 1 as required for each location.

d) Surface mounted as required/shown/called for on drawings for each location.

B. Modular Design:

1. Replaceable module design. The panel mounted suppressor unit shall be designed with replaceable modules for purposes of in-service replacement.

2. The suppressor unit shall be designed with redundant back-up surge protection in the event of a module failure.

3. Module status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure.

4. Unit status indicators shall be provided to indicate the status of the complete suppressor unit. The LED status indicators shall be located on the hinged front cover to redundantly indicate module or unit failure.

5. Minimum Surge Capacity (L-N). :

   a) 75,000 Amps.

6. Maximum Clamping voltage, Peak Let thru Voltage, Suppressed Voltage Rating (SVR) and Maximum Continuous Operating Voltage. Comply with the following maximum voltages for both UL 1449 testing requirements and IEEE Cat C3 waveforms :

75KA Unit	L-L	L-N	L-G	N-G	MCOV
120/208 V, 3ph, 4W, wye					150V
UL 1449	800V	400V	400V	400V	
IEEE Cat C3	850V	425V	425V	425V	

7. Minimum Short Circuit Withstand Rating: 100,000 amps.

8. Manufacturers:

   a) 75KA Units.

      1. Advanced Protection Technologies Series TE/****XPS for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

      2. Leviton #52***-M3S Series for applied voltage with #52000-RS remote supervisor in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

      3. Sentrex Zonemaster 90 ZHA Series for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

      4. Intermatic #UG40 Series for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

2.3 SECOND LEVEL SURGE PROTECTIVE DEVICES AND UPS/ATS SYSTEMS.

A. General. Provide Second Level surge protective devices on each second level of the distribution system (including sub panels) and on all major electronic equipment ATS Systems. Suppressors. shall meet or exceed the following (in addition to requirements under 'General' above):

1. Suppressors shall be tested as per IEEE C62.41-1991 to determine clamping voltage using Cat. B3 test criteria and UL 1449 requirements.

2. Suppressors shall be sequential surge tested as per IEEE C62.45-1987, and shall withstand 1000 test cycles at 3KA, Cat. B3 test criteria.

3. Enclosure:

   a) UL listed.

   b) Fire retardant.

c) NEMA 1 as required for each location.

d) Surface mounted as shown/called for on drawings for each location.

B. Non-Modular Design

1. Remote Monitoring. Provide complete with:

a) Normally open and normally closed dry contacts for remote annunciation of unit status for interfacing with building management system.

2. Status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure. The LED status indicators shall be located on the front cover to redundantly indicate module or unit failure.

3. Minimum Surge Capacity (L-N). :

a) 50,000 Amps.

4. Maximum Clamping voltage, Peak Let thru Voltage, Suppressed Voltage Rating (SVR) and Maximum Continuous Operating Voltage. Comply with the following maximum voltages for both UL 1449 testing requirements and IEEE Cat B3 waveforms :

50KA Unit	L-L	L-N	L-G	N-G	MCOV
120/208 V, 3ph, 4W, wye					150V
UL 1449	800V	400V	400V	400V	
IEEE Cat B3	850V	425V	425V	425V	
277/480 V, 3ph, 4W, wye					320V
UL 1449	1800V	800V	800V	800V	
IEEE Cat B3	1700V	850V	850V	850V	

5. Minimum Short Circuit Withstand Rating: 100,000 amps.

6. Manufacturers:

a) 50KA Units (L-N)

1. Innovative Technologies VEG 120 (with internal protection) for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

2. Sentrex Series HA**** for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

3. Leviton #42*** Series for applied voltage with #32000-RS remote supervisor in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

4. Advance Protection Technologies TE/****XT.

5. Intermatic #PG2000 Series for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

2.4 Service Surge Arrester

A. Service Surge arrester shall be UL listed as Surge Arrester and as required to comply with Local Authority Having Jurisdiction. 50 kA per phase rating. Minimum short circuit current rating 200,000 amps.

PART 3 – EXECUTION

3.1 GENERAL

A. Provide, install and connect suppressor at first piece of electrical equipment (panel, switchboard, ATS, etc.) that the electrical service encounters as it enters the facility.

B. Provide, install and connect suppressor at each branch panel as noted on drawings.

C. Provide, install and connect suppressor at each Automatic Transfer Switch (ATS) in project whether shown on drawings or not.

D. Provide, install, and connect surge protection at location where Section 16700 equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect TVSS equipment to equipment being protected and maintain U.L. listing.

E. Provide surge suppressor at panel feeding exterior site lighting circuits for each circuit.

3.2 INSTALLATION OF SUPPRESSORS

A. Suppressors for other then 16700 equipment shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.

B. Suppressors for 16700 to 16899 section equipment power source shall be coordinated with the individual specification section contractor. Locate in terminal cabinet with surge protection equipment and bond together.

C. Suppressors shall be close nippled to the device being protected in a position near the neutral bus which will minimize lead length between suppressor and the buses or control breaker to which the suppressor connects. Suppressor leads shall not extend beyond the suppressor manufacturer's recommended maximum lead length without specific acceptance of the engineer.

D. Location shown on drawings is diagrammatic only.

E. Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.

F. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and accepted connections unless otherwise noted. Referenced to a common earth ground.

G. Suppressors shall be installed in a manner that allows simple replacement within short periods of downtime.

H. Suppressors other then point of use type and those for exterior lighting poles shall be installed with a means of disconnecting the suppressor at the panel. At the main service entrance location, provide a dedicated 30 amp, 3P-CB, 100,000 A.I.C. for the TVSS device. At the distribution secondary and/or subpanels location, provide dedicated 20 amp or 30 amp, 3P-CB, for the TVSS device. Label disconnect or CB "Surge Protector". Fused disconnects may be substituted for the CB, with the acceptance of the engineer. Contractor to change rating of CB's noted above as required to properly provide system as recommended by manufacturer.

END OF SECTION 16691

PART 1 - GENERAL

1.1 GENERAL

A. Applicable provisions of applicable sections of Division 16, "General Conditions," "Supplementary General Conditions," "General Requirements," and Division One, govern work under this Section.

B. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and test an automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.

C. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at the time of design. However, it is this contractor's responsibility to coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the engineer's attention at least seven (7) days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the authority having jurisdiction.

D. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.

E. The Contractor shall provide and install the Fire Alarm system (including all equipment, wiring, etc.) in accordance with the Manufacturer's recommendations.

1. Installation of devices shall be in accordance with the Manufacturer's requirements as well as the requirements of the Contract Documents. Recommendations by the Manufacturer for the proper installation of the Fire Alarm system and its equipment shall not preclude the requirement for the Contractor to comply with the requirements of the Contract Documents.

2. Termination of Fire Alarm circuits shall be in accordance with the Manufacturer's recommendations, applicable requirements of the National Electric Code (NFPA 70), ADA, other applicable Codes and the Contract Documents.

3. The Fire Alarm Installer shall be responsible for ensuring that prior to bidding the project the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the Fire Alarm System Manufacturer's recommendations for proper installation of the system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.

1.2 DESCRIPTION

A. The Contractor shall furnish and install a complete Addressable Analog Fire Detection System. The system shall include but not be limited to:

1. Main Fire Alarm Control Panel (FACP) including all required power supplies
2. Fire Alarm Annunciator Panel (FAAP)
3. Manual Pull Stations
4. Smoke Detectors
5. Duct Detectors
6. Heat Detectors
7. Combination Audible/Visual devices.
8. Visual devices.
9. U.L. Listed Dialer.
10. Modem for remote service capabilities.
11. Surge Suppression
12. Programming.
13. Grounding
14. Firestopping
15. Wire and cable labeling.
16. Electrical power required to comply with all functions and operations called for in this section of the specifications. Contractor shall provide and install all 120 VAC circuits as required.
17. Conduit, wire, wire fittings, terminal cabinets with plywood and terminal strips, and all accessories required to provide a complete operating system.

B. The contractor shall furnish and install all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code, to accomplish incidental functions of the fire alarm system including but not limited to the following:

1. Monitoring of Sprinkler System and/or Fire Protection System Flow and Tamper switches.
2. Monitoring of Sprinkler System and/or Fire Protection System Valve Supervisory switches.
3. Monitoring of Post Indicator Valve (PIV) switches.
4. HVAC system control and/or shutdown.
5. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown.
6. Control of fire, smoke, and/or combination fire/smoke dampers.
7. Fire suppression and or extinguishing systems.
8. Control of time out room door lock devices.
9. Connection to telephone tie lines, UL Listed dialer, etc. required for monitoring of the fire alarm system.

C. The system shall operate as a non-coded, continuous ringing system which will sound all audible devices and activate all visual devices until it is manually silenced. Where system is

silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.

D. The system shall be wired as a Class B system for all circuits.

E. The system is to be a complete analog addressable system.

F. All portions of fire alarm system shall be installed in conduit. Conduit and boxes to be installed by electrical contractor.

G. The fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.

H. Contractor to advise owner of requirements for monitoring the fire alarm system by owner's monitoring company and provide all electrical required for remote monitoring.

I. Provide and install wiring, equipment, etc. for connection to devices furnished under other divisions of the work.

J. Although they may not be indicated on the Fire Alarm system diagram and/or drawings, all required control and interlock wiring between the Fire Alarm system and building equipment shall be provided hereunder. Controls are required to/for/from:

1. Fire/smoke air and duct detectors
2. Fire, smoke and/or combination fire/smoke dampers.
3. Supply/Return fans, Exhaust fans.
4. Automatic fire extinguishing systems
5. Sprinkler and/or Fire Protection system components

K. Provide wiring for Post Indicator Valve Alarms, in each instance in which these are provided under work of Other Trades, connected to Fire Alarm System.

L. Provide terminal cabinets sized to house terminal strips and surge suppression equipment.

M. Surge Suppression

1. The contractor shall have equipment installed on the AC voltage supply and other lines taking care to arrest damaging electrical transient and spikes which can cause damage to the microprocessor components of the system. Central office telephone lines shall have equipment installed to arrest high voltages from electrical and/or lightning from entering the system and causing damage.
2. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building fire alarm system from the effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
3. Provide surge suppression equipment at the following locations:
   a) On each conductor pair and cable sheath entering or leaving a building.
   b) On each conductor associated with fire protection (sprinkler) system fire alarm connections.
   c) On any and all telephone lines.
   d) In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment. Where equipment being protected has internal surge suppression equipment, the surge

protection equipment herein specified is required to be installed in addition to internal equipment protection.

1.3 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

A. The equipment and installation shall comply with the current or applicable provisions of the following standards:

1. ANSI S3.41 American National Standard Audible Emergency Evacuation Signal
2. National Fire Protection Association Standards:
   a) NFPA 70 National Electric Code (including but not limited to Article 760, Fire Alarm Systems), Article 770 and Article 800.
   b) NFPA 72 National Fire Alarm Code
   c) NFPA 101 Code For Safety to Life from Fire in Buildings and Structures
   d) NFPA 90A Installation of Air Conditioning and Ventilating Systems
3. Underwriters Laboratories Inc. The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
   a) UL 864 (Category UOJZ) APOU Control Units for Fire Protective Signaling Systems. All Control Equipment shall be listed under UL category UOJZ.
   b) UL 268 Smoke Detectors for Fire Protective Signaling Systems
   c) UL 268A Smoke Detectors for Duct Applications
   d) UL 217 Smoke Detectors Single Station
   e) UL 521 Heat Detectors for Fire Protective Signaling Systems
   f) UL 464 Audible Signaling Appliances
   g) UL 1638 Visual Signaling Appliances
   h) UL 1481 Power Supplies for Fire Protective Signaling Systems
   i) UL 1424 Cables
   j) U.L. 1449 3rd Edition Standard for Safety for Surge Protective Devices
   k) U.L. 497, U.L. 497A, U.L. 497B.
4. All fire alarm equipment, including accessories to the system and including all wires and cable unless otherwise noted, shall be listed by the Underwriters' Laboratories product directory called Fire Protection Equipment and/or the Electrical Construction Materials List.
5. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
6. The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760.
7. All equipment supplied as part of the Fire Alarm System shall be provided by a single manufacturer and shall comprise a complete U.L. Listed Fire Alarm System.
8. IEEE: The fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in

Table 1, Location Category A High Exposure of ANSI/IEEE Standard C62.41-1980 (formerly IEEE Standard 587).

B. The equipment and installation shall comply with the current or applicable provisions of the following codes and laws:

1. Americans with Disabilities Act (ADA): The fire alarm system shall comply with ADA, Public Law 101-336, 1990. The system shall comply with ADA Accessibility Guidelines (ADAAG).

2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.

3. Local and State Building Codes.

a) Standard Building Code: Latest adopted edition.

b) Florida Administrative Code. All applicable chapters including but not limited to:

1. Chapter 4A Rules, including but not limited to:

(a) Ch 4A-3 Fire Prevention - General Provisions.

(b) Ch 4A-43 (Florida Handicap Code - Lodging)

(c) Ch 4A-46 Fire Protection System Contractors and Systems.

(d) Ch 4A-48 Fire Safety Standards for the Fire Alarm Systems.

2. Florida Administrative Code 10A-12 (Florida Handicap Code - Hospice)

c) Florida Department of Insurance:

1. Insurance Code: The fire alarm system and installation thereof shall comply with the State of Florida Department of Insurance rules. The requirements of the Florida State Department of Insurance shall be as promulgated by the Division of State Fire Marshal.

2. Fire Alarm Rules: The fire alarm system and installation thereof shall comply with the Fire Safety Rules promulgated by the Florida State Fire Marshal.

d) Department of Community Affairs Florida Board of Building Codes and Standards - Florida Accessibility Code For Building Construction, January 1994 Edition.

e) Orange County Code

f) Authority Having Jurisdiction:

1. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.

2. Fire Department:

3. Building Official:

4. State of Florida: Division of State Fire Marshal.

C. Surge Suppression

1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters' Laboratories, shall bear the U.L. seal and be marked in accordance with referenced standard. Such surge suppression equipment shall be U.L. listed and labeled for intended use.

2. Comply with all standards and guides as listed under "References" above.

D. Systems not capable of complete network interface operations as described in this specification shall supply a complete local area or wide area network with CRT/terminals at each location and shall obtain UL site certification and acceptance prior to the completion date. Certification shall not delay final system acceptance.

1.4 RELATED SECTIONS

A. All applicable sections of Division 0, Division 1, and Division 16.

B. Applicable sections of these specifications with regard to, but not limited to:

1. Doors
2. Standpipe and fire hose systems
3. Sprinkler systems
4. Extinguishing systems
5. Ductwork accessories: smoke dampers

C. Section 16770 - Public Address System

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years experience and with service facilities within 50 miles of Project.

B. Installer:

1. Company specializing in installing the products specified in this section with minimum ten (10) years experience.
2. The Installer shall be currently licensed by the Electrical Contractors' Licensing Board as a Certified Alarm System Contractor I (EF).
3. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, a fire alarm system manufacturer.
4. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.
5. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service 7-days-a-week, 24 hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least ten (10) consecutive years going back from date of bid.

C. Surge Suppression

1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
3. Verify proper clearances, space, etc. is available for surge suppressor.

D. Coordination/Project Conditions

1. Verify proper grounding is in place.
2. In installations where the electrical contractor does not provide a counterpoise system in conjunction with the underground raceway system, the fire alarm contractor shall provide

a coupling conductor within the fire alarm underground raceway system to run along side fire alarm conductors. Coupling conductors shall be sized according to applicable codes and standards.

E. To establish the type and operating characteristics of the fire alarm system, the equipment specified herein is used as a guide in determining the functions of the fire alarm system. Other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the Engineer:

1. Contractor qualifications (as listed above).
2. Complete lists, descriptions and drawings of materials to be used.
3. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
4. A complete riser diagram of Fire Alarm System.

F. Acceptable Manufacturers

1. Notifier
2. Fire Control Instruments, Inc.
3. Siemens
4. Edwards Systems Technology

1.6 SUBMITTALS

A. Submit in accordance with Sections 16010 and 16012.

B. In addition to requirements of 16010 and 16012, the contractor shall submit:

1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)
2. Manufacturer's data on all products, including but not limited to:
   a) Catalog cut sheets.
   b) Roughing-in diagrams.
   c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
   d) Operation and maintenance manuals.
   e) Typical wiring diagrams and risers.
   f) The contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.
3. Submit floor plans to locate all devices. Wiring diagrams shall include wire and raceway sizes, fire alarm control panels, riser wiring and associated raceway sizes, wiring details, connections and terminal identification. All devices shall be identified by the same applied identification symbol as shown on the contract documents.
4. Submit all load calculations and cable/wire sizing for each branch of the individual fire alarm field circuits. Wire sizing calculations to prove maximum three percent (3%) voltage drop at all AC voltages and maximum eight percent (8%) voltage drop at all DC voltages.
5. Battery sizing calculations.

6. Submit a detailed step by step testing procedure for a component by component system functional checkout and test.
7. Point to point wiring diagrams and block diagrams of system to be installed. Point to point wiring diagrams may be submitted at time of operation and maintenance manuals in lieu of in submittal brochure. Block diagrams shall be required with SUBMITTALS.
8. Riser diagrams and floor plans showing conduit runs and number of wires. All devices shall be identified by the same applied identification symbol as shown on the drawings.
9. Surge Suppression
    a) Surge protective data for 120 volt power source, power circuit, outside signaling circuit, and exterior incoming circuits from other buildings (if any), and outgoing circuits to other buildings (if any).
    b) Submit Product Data for each type of suppressor:
        1. Dimensions.
        2. Means of mounting.
        3. Compliance with U.L. Standards referenced.
        4. Compliance with IEEE Standards referenced.
        5. Design type (Hybrid, MOV).
        6. Size of wire leads.
        7. Warrantee.
        8. Performance data showing compliance with performance as specified herein.
        9. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
        10. Manufacturer's certified test data on each suppressor type.
        11. Test data from an independent test laboratory.
10. Name, qualifications, etc. of company providing and installing system.
11. Qualifications of installer. Submit proof installer meets specified requirements.
12. Proof of U.L. Listing. Indicate the U.L. listing, the U.L. classification, and NEC insulation type used for each type of wire to be used in installation of fire alarm and communications system.
13. Manufacturer's drawings showing all dimensions (height, width, and depth) for all cabinets used to house system components. Provide catalog pages, mounting details and specification sheets for all fire alarm system components and rough-in boxes.
14. Submit Florida Registered Firm certificate number.
15. Submit Florida Fire Alarm Contractor's license number.
16. Submit Fire Alarm Technician(s) Manufacturer's certification.
17. Detailed drawing of the Fire Alarm Control Panels layout indicating the exact arrangement of all zones, including expansion zones.
18. Network:
    a) Complete description data indicating UL listing for all network components.
    b) Complete sequence of operation of all functions of the network.

c) A list of every network node address.

d) A list of every address of every device connected to a network node that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits, and auxiliary control.

e) Complete network wiring diagrams for all components and interfaces to equipment supplied by others.

19. All drawings required herein shall be on AutoCAD Release 12 or higher.

20. Where required by Authority Having Jurisdiction submit signed and sealed documents as required by Authority Having Jurisdiction. Where Authority Having Jurisdiction requires shop drawings to be signed and sealed by a Registered Engineer, Contractor is required to submit same and include in his bid all costs associated with having a Registered Engineer other then the design Engineer of Record perform signing and sealing.

1.7 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Sections 16010.

B. In addition to the requirements of 16010, the contractor shall submit:

1. Updated and revised contract documents to record actual locations (as-installed) of all equipment, devices, initiating devices, signaling appliances, and end-of-line devices.

2. Record actual type, size, and routing of cables installed.

3. Record all cable identifications.

4. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".

5. All drawings required herein to be on AutoCAD Release 12 or higher.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit in accordance with Section 16010.

B. In addition to the requirements of 16010, the contractor's O & M Manuals shall include:

1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.

2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and codings (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.

3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.

4. Repair parts list for each and every major equipment item furnished.

5. Service manuals for each and every major equipment item furnished.

6. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.

7. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.

8. Surge Suppression

a) O & M data to include:

1. All accepted shop drawings, product data, and/or cutsheets.

2. Installation, connection, and maintenance information on each type of surge suppression.

3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.

9. Complete equipment rack layouts showing locations of all rack mounted equipment items.

10. CAD floor plans, prepared at a scale of not less than 1/16" = 1'-0" showing detectors, speaker locations and orientation, rack locations, and all other related device locations.

11. The Contractor/Installer shall videotape the entire training session(s), and submit the video tape with the Operational Manual.

C. Drawings required herein are in addition to those required under "PROJECT RECORD DOCUMENTS".

1. All drawings required herein shall be on AutoCAD Release 12 or higher. .

1.9 WARRANTY

A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.

1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.

2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

B. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

C. Surge Suppression

1. All surge suppression devices shall be warranted to be free from defects in materials and workmanship for a period of five (5) years.

2. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the owner.

3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire alarm system for one (1) year from date of Substantial Completion.

1. No charge shall be made by the installer and/or contractor for any labor, equipment, or transportation during this period to maintain functions.

2. Respond to trouble call within twenty-four (24) hours after receipt of such call.

1.11 EXTRA MATERIALS

A. Provide six (6) keys of each type.

B. Provide three (3) of each type of automatic smoke detector without base.

C. Provide three (3) of each type of surge suppression device.

1.12 OWNER'S INSTRUCTION:

A. Provide instruction to the Owner's designated personnel upon completion of the system installation. Instruction shall include a functional training session on fire alarm control panel operation and instruction on peripheral device operation, including what are normal indications and alarm indications of each type of new/added device. Videotape all training sessions and deliver (4) copies of tapes to Owner (for use in future training).

1.13 SYSTEM OPERATION

A. System operation shall meet the operation requirements of all codes and regulatory requirements.

B. Upon activation of the Fire Alarm System by a manual station, smoke detector, or any other new or existing automatic device the following shall take place:

1. Energize all alarm signaling devices.
2. Sound all audible alarms and flash visual signals.
3. Alert local fire department or proprietary system.
4. Cause alarm to be displayed on the annunciator section of the control panel.
5. Close all doors or fire shutters, held open by automatic release devices throughout the facility, or by zone (coordinate with architect and door hardware supplier, provide all electrical required).
6. Unlock all electrically locked time-out room doors (coordinate with the architect and door hardware supplier, provide all electrical required).
7. Shut down all air handlers, exhaust fans supplying or exhausting air.
8. Shut all fire and/or smoke dampers in ducts associated with the air handling units and exhaust fans which are shut down.
9. Transmit signals to the building automation system to tell system that the fire alarm system has taken control of respective mechanical system.

C. System operation shall meet the operation requirements of all codes and regulatory requirements.

D. Upon activation of the Fire Alarm System by a manual station the following shall take place:

1. Energize all alarm signaling devices.
2. Sound all audible alarms and flash visual signals throughout the building.
3. Alert local fire department or proprietary system.
4. Cause alarm to be displayed on the annunciator section of the control panel.
5. Cause alarm to be displayed on remote annunciator
6. Close all doors, held open by automatic release devices throughout the facility, or by zone (coordinate with architect and door hardware supplier, provide all electrical required).
7. Unlock all electrically locked doors (coordinate with architect and door hardware supplier, provide all electrical required).

E. Upon activation of the Fire Alarm System by any smoke detector, any sprinkler flow alarm switch or other automatic detection device, the following shall take place in addition to the above:

1. Shut down all air handlers and exhaust fans supplying or exhausting air in at least the zone where the alarm is initiated.
2. Shut all smoke dampers in ducts associated with the air handling units and exhaust fans which are shut down, in at least the zone where the alarm is initiated. (Coordinate with mechanical contractor and provide all electrical as required).

F. System supervisory faults, such as shorts, opens, and grounds in conductors, operating power failure, or faults within supervised devices, shall place the system in the trouble mode, which causes the following system operations:
1. Visual and audible trouble signal indicated by zone at the fire alarm control panel.
2. Visual and audible trouble signal indicated at remote annunciator panel.
3. Trouble signal transmitted to central station.
4. Manual acknowledgement function at fire alarm control panel shall silence audible trouble signal; visual signal shall be displayed until initiating failure or circuit trouble is cleared.

G. Alarm Reset: The system shall remain in the alarm mode until manually reset with a key accessible reset function. The system shall reset only if the initiating circuits are cleared.

H. Lamp Test: manual lamp test function causes alarm indication at each lamp on the fire alarm control panel and the remote annunciator.

I. When the fire alarm system is activated as a drill, all incidental functions shall be exercised including notification of the fire department.

J. Where required by codes or authority having jurisdiction:
1. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.

K. The fire sprinkler valve tamper switch, when closed, shall annunciate a supervision signal at the fire alarm control panel and annunciator panels, if any. This supervision signal shall not cause a general alarm.

L. Operation of auxiliary contacts in control panel to shut all smoke dampers in ducts associated with air handling units and exhaust fans which are shut down. (These shall not be controlled from detector unit contacts.)

1.14 ZONING

A. Alarm Zones.
1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
a) One per building, per floor for pull stations.
b) One per building, per floor for automatic devices.
c) One for each duct smoke detector.
d) Each device shall be an annunciated point.

B. Notification Zones.
1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
a) One (or more) circuit(s) for administration building
b) One (or more) circuit(s) for exterior horns

c) One (or more) circuit(s) for remainder of campus.

2. Breakdown circuits as required for load and distances involved.

C. Alarm Zones.

1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:

a) One per 3000 square feet per floor, for pull stations and heat detectors.

b) One per 3000 square feet per floor, for smoke detectors.

c) One for each duct smoke detector.

D. Notification Zones.

1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:

a) One per floor. Breakdown circuits as required for load and distances involved.

PART 2- PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.

2.2 RACEWAYS

A. General:

1. All raceways (conduit, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 16 of these specifications.

2. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the fire alarm system.

B. Conduit: Comply with Section 16111 except as noted below:

1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.

2. Size: Minimum size shall be 3/4" conduit.

C. Boxes:

1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.

2. Boxes shall be sized as required by the fire alarm system manufacturer and NEC for cables and/or device installed.

2.3 TERMINATION CABINETS

A. Terminal cabinets are to comply with applicable sections of these specifications.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.5 FIRE ALARM CONTROL PANEL (FACP)

A. General

1. The fire alarm control panel shall be of dead front construction and be modular in design. The control panel shall be capable of future expansion and shall provide active signal initiating as noted on drawings (or as herein) specified with zones as noted on drawings (or as herein specified). The control panel shall provide provisions for future expansion. The fire alarm control panel shall be semi-flush mounted (unless otherwise noted on drawings) and located as shown on the drawings.

B. System Capability

1. Communication with addressable devices: The system must provide communication with all initiating and control devices individually. All of these devices are to be individually annunciated at the control panel. Annunciation shall include "Alarm", "Trouble", "Open", "Short", "Ground", "Device Fail" or "Incorrect Device" conditions for each point.
2. All addressable devices are to have the capability of being disabled or enabled individually.
3. Each Signal Line Circuit (SLC) two-wire loop shall be capable of addressing a minimum of ninety-six (96) addressable devices and ninety-six (96) monitor or control modules.
4. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
5. Wiring Type, Distances, Survivability and Configurations: The system must allow up to 2,500 feet wire length to the furthest addressable device. Style 4 Signaling Line Circuit (as defined by NFPA-72) communications will be provided.
6. The system shall be capable of addressable devices and conventional devices within the same system.
7. All system circuits shall be inherently power limited per NEC 760.
8. The system shall be capable of communication with a minimum of fifteen (15) remote module locations.

C. Master Controller

1. The master controller shall be an integral part of the control panel and be microprocessor-based.
2. The master controller shall store all programming in non-volatile memory.
3. The master controller shall have an event log capable of storing a minimum of two hundred fifty-five (255) events in non-volatile memory.
4. The master controller shall include an eighty (80) character Liquid Crystal Display.
5. The master controller shall include, as a minimum, switches to accomplish Alarm/Trouble Acknowledge, Alarm Silence, Trouble Silence and System Reset.
6. The master controller shall include, as a minimum, LED's to indicate System Alarm, System Trouble, Supervisory Alarm and System Silence.
7. The master controller shall support connection of serial remote annunciators.
8. The master controller shall provide a minimum of two (2) notification appliance circuits (Class B, Style Z).
9. The master controller shall be capable of being expanded as necessary to accommodate all required modules.

D. Notification Appliance Circuits

1. The Notification Appliance Circuits Module shall provide fully supervised style Z (Class B) notification circuits. These circuits shall supervise and power polarity reversing loops containing up to 1.75 amperes of 24 Volt notification devices.

2. An expansion printed circuit board shall be provided for this module to extend its capability to 8 such notification circuits.

3. The module shall be provided with plugable contact wiring terminal strips for ease of installation and service. The terminal strips shall be UL listed for 12 AWG wiring.

E. Control panel shall include all equipment required to alert fire department and/or owner's monitoring service.

F. Power Supply

1. The power supply for the panel and all fire alarm peripheral shall be integral to the control panel. The power supply shall provide all control panel and peripheral power needs as well as 3.0 amperes of unregulated 24 VDC power for external audio-visual devices. The audio-visual power may be increased as needed by adding additional modular expansion power suppliers. All power supplies shall be designed to meet UL and NFPA requirements for power-limited operation on all external signaling lines, including initiating circuits and indicating circuits.

2. All power supplies shall be provided by the same manufacturer as the fire alarm control panel (FACP). Power supplies provided by manufacturers other than the manufacturer of the fire alarm control panel (FACP) shall not be acceptable.

3. Circuit breakers, or other over-current protection on all power outputs.

4. Input power shall be 120 VAC, 60 Hz. The power supply shall provide internal batteries and charger. Internal battery capacity shall be as required.

5. The battery pack shall provide maximum normal operating and supervisory power for:

a) 24 hours per NFPA 72

b) Provide low maintenance gel cell type batteries with sufficient ampere-hour rating to meet the above NFPA Standard and to operate all alarm signals for a duration of 15 minutes at the end of the required period of time.

G. Wall Mount Equipment Enclosure

1. The control panel, and all associated equipment, shall be housed in an enclosure designed for mounting directly to a wall or vertical surface. The back box and door shall be constructed of 16 gauge steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

2. The enclosure(s) shall be of sufficient size to house all equipment required for this project. All equipment shall be mounted in the enclosure(s) as designed by the manufacturer. Provide enclosures in quantities as required to provide a complete, UL Listed Fire Alarm system.

2.6 MANUAL STATION (NON-BREAK GLASS)

A. Manual fire alarm station shall be non-code, non break glass type providing noncoded signals and operating with a double action motion. Upon actuation, they shall not be restorable to normal except by use of a key. The key shall also allow stations to be tested nondestructively. The stations shall be constructed of high impact, flame retardant Lexan or metal with operating directions provided on the cover in highlighted, embossed lettering. The words

"FIRE ALARM" shall appear on the door in embossed letters one-half inch high or larger. Mount at 48" above finished floor to top and in accordance with NFPA and handicap standards. Manual stations shall be U.L. listed. Unit shall be equipped with an addressable interface module.

2.7 IONIZATION SMOKE DETECTOR

A. The contractor shall furnish and install Analog addressable ionization smoke detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.

B. The smoke detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch.

C. The sensitivity of the detector shall be monitored without removal of the detector head. Metering test points shall be accessible on the exterior of the detector head. Field adjustment of the sensitivity shall be possible when conditions require a change.

D. It shall be possible to perform a functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.

E. To facilitate installation, the detector shall be nonpolarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.

F. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

2.8 DUCT MOUNTED SMOKE DETECTOR

A. The Duct Mounted Smoke Detector for the fire and smoke detection system shall be a high velocity rated Analog addressable series smoke detector intended for use with ventilation and conditioning ducts.

B. The detector shall provide detection of combustion gases and smoke in air conditioning ducts in compliance with NFPA 90A. The detector shall be UL-listed specifically for the use in air handling systems.

C. The detector shall operate at air velocities raging from 300 feet per minute to 4000 feet per minute without requiring compensation for operation at specific air velocities. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

D. Whether shown on drawings or not, a remote alarm indicator/test station shall be provided for each duct mounted smoke detector to annunciate smoke detector operation remotely. Mount unit in ceiling or wall near respective remote smoke detectors (in an occupied space).

2.9 HEAT DETECTORS

A. The contractor shall furnish and install Analog addressable heat detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.

B. The heat detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch.

C. Fixed temperature automatic heat detectors shall be rated at 135°F. The fixed temperature element shall use dual thermistor technology. Detectors shall have a smooth ceiling rating of 625 square feet and 2 Form 'A' contacts with rating of 3 amps at 6 to 125 volts A.C. and 1 amp at 6 to 28 volts D.C.

D. Detectors shall be installed in accordance with appropriate articles of National Fire Protection Association and the spacing rating assigned by the Underwriters' Laboratories and located as shown on the drawings. Automatic heat detectors shall be Underwriter's Laboratories and Factory Mutual approved.

E. Where indicated on the drawings the contractor shall provide heat detectors rated, by the manufacturer, as explosion proof. If not an integral part of the heat detector assembly, the addressable module shall be located outside the area protected by the explosion proof heat detector (but interior to the building) in an accessible area. If the addressable module is located above a gypboard ceiling the contractor shall provide a fire rated access panel.

2.10 ADDRESSABLE MODULE

A. Analog addressable device shall be furnished as required to monitor fire alarm or supervisory initiating devices or control auxiliary functions. Each module shall contain address switches to assign a unique input point for programming or control by the system.

2.11 RELAYS

A. Relays required for control (i.e. Air Handler shutdown, Supply Fan shutdown, Exhaust Fan shutdown, Door Lock release, Smoke Damper closure, Fire Damper closure, Smoke/Fire Damper closure, or any other interface required by these specifications or applicable codes) shall be U.L. Listed relays suitable for use in Fire Alarm systems.

B. Per NFPA, relays used for control of other systems shall be located within three feet (3') of the device to be controlled.

C. Relays shall be analog addressable devices powered and controlled from the fire alarm system. Each relay shall contain address switches to assign a unique input point for programming or control by the system.

D. Each relay shall provide at least one set of Form "C" dry relay contacts.

2.12 AUDIBLE NOTIFICATION DEVICES

A. Audible notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.

B. The audible notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4" sq. x 2 -1/8" backbox.

C. The audible notification devices shall be U.L. listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA measured at 10 feet or more than 120 dBA at the minimum hearing distance from the audible appliance.

1. The audible notification device shall compliant with ANSI S3.41 for signal character conformance.

D. Audible notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.

2.13 AUDIBLE/VISUAL NOTIFICATION DEVICES

A. Audible/visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.

B. The audible/visual notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4" sq. x 2 -1/8" backbox.

C. The audible portion of the audible/visual notification devices shall be U.L. listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA

measured at 10 feet or more than 120 dBA at the minimum hearing distance from the audible appliance.

1. The audible portion of the audible/visual notification device shall compliant with ANSI S3.41 for signal character conformance.

D. The audible portion of audible/visual notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.

E. The visual portion of the audible/visual notification devices shall comply with the Americans with Disabilities Act which includes the following:

1. The lamp shall be a xenon strobe type or equivalent.
2. The color shall be clear or nominal white (i.e. unfiltered or clear filtered white light).
3. The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
4. The intensity shall be a minimum of 75 candela. The use of visual devices rated at 15/75 or 110 candela shall not be acceptable.
5. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
6. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

2.14 VISUAL NOTIFICATION DEVICES

A. Visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein. Visual notification devices shall be of the flashing type in compliance with Americans with Disabilities Act.

B. The visual notification devices shall comply with the Americans with Disabilities Act which includes the following:

1. The lamp shall be a xenon strobe type or equivalent.
2. The color shall be clear or nominal white (i.e. unfiltered or clear filtered white light).
3. The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
4. The intensity shall be a minimum of 75 candela. The use of visual devices rated at 15/75 or 110 candela shall not be acceptable.
5. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
6. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

2.15 SURGE SUPPRESSION

A. Non-Addressable Initiation Devices:

1. Plug-in replacement modular design with associated female wiring connector.
2. U.L. 497B listed and labeled.
3. Multi-stage hybrid protection circuit.

4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 μs waveform, 500A per line with 10 x 700 μs waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μs waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 1500 pf.
9. Manufacturer:
   a) EDCO #PC642C series with #PCBIB base.
   b) Or approved equal.

B. Addressable Initiation Devices and Data Loops:
1. Plug-in replacement modular design with associated female wiring connector.
2. U.L. 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 μs waveform, 500A per line with 10 x 700 μs waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μs waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 50 pf.
9. Manufacturer:
   a) EDCO #PC642C-LC series with #PCBIB base.
   b) Or approved equal.

C. Horn, Strobe, Control Power (Low Voltage):
1. Plug-in replacement modular design with associated female wiring connector.
2. U.L. 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 5KA with 8 x 20 μs waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μs waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Series Resistance: 0.2 ohms total per pair.
9. Manufacturer:
   a) EDCO #P164 series (1 pair); #P264 series (2 pair), each with #SD12-PC base.
   b) Or approved equal.

D. Power Circuit (120 volt):

1. U.L. 1449 listed.
2. 15 amp, 120V rated.
3. Suppressors shall be tested per IEEE, C62.41-1991 for Categories A and B.
4. Normal mode (L-N), and common mode (L+N-G) protection.
5. Internal fusing.
6. Hybrid design.
7. Indicators for normal operation and failure indication.
8. Enclosure:
    a) Fire retardant high impact, phenolic or plastic housing or metal enclosure.
9. Clamping voltage U.L. 1449, Line to Neutral, Category B Impulse At (3KA, 8 x 20 µs): 385V @ 120V.
10. Maximum Surge Capacity: 20,000 amps.
11. Maximum Continuous Operating Voltage: 115% of line voltage.
12. Provide hardwire connection or add 15 amp receptacle device to hardwired devices to match equipment being protected and maintain U.L. listing.
13. Provide additional 15 amp in-line fusing as required to comply with U.L. and the N.E.C. when connected to a 20 amp, 120V circuit.
14. Manufacturers:
    a) Leviton #51020-WM (hardwired).
    b) EDCO #HSP-121BL2.

E. Telephone Line Circuits

1. Must be U.L. 497 listed and labeled for primary protection.
2. Multi-stage hybrid protection circuit.
3. Plug-in replaceable modular design or individually mounted units.
4. Fail short/fail safe.
5. Surge capacity: 500 amp with 10 x 700µs waveform.
6. Clamp voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700µs waveform.
7. Maximum continuous operating voltage: 125% of peak operating voltage, minimum.
8. Manufacturers:
    a) EDCO #COHP(FS).
    b) Or approved equal.

F. Terminations

1. Provide terminals sized for circuits required on project.
2. Where surge suppression modules are for mounting on 'M' block assembly, provide M block assembly complete with grounding system that mates with surge suppression equipment.

G. Terminal Cabinets

1. Provide terminal cabinets for all terminations and surge suppression equipment including 120VAC power surge suppressor as required in Section 16691. Size terminal cabinets as required to facilitate installation of terminations and surge suppression in a neat and workmanlike manner.

2. Terminal cabinet to meet specifications in Section 16160 unless specifically manufactured for use.

3. Manufacturers:

a) Interior.

1. Square "D"

2. Hoffman

3. BUD

b) Exterior.

1. Hoffman

2. BUD

3. Carlon

2.16 CABLE

A. Contractor shall provide and install cable as required by the manufacturer, as specified elsewhere in these specifications, and to provide a complete, fully operational, UL Listed Fire Alarm system.

B. Fire alarm system cables installed in exterior and/or underground raceways shall comply with the applicable sections of N.E.C. Article 800.

2.17 WATERFLOW DETECTOR

A. Waterflow switch to be supplied and installed by the mechanical contractor and wired in to Fire Alarm System by systems contractor. Zone as shown on zone schedule.

2.18 SPRINKLER SUPERVISORY SWITCHES

A. Supervisory Switch to be supplied and installed by mechanical contractor and wired in to Fire Alarm System by systems contractor. Zone as shown on zone schedule.

PART 3- EXECUTION

3.1 INSTALLATION

A. The contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.

B. Locate, install, and test fire alarm and detection systems in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electric Code, the National Electrical Contractor's Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.

C. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.

D. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.

E. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.

F. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in Fire Alarm Installation and Service.

G. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The certifying licensee shall be present for the final test prior to certification.

H. As-built plans and wiring diagrams shall bear the signature and license number of the licensed fire alarm planning superintendent, the date of installation and the name, address, and certificate-of-registration number of the registered firm.

I. All components shall be completely wired. System shall be fully operable when main power service has failed and the Emergency Standby Generator has assumed emergency system loads. This shall require that any devices which required 120 volt power shall receive supply from an emergency 120 volt source.

J. Installation of detectors:

1. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.

2. All concealed detectors shall be provided with a remote indicating lamp and test switch installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.

3. Duct detectors shall be installed in accordance with NFPA 90A. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

3.2 RACEWAYS AND BOXES

A. Provide dedicated raceway with applicable boxes for all fire alarm wiring in accordance with applicable sections of these specifications.

B. All initiating, indicating and auxiliary control devices shall be mounted on UL listed outlet boxes.

C. Provide supporting devices per Section 16190.

D. Identify raceways and boxes per Section 16195.

3.3 WIRE/CABLE

A. Conductor: 98% conductivity, solid copper or stranded copper. If stranded conductors are used, then a compression lug shall be installed at every end. Wrapping twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductors without crimp-on lugs may be terminated into terminal strips of box-lug connectors.

B. Insulation: A type accepted by NEC for the application. Individual conductors shall be Type THHN/THWN. All cable shall be U.L. listed for fire-protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types.

C. Size: All conductors shall be sized as prescribed by the system manufacturer, with following minimums:

1. Multiplex Signaling Line Circuit: AWG #14, shielded twisted pair cable.
2. Notification Appliance Circuits, Devices: AWG #14 THHN/THWN conductors.
3. Initiating Circuits, Hard-Wired Devices: AWG #14 THHN/THWN conductors.
4. Initiating Circuits, Addressable Devices: AWG #14, shielded twisted pair cable.
5. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits.

D. The above wire sizes shall be increased to size as required to comply with authority having jurisdiction or as required for voltage drop, load, etc.

E. Color Coded:

1. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.

F. U.L.:

1. General: Fire-protective signaling cable shall be U.L. listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
2. Non-Power Limited: Fire protective signaling circuits classified as non-power limited shall use cable listed under U.L. Electrical Construction Materials Directory. Category HNHT, "NON-POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". all such cable shall have fire resistance, listing and markings as described in NEC 760-17. Minimum cable marking shall be NPLF.
3. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under U.L. Category HNIR, "POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.
4. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be U.L. listed as described in NEC 760-71. All such cable shall bear a cable marking that includes a Type designation as given in NEC Table 760-71(h). Provide Type FPL.

G. Connections of Installation Wiring:

1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.
2. Connections of installation wiring to alarm initiating devices and alarm indicating appliances shall be monitored for integrity.
3. Interconnecting means shall be arranged so that a single break or single ground fault will not cause an alarm signal.

4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.

5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

3.4 MANUAL PULL STATIONS

A. Install at 48 inches to top above finished floor.

B. All manual stations shall be in unobstructed locations.

C. Install to comply with NFPA, ADA, and all handicap/accessibility code requirements.

D. Provide, install, and connect additional pull stations (from that shown on drawings) as required to comply with above requirements.

3.5 AUDIBLE SIGNAL DEVICES, VISUAL SIGNAL DEVICES OR COMBINATION AUDIBLE/VISUAL SIGNAL DEVICES

A. Shall comply with NFPA, the Americans with Disabilities Act and other applicable handicap/accessibility codes including but not limited to the following:

1. Wall mounted devices shall have their bottom edge at heights above the finished floor of not less than 80 inches and no greater than 96 inches.

2. In general, no place in any room or space required to have a visual signal appliance shall be more then 50 ft. from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 ft. across, without obstructions 6 ft. above the finished floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 ft. apart, in lieu of suspending appliances from the ceiling. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3. No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 ft. from the signal. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3.6 END-OF-LINE DEVICE

A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

3.7 AUXILIARY CONTROL RELAYS

A. An auxiliary fire alarm relay used to control an emergency control device, e.g. motor controller for HVAC system fan or elevator controller shall be located within 3 ft. of the emergency control device.

B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.

C. Auxiliary control relays shall be listed for use with fire alarm systems.

3.8 CABLE IDENTIFICATION

A. Provide and install permanent cable markers on all cables/wire lines, telephone lines, etc. at terminal strips, terminal cabinets and at main equipment.

3.9 TELEPHONE TIE

A. Provide new conduit/wire from FACP and terminal cabinet to main telephone board. Connect as directed by owner/telephone company. Provide and install dialer with surge suppression on telephone line.

3.10 SURGE PROTECTION

A. General

1. Provide, install and connect new surge suppression equipment as specified herein, including protection of equipment power source, cable/wire entering or leaving building housing, main fire alarm system equipment, ground lugs, #6 copper ground wire in 3/4"c. to existing main building service ground.
2. Extreme care shall be taken by contractor to assure a properly surge protected system.
3. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
4. Installation of surge protection equipment and it's grounding must be per manufacturer's recommendations to assure short and proper ground paths.

B. Equipment Selection

1. Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.

C. Equipment Installation

1. Install surge suppression equipment per manufacturers recommendation at each wire terminal as noted under Part 1.
2. Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.
3. Locate surge suppression equipment in terminal cabinet nearest main equipment cabinet (FACP).
4. Coordinate with Section 16691 contractor to assure that surge suppression for 120VAC power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.

D. Ground Installation

1. Ground Bus Connections.
   a) Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
   b) Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
   c) Connect terminal cabinet "local" ground bus to "systems" ground bus installed per 16170 with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
   d) Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
2. Surge suppression equipment grounding.
   a) Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.
   b) Coordinate with Section 16691 contractor to assure that 120VAC power source/supply surge suppressor is also grounded to same local ground bus as

surge suppressors provided in this section for same system (i.e. fire alarm, intercom, television, etc.).

3. Conductors.

   a) Conductors shall meet requirements of Section 16123. Minimum size to be #12 THWN.

   b) Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.

   c) Do not bundle unprotected conductors with protected conductors.

   d) Conductors shall be kept as short as possible.

   e) Conductors shall be secured at 12" intervals with an accepted copper clamp.

   f) Grounding conductors shall be properly connected to the building service ground by accepted clamps.

4. Grounding Connectors

   a) Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or U.L. for the purpose.

   b) All connectors and fittings shall be of the Nicopress crimp or compression set screw type.

   c) Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

5. Telephone Circuits

   a) Systems utilizing telephone company pairs as a transmission medium shall be provided with a suppressor conforming to device in Part 2 of this specification.

   b) Suppressors shall be installed at each point where interface is made to telephone company pairs.

   c) In cases where a modem or other device is used to interface with the telephone circuit the following procedure shall apply:

      1. Where the modem or coupling device is furnished by the telephone company the suppressors shall be installed on the system side of the modem or coupling device.

      2. Where the modem or coupling device is furnished by the system contractor, the suppressor shall be installed on the telephone line side of the modem or coupling device.

3.11 CONDUIT/BOX IDENTIFICATION

A. Contractor shall identify fire alarm conduit and boxes with red paint in exposed locations. Identify conduit in concealed locations with 4" mark of red paint every 4'-0" O.C.

3.12 DEMONSTRATION

A. When system is complete it shall be demonstrated to Owner's Representative who shall be given complete instructions, spare parts, manuals and maintenance information.

3.13 SYSTEM TESTING

A. Prior to certification of the fire alarm system the contractor shall accomplish a complete test of the fire alarm system in accordance with NFPA 72, Test Methods.

B. Perform a complete, functional, component by component test of the entire fire alarm and detection system. Provide a detailed step by step testing procedure which is unique to this project, reflecting the type of system and the number and location of all components.

C. Demonstrate the proper operation of each component as follows:

1. Ionization, photoelectric, and duct smoke detectors: activate the detector with a "false smoke" product which has been specifically formulated for testing smoke detection systems.

2. Heat detectors: activate the detector by utilizing the detector check button.

3. Pull Stations: activate the station by operating the station in its normal mode.

4. Audible and Visual Alarms: verify proper operation when the system is put into the alarm mode.

5. Sprinkler Flow Switches: open the sprinkler system's inspection test valve. Verify that the flow switch sends an alarm signal within the allowed time corresponding to the switch's time delay setting.

6. Fire Alarm Panels: functionally check-out and test the panel per the manufacturer's written instructions. Demonstrate the proper operation of each modular component. Demonstrate automatic power change to batteries and back to building power upon a drop in voltage below the voltage threshold as specified by the panel manufacturer.

D. Demonstrate the supervisory function at each device loop circuit, and at all single component wiring runs such as for the sprinkler valve supervisory switches.

3.14 CERTIFICATION

A. After completion of the installation of the system, the licensee shall complete a NFPA Inspection and Testing form. The Inspection and Testing form format shall be as indicated in NFPA 72, Inspection and Testing Form. When an Inspection and Testing form has been completed, legible copies shall be distributed as directed by the Authority Having Jurisdiction.

B. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the Inspection and Testing form. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a "tie-on" tag. It shall be as required in the Fire Safety Rules.

3.15 FINAL DRAWINGS

A. As-built drawings shall be given to the Owner's representative, at time of instruction, in addition to those to be supplied as general requirements of the job.

3.16 AUTHORITY HAVING JURISDICTION

A. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at time of design. However, it is this contractor's responsibility to coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the authority having jurisdiction.

END OF SECTION 16721

PART 1 - GENERAL

1.1 GENERAL

A. Applicable provisions of applicable sections of Division 16, "General Conditions," "Supplementary General Conditions," "General Requirements," and Division 1, govern work under this Section.

B. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and install a Premise Distribution Empty Raceway System. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.

C. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at the time of design. However, it is this contractor's responsibility to coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the engineer's attention at least seven (7) days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the authority having jurisdiction.

1.2 SCOPE OF WORK

A. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways required for a complete and fully functional system as intended by these specifications. The Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall provide and install, within the wall, a properly sized conduit extended above ceiling and turned into room it serves for each device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from the device to an accessible area. Routing of raceway from device to device shall not be acceptable. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install sleeves and firestopping where penetrations are made through rated walls and floors.

1.3 DESCRIPTION OF SYSTEM

A. The Contractor shall provide a complete empty raceway system for the Premise Distribution System (PDS) to include all equipment, materials, and labor as required to provide, install and test complete a system as described herein. The system to include but not be limited to:

1. Telephone Service Entrance Pathway: Raceway from point of telephone utility connection to building service terminal backboard.
2. Backbone Pathway: Conform to ANSI/EIA/TIA-569 using conduit, cable tray, backboards, etc. as indicated.
3. Horizontal Pathway: Conform to ANSI/EIA/TIA-569-1990, using raceway, J-hooks, sleeves, backboards, and cabinets as indicated.
4. Raceways, outlet boxes, cabinets, identification, etc.: Conform to applicable sections in these specifications. Provide/install complete with all required basic materials.
5. Terminal backboards and/or cabinets.
6. Fireproofing.

B. Special Requirements for Cable Routing and Installation:

1. Sealing of openings between floors, through rated fire and smoke walls, existing or created by this contractor for cable pass through shall be the responsibility of the Contractor. Sealing material and application of this material shall be accomplished in such a manner which is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for raceway passage between locations as shown on the drawings shall be the responsibility of the Contractor. Any openings created by or for this Contractor and left unused shall also be sealed as part of this work.

2. The Contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.

1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

A. Reference Section 16014.

B. All referenced Standards, Codes, and Regulatory Requirements shall be either the latest version adopted by the Authority Having Jurisdiction or, where not formally adopted, the latest published version.

C. The equipment and installation shall comply with the current or applicable provisions of the following standards:

1. American Society for Testing and Materials (ASTM)

2. ANSI/TIA/EIA-568-A - Commercial Building Telecommunications Cabling Standard.

3. ANSI/EIA/TIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces.

4. ANSI/TIA/EIA-606 - Administration Standard for The Telecommunications Infrastructure of Commercial Buildings.

5. ANSI/TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

6. ANSI/EIA/TIA-492-AAAA - Detail Specification for 62.5 Micrometer Core Diameter/125 Micrometer Cladding Diameter Class 1a Multimode, Graded Index Optical Waveguide Fibers.

7. ANSI/EIA/TIA-TSB-67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.

8. FCC: Federal Communication Commission Part 68 as modified by Wiring Docket 88-57.

9. BICSI TDMM - Building Industry Consulting Service International, Inc. Telecommunications Distribution Methods Manual

10. Florida DMS/DOC - General Facility Requirements for Telecommunications Systems.

11. LPC - Lightning Protection Code (NFPA-780).

12. NEC - National Electrical Code (NFPA-70).

13. NFPA 262 - National Fire Prevention Association, 1470 Atlantic Avenue, Boston, MA 02210.

14. IEEE 802.3 - Institute of Electrical and Electronics Engineers LAN Standard for Ethernet.

15. IEEE 802.5 - Institute of Electrical and Electronics Engineers LAN Standard for Token Ring.

16. UL Listed - Underwriters Laboratories Listed.
17. UL Certified - UL's LAN Cable Certification Program.
18. UL 910 - Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.
19. UL 1666 - Test for Flame Propagation Height of Electrical and Optical Fiber Cables Installed Vertically in Shafts.
20. UL 1449 3rd Edition Standard For Safety for Surge Protection Devices
21. UL 497, UL 497A, UL 497B.
22. ANSI - American National Standards Institute.
23. NEMA - National Electrical Manufacturer's Association.

D. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

E. The equipment and installation shall comply with the current or applicable provisions of the following codes and laws:

1. Americans with Disabilities Act (ADA): Where applicable, the Premise Distribution System shall comply with:
   a) ADA, Public Law 101-336, 1990.
   b) ADA Accessibility Guidelines (ADAAG).
2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
3. Local and State Building Codes.
   a) Standard Building Code
   b) Florida Administrative Code
   c) Department of Community Affairs Florida Board of Building Codes and Standards - Florida Accessibility Code For Building Construction
4. Authority Having Jurisdiction:
   a) General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.

1.5 RELATED SECTIONS

A. All applicable sections of Division 0, Division 1, and Division 16.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.

B. Supplier: Authorized distributor of specified manufacturer with minimum 5 years documented experience.

C. Installer:

1. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and metallic premise distribution systems and have personnel who are adequately trained in the use of such tools and equipment.

2. Contractor shall specialize in installing raceway systems for Premise Distribution Systems with minimum five (5) years documented experience.

3. The Contractor shall be a direct sales division of, or the authorized and designated distributor for the equipment manufacturer whose product he intends to install.

4. The Installer shall be currently licensed by the Electrical Contractors' Licensing Board as a Statewide Low Voltage System Specialty Contractor (ES-069).

5. Installing Contractor shall maintain a permanent, local staff of specialists, including a Superintendent, for planning, installation, and service.

6. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service 7-days-a-week, 24 hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing Premise Distribution Systems for at least five (5) consecutive years going back from date of bid.

7. A resume of qualification shall be submitted with the Contractor's proposal indicating the following:

   a) A list of recently completed PDS projects of similar type and size with contact names and telephone numbers for each.

   b) A technical resume of experience for the Contractor's on-site Installation Foreman who will be assigned to this project.

   c) Similar documentation for any sub-contractor who will assist the Contractor in performance of this work.

8. Perform work governed by local telephone utility (service entrance only) in accordance with telephone utility's rules and regulations.

D. To establish the type and operating characteristics of the Premise Distribution System, the equipment specified herein is used as a guide in determining the functions of the system. Other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the engineer (See Section 16010 on Substitutions):

1. Contractor qualifications (as listed above).

2. Complete lists, descriptions and drawings of materials to be used.

3. A complete narrative outlining the differences between the specified product and the contractor's proposed substitution product.

4. A complete riser diagram of Premise Distribution System.

5. Where the Contractor proposes to substitute the specified cable (either copper or fiber optic) he shall provide to the engineer a complete copy of the U.L. Test report for that product. Proposed cable substitutions that are not accompanied by the appropriate U.L. test report will be rejected.

1.7 SUBMITTALS

A. Submit in accordance with Sections 16010 and 16012.

B. In addition to requirements of 16010 and 16012, the contractor shall submit:

1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)

2. Manufacturer's data on all products, including but not limited to:

   a) Catalog cut sheets.

b) Roughing-in diagrams.

c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

d) Operation and maintenance manuals.

e) The Contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.

f) Qualifications: Submit qualifications of system installer including but not limited to:

g) Contractor's license.

h) Proof of certification by the manufacturer(s).

i) Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

j) Submit labeling scheme and sample of label.

k) Contractor shall submit test reports, manufacturer's specification sheets and any other information necessary to determine compliance with material and equipment specifications described herein.

l) Submit a detailed step by step testing procedure for a component by component system functional checkout and test.

1.8 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Sections 16010.

B. In addition to the requirements of 16010, the contractor shall submit:

1. Record actual locations and sizes of pathways, terminal boards, etc.

2. Record "to and from" locations for all raceways at each terminal board or cabinet.

3. Provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment (cables, connectors, outlets, equipment). A clear and consistent nomenclature scheme is to be defined and used on the documentation.

4. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".

1.9 OPERATION AND MAINTENANCE DATA

A. Submit in accordance with Section 16010.

B. In addition to the requirements of 16010, the contractor's O & M Manuals shall include:

1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.

2. A complete and correct system schematic, showing detailed connections for all parts of the system. System performance measurements shall be documented as noted elsewhere in this specification.

3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, etc..

4. Drawings required herein are in addition to those required under "PROJECT RECORD DOCUMENTS".

1.10 WARRANTY

A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.

B. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.

C. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

D. The contractor shall guarantee all raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

1.11 DEFINITIONS

A. Horizontal Pathways. Horizontal pathways are facilities for the installation of communication cable from the communications closet to the work area communications outlet. Horizontal pathways encompass underfloor, accessfloor, conduit, tray and wireway, ceiling, sleeves, perimeter facilities and applicable fireproofing.

B. Backbone Pathways. Backbone pathways consist of intrabuilding and interbuilding pathways. The term backbone replaces rise, house, and building-tie cable terminology. Backbone pathways may be either vertical or horizontal. Interbuilding backbone pathways extend between buildings. Intrabuilding backbone pathways are contained within a building.

PART 2PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.

B. Provide all components, equipment, parts, accessories and associated quantities required for complete installations. All components may not be specified herein.

C. All devices/components/products shall be suitable for use intended, and meet all stated performance requirements for PDS configurations specified in this section.

2.2 RACEWAYS

A. General:

1. All pathways (conduit, raceways, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 16 of these specifications.

2. All pathways (conduit, raceways, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of ANSI/EIA/TIA-569.

3. Conduit. (Comply with Section 16111 except as noted below).

4. Metal flexible conduit shall not be used for PDS system.

5. Bushings: Provide insulated bushings on ends of all raceway. All backbone conduits shall have bonding bushings and be bonded to the Systems Ground Bus Bar with an insulated #6 AWG wire.

6. Pull Cords: Install pull cords in all raceway runs that are installed without cable.

7. Size:

a) See Part 3 for size requirements.

b) Minimum size shall be 1".

8. Boxes:

a) All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.

b) Boxes shall be sized as required by EIA/TIA and NEC for cables, conduit and/or device installed.

2.3 TERMINATION BACKBOARDS

A. Material: 3/4" A/C grade, Class A Flame Spread plywood.

B. Size: 8 ft. high with width as shown on drawings unless otherwise noted or required in these specifications.

C. Finish: Paint terminal board with gray paint having a flame spread rating of Class A as a minimum.

2.4 TERMINATION CABINETS

A. Terminal cabinets are to comply with applicable sections of these specifications.

2.5 "SYSTEMS" AND "LOCAL" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

PART 3EXECUTION

3.1 INSTALLATION

A. General

1. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The Contractor shall provide and install all raceways required for a complete and fully functional system as intended by these specifications. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall provide and install, within the wall, a properly sized conduit extended above ceiling and turned into room it serves for each device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from the device to an accessible area. Routing of raceway from device to device shall not be acceptable. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install sleeves and firestopping where penetrations are made through rated walls and floors.

2. Locate, install, and test the Premise Distribution System in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electric Code, the National Electrical Contractor's Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.

3. Install raceways and outlets as required to comply with all applicable requirements of the references and/or regulatory requirements called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.

4. Install all electrical basic materials per applicable sections of these specifications.

5. Properly ground system per applicable sections of these specifications.

6. Support raceways, backboards, and cabinets under the provisions of Section 16190, and/or as required by manufacturer's instructions.
7. Install raceways to conform to applicable sections of these specifications.
8. The PDS system contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.

B. Outlets:

1. General: Install outlets for PDS where indicated on the drawings. Install devices/inserts in outlets so that same orientation is used throughout project.
2. Outlets: Install per applicable section of these specifications (i.e., outlet boxes, indoor service poles, floor boxes, etc.).
3. Wall Plates: Provide and install a blank stainless steel cover plate on each outlet box.

C. Pathway

1. General

a) Provide and install raceway for all drops down walls, to non-exposed location, penetrations of fire rating assemblies/walls/etc., where exposed to damage, exterior locations, underground locations, interconnection of CC's, CP's, and CER's, or any combination thereof, for all backbone cables, and all areas required by applicable codes and standards or as otherwise noted/required in these specifications.

b) Where acceptable to authority having jurisdiction and all applicable codes/standards, cables above accessible ceilings may be run without raceways provided complete installation complies with all applicable codes/standards. Proper firestopping and support hardware must be utilized.

c) All raceways shall meet the applicable requirements of all Sections 16100 through 16199.

d) All raceways at terminal boards shall terminate at point within 6 inches of termination board with appropriate bushing, (ground if metal).

e) Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage PDS systems. PDS system wiring may be installed in underground pull boxes with other low-voltage systems provided:

1. Installation meets/complies with all applicable codes and standards.

f) Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.

g) Install raceways so no more than two 90° bends are in any raceway section without pullbox. Install additional pullboxes as required to maintain maximum of two 90° bends between pullboxes and/or termination points.

h) Label all raceway at both ends to indicate destination and PDS source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as-built (record) drawings.

i) Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.

j) Special Raceway Systems: Special raceway systems may be specified for some portions of the PDS system. Refer to the drawings and other sections of these specifications to determine where or if such systems are used.

k) Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.

D. Fire Stop

1. Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.
2. Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.
3. Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.

E. Horizontal Cable Pathway

1. Sleeves

a) Install rigid steel conduit sleeves with bushings on both ends at penetration of all walls above ceilings. Stub-out each side of wall a minimum of 12 inches.

b) Install firestopping at sleeves and all rated firewall/smoke wall penetrations. Stub-out wall as required for routing. Firestopping assembly must comply with UL for wall routing and material used.

c) Size sleeves as required by the NEC for cable installed, but in no case shall sleeve be less than 2 inch diameter, nor smaller than that required by "4)" below.

d) Sleeve size shall not be smaller than that required by EIA/TIA-569, Table 4.1-1, "Conduit Sizing."

F. Backbone Pathways

1. Install raceways as required above under "General."
2. Minimum size: 2" C.
3. Increase size of conduit/raceway/pathway called for above if larger size is called for on drawings or larger size is required per paragraph "2)" below.
4. Conduit/raceway/pathway size shall not be smaller than that required by EIA/TIA-569, Table 5.2-1, "Conduit Fill for Backbone Cable." Conduit size shall be based on type of cable and quantity of cables.

G. Pullboxes, Splice (Junction) Boxes, Outlet Boxes

1. Install per applicable sections of these specifications and all applicable codes/standards.
2. Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.
3. A pull or splice box shall be placed in a conduit run where:

a) the length is over 100 feet,

b) there are more than two 90° bends, or

c) if there is a reverse bend in the run.

4. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.

5. Outlet boxes shall be installed at locations shown on drawings per applicable codes/standards.
6. Provide bushed nipple at speakers receiving cable without raceway/conduit.
7. Every pullbox and/or splicebox shall have a hinged cover. Install appropriate access panel to allow cover to open.
8. Size:
    a) Where a pullbox is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pullbox.
    b) Where a pullbox is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
        1. for straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway;
        2. for angle and U pulls:
            (a) have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and
            (b) have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
                (1) ·six times the trade size diameter of the raceway; or
                (2) ·six times the trade size diameter of the larger raceway if they are of different sizes.
        3. for a raceway entering the wall of a pullbox opposite to a removable cover, have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.
9. Where a splicebox is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."
10. No box shall be smaller than that required by NEC 370-28 (a), (1) and (2).

H. Telephone System Service Entrance Conduit/Raceway:
1. General:
    a) Provide an underground telephone service entrance conduit system.
2. Raceway:
    a) Provide rigid Schedule 40 PVC conduit except all stub-ups, elbows and changes of direction shall be galvanized rigid steel.
    b) All bends shall be formed with large sweeping radius.
    c) Provide nylon pull cord in each raceway.
    d) Provide insulating bushing at all ends.
    e) Leave at least 12" of free pull cord and cap all ends.

f) Provide a pull box whether shown on drawings or not at least every two 90° bends and more as may be required by the telephone company cable installers. Pull boxes shall be dedicated to telephone cables.

g) Change of direction shall not exceed 90° per bend.

h) Provide suitable raceway mounting anchors or bracing to withstand cable pulling force.

i) Terminate and identify service conduit at the property line as directed by the telephone company cable installer.

j) For penetration of foundation walls below grade, provide a galvanized rigid conduit sleeve that extends at least 24" outside wall, or longer to reach undisturbed soil, to prevent service conduit shearing by building settlement.

k) Telephone service conduit shall be buried with at least 24" of cover.

l) When concrete encasement is not provided, bury a continuous orange plastic warning tape above the service conduit, "CAUTION-TELEPHONE LINE BURIED BELOW," or similar accepted wording. Tape shall be TerraTape by Reef Industries or accepted substitution. Tape shall be six inches wide, 6 mil plastic with minimum 600% elongation (extra-stretch).

m) Telephone service conduits shall be separated from power conduits by not less than:

1. of concrete or

2. of earth, well-tamped.

I. Termination Backboards

1. Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.

2. Install termination backboards plumb, and attach securely to building wall at each corner.

3. Finish paint termination backboards with durable gray paint having flame spread rating of Class A prior to installation of any equipment on termination boards.

4. Mark all backboards with the legend "PDS" under the provisions of Section 16195.

J. Grounding

1. Provide and install complete grounding system as required to comply with all sections of these specifications and applicable codes.

2. Connect Central Equipment rack to "systems" ground bus with #6 green insulated copper ground wire.

3. Connect metal conduit (via grounding bushing) to "systems" ground bus.

4. Connect cable shields to "systems" ground busbar.

5. Connect surge suppression equipment to "systems" ground busbar.

K. Terminal Boards

1. General:

a) Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.

2. Grounding:

a) Ground each terminal board by extending 1 AWG #6 green insulated copper conductor in 3/4" non-metallic conduit from a junction box at terminal board to the nearest accessible acceptable building grounding electrode system as defined in NEC Article 800-40(b). Where "SYSTEMS" grounding bus/bar (see Section 16170) is provided in same room as terminal board, the bus/bar may be used for grounding point if acceptable to telephone system installer and all applicable codes.

b) Locate junction box where directed by PDS installers.

c) Coil a minimum 6 ft. length of conductor pigtail and leave inside junction box.

3.2 FIELD QUALITY CONTROL

A. Perform all testing where necessary or specified to assure a fully functional system. Replace and/or repair and retest components that fail performance standards.

3.3 DEMONSTRATION

A. Demonstrate system to designated Owner personnel as required by applicable sections of these specifications.

B. Conduct walking tour of project. Briefly describe function, operation, and maintenance of each component.

C. Provide detailed operation and maintenance instruction and training.

D. Use submitted operation and maintenance manual as reference during demonstration and training.

END OF SECTION 16742

PART 1 - GENERAL

1.1 GENERAL

A. Applicable provisions of applicable section of Division 16, General Conditions, Supplementary General Conditions, General Requirements, and Division 1 govern work under this section.

B. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and test a Public Address System(s) (hereinafter referred to as "system" or "sound system). Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.

C. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least seven (7) days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the Authority Having Jurisdiction.

D. The Contractor is advised that circuit routing for this system is not shown on the project drawings. The Contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. Contractor shall provide and install a properly sized, flush mounted outlet box for every device with appropriate raceway to accessible location above ceiling. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. In locations where raceway and/or conduit is not accessible after completion of the project, and in non-ceiling areas, and in exposed locations, cabling shall be installed in appropriate raceway system complete to concealed/accessible location and/or termination equipment. Connect each device as required to perform requirement specified herein and/or on the drawings. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.

1.2 DESCRIPTION OF SYSTEM

A. The Contractor shall furnish and install a complete Public Address System(s). The system shall include but not be limited to:

1. Flush in-ceiling.
2. Speaker enclosure.
3. Compression circuiting.
4. Output provisions of 25V or 70.7V constant voltage lines.
5. Microphones and receptacles.
6. Surge suppression equipment on power source.
7. Ability to select speakers in zones as called for on drawings so that any input may be heard over any one (1) or two (2) individually or in any combination. Provide and install switches and relays to perform this function.

8. Speakers, backboxes, etc.
9. Raceway/outlet system, wire, cable, etc., complete with all basic materials.
10. Wire and cable labeling.
11. Terminal blocks.
12. Terminations.
13. Grounding.
14. Surge suppression.
15. Firestopping.

B. The system is to include all equipment, materials, and labor as required to provide, install and test a complete system as described herein.

C. System is to provide for distribution to local speakers all local microphone and/or input signals.

D. System speakers shall be tapped for individual room requirements. Speakers shall be tapped, main system amplifier sized, and overall system balanced to allow minor system adjustments after installation has been substantially completed. In no instance shall any speaker be tapped to its minimum setting prior to final adjustments.

E. Special Requirements for Cable Routing and Installation:

1. The majority of speaker wiring within buildings will be installed above ceilings. All cabling used throughout this project shall comply with the requirements as outlined in the National Electrical Code (NEC). All cabling shall bear CMP and/or appropriate markings for the environment in which they are installed.
2. Sealing of openings between floors, through rated fire and smoke walls, existing or created by this Contractor for cable pass through shall be the responsibility of the Contractor. Sealing material and application of this material shall be accomplished in such a manner which is acceptable to the fire and building Authorities Having Jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor's work. Any openings created by or for this Contractor and left unused shall also be sealed as part of this work.
3. The Contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
4. Maintain proper separation between system cables and all power and/or unshielded cables, as required to prevent noise, crosstalk, etc.

F. Surge Suppression:

1. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electronic equipment systems from the effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
2. See Specification Section 16691 Surge Protective Devices for surge suppression equipment required for 120 VAC and above circuits.

1.3 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

A. The equipment and installation shall comply with the current or applicable provisions of the following standards:

1. All requirements of EIA/TIA.
2. All requirements of Federal Communications Commission.
3. National Fire Protection Association Standards - NFPA 70 National Electrical Code
4. UL 13 - Power-Limited Circuit Cables
5. UL 444 - Communications Cables
6. UL 1449, 3rd Edition Standard for Safety for Surge Protective Devices

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and show.

C. Surge Suppression

1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters Laboratories, shall bear the UL seal and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.
2. Comply with all standards and guides as listed under "References" above.

1.4 RELATED SECTIONS/DIVISIONS/DOCUMENTS

A. All applicable sections of Division 0 and Division 1.

B. All applicable sections of Division 16 including, but not limited to,:

1. Sections 16000 through 16199.
2. Section 16691 - Surge Protective Devices (120V AC to 480V AC).

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years experience and with service facilities within 50 miles of Project.

B. Supplier: Authorized distributor of amplifier/control equipment manufacturer.

C. Installer:

1. Company specializing in installing the products specified in this section with minimum ten (10) years experience.
2. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for the amplifier system manufacturer.
3. Installing Contractor shall maintain a local staff of specialists, including a Superintendent, for planning, installation, and service.
4. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing educational intercommunication systems for at least ten (10) consecutive years going back from date of bid.

D. Surge Suppression

1. All surge protective devices shall be manufactured by a company normally engaged in

the design, development, and manufacture of such devices for electronics/communications systems equipment.

2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
3. Coordination/Project Conditions
   a) Verify proper grounding is in place.
   b) Verify proper clearances, space, etc. is available for surge suppressor.

E. To establish the type and operating characteristics of the Public Address System(s), the equipment specified herein is used as a guide in determining the functions of the system. Other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the Engineer (See Section 16010 on Substitutions):

1. Contractor qualifications (as listed above).
2. Complete lists, descriptions and drawings of materials to be used.
3. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
4. A complete riser diagram of the Public Address System(s).

1.6 SUBMITTALS

A. Submit in accordance with Sections 16010 and 16012.

B. In addition to requirements of 16010 and 16012, the Contractor shall submit:

1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)
2. Manufacturer's data on all products, including but not limited to:
   a) Catalog cut sheets.
   b) Roughing-in diagrams.
   c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
   d) Operation and maintenance manuals.
   e) Typical wiring diagrams and risers.
   f) The Contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.
   g) Complete wiring diagram for speaker zone switching and PABS System interface.
3. Included as part of the shop drawing submittals shall be an overall plan of the site indicating the following:
   a) All speaker locations
   b) The transformer tap value for each speaker
4. Manufacturer's drawings showing all dimensions (height, width, and depth) for all cabinets used to house system components. Provide catalog pages, mounting details

and specification sheets for all system components and rough-in boxes.

5. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices (where applicable).
6. Surge Suppression
   a) Surge protective data for 120 volt power source.
   b) Submit Product Data for each type of suppressor:
      1. Dimensions.
      2. Means of mounting.
      3. Compliance with UL Standards referenced.
      4. Compliance with IEEE Standards referenced.
      5. Design type (Hybrid, MOV).
      6. Size of wire leads.
      7. Warrantee.
      8. Performance data showing compliance with performance as specified herein.
      9. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
      10. Manufacturer's certified test data on each suppressor type.
      11. Test data from an independent test laboratory.
7. Name, qualifications, etc. of company providing and installing system.
8. Qualifications of installer. Submit proof installer meets specified requirements.
9. Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of wire to be used in installation of system.
10. Submit manufacturer's qualification certificates for all employees accomplishing the work of this project.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Article REGULATORY REQUIREMENTS.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Submit test reports, manufacturer's specification sheets and any other information necessary to determine compliance with material and equipment specifications described herein.

1.7 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Section 16010.

B. In addition to the requirements of 16010, the Contractor shall submit:

1. Record actual locations and sizes of pathways, speakers, terminal blocks, etc.
2. Record actual type and size of cables installed.
3. Record "to and from" locations coordinated with cable labeling for all cables at each terminal block or cabinet.

4. Final tap value for each speaker location.

5. Provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings, detailed cable drawings, with all cables and terminations identified, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment (cables, connectors, outlets, equipment). A clear and consistent nomenclature scheme is to be defined and used on the documentation and the cable labeling which facilitates locating and identifying each cable.

6. Cable Route Diagram: Provide locations and routes of "as-built" cable system and include:

   a) End points.

   b) Cable routing.

   c) Splice points.

   d) Terminations (connector type).

   e) Cable lengths (include slack).

7. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".

1.8 OPERATION AND MAINTENANCE DATA

A. Submit in accordance with Section 16010.

B. In addition to the requirements of 16010, the Contractor's O & M Manuals shall include:

1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.

2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and codings (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.

3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.

4. Operation Data: Include instructions for adjusting, operating, and extending the system.

5. Maintenance Data: Include repair procedures and spare parts documentation for each and every major equipment item furnished.

6. Test Data: Record of results for all cables/cable runs tested.

7. Data sheets showing all field labeling used for termination blocks, cable runs, speakers and on equipment.

8. Service manuals for each and every major equipment item furnished.

9. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.

10. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include

descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.

11. Surge Suppression

    a) O & M data to include:

        1. All accepted shop drawings, product data, and/or cutsheets.

        2. Installation, connection, and maintenance information on each type of surge suppression.

        3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.

12. Complete equipment rack layouts showing locations of all rack mounted equipment items.

C. Drawings required herein are in addition to those required under "PROJECT RECORD DOCUMENTS".

1.9 WARRANTY

A. The Contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.

1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.

2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

B. The Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

C. Surge Suppression

1. All surge suppression devices shall be warranted to be free from defects in materials and workmanship for a period of five (5) years.

2. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the owner.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of Public Address System(s) for one (1) year from date of Substantial Completion.

1. No charge shall be made by the installer and/or Contractor for any labor, equipment, or transportation during this period to maintain functions.

2. Respond to trouble call within twenty-four (24) hours after receipt of such call.

1.11 OWNER'S INSTRUCTION:

A. Training of school personnel (a minimum of two) shall be provided.

B. Training to cover the operation, location, nomenclature, documentation, documentation maintenance procedures, a "walk-through" for location and labeling orientation, operation of equipment installed as part of the contract, test documentation, and troubleshooting of the system.

C. Provide instruction to the Owner's designated personnel upon completion of the system installation. Videotape all training sessions and deliver (4) copies of tapes to Owner (for use in future training).

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.

B. Provide all components, equipment, parts, accessories and associated quantities required for complete installations. All components may not be specified herein.

C. All devices/components/products shall be suitable for use intended, and meet all stated performance requirements for Public Address System(s) specified in this section.

D. Manufacturers:

1. Basis of Design:

a) Bogen

2. Acceptable Substitution

a) Rauland-Borg

b) Or approved equal

2.2 RACEWAYS

A. General:

1. All raceways (conduit, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 16 of these specifications.

B. Conduit: Comply with Section 16111 except as noted below:

1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.

2. Size: Minimum size shall be 3/4" conduit.

C. Boxes:

1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.

2. Boxes shall be sized as required by the system manufacturer and NEC for cables and/or device installed.

2.3 TELEPHONE PAGING AMPLIFIER

A. Bogen Model TPU100B, wall-mounted telephone paging amplifier rated at 100 watts. Amplifiers permit paging from telephone and/or microphone; music input through an RCA jack or screw.

B. Features:

1. Inputs for 600-ohm balanced telephone line, Lo-Z balanced microphone, and background music.

2. Music input (RCA jack or screw terminals).

3. Integral automatic level control (ALC) circuit for controlling pages made by persons with varying voice levels and paging techniques.
4. Page from telephone and/or microphone.
5. Signal-activated paging channel automatically mutes background music.
6. Adjustable background music muting level during a page. Music gradually returns to its normal level after a page.
7. Audio enhancement circuit increases intelligibility, improves perceived loudness (with no increase in power), and reduces listener fatigue.
8. Separate controls for page volume, music volume, night ringer, music mute, and Audio Enhancement.
9. Bass and treble controls.
10. Built-in night ringer activated by contact closure or by 90V ring signal.
11. Balanced or unbalanced 16-ohm, 25V, 25V CT, and 70V outputs.
12. VOX sensitivity level control eliminates accidental transmission of background noise from a paging telephone.
13. Thermal and electronic overload protection.
14. Peak level indicator lights when amplifier is driven into clipping.
15. UL and C-UL listed.

C. Specs:

1. Frequency Response: 70 Hz to 15k Hz ± 1 dB
2. Distortion: Less than 1%
3. Hum and Noise: (20 Hz to 20 kHz) Music: -70 dB; Tel: -70 dB; Mic: -55 dB
4. Sensitivity: Music: 85mV; Tel: -20 dBm (77mV); Mic: 600µV
5. Tone control: Bass: ±9dB @ 100 Hz; Treble: ±9 dB @ 10 kHz
6. Regulation: 2 dB
7. Inputs:
   a) Tel: 600 ohm balanced line, transformer isolated
   b) Music: Hi-Z source, RCA jacks or screw terminals
   c) Mic: Lo-Z balanced, screw terminal connection (dynamic only)
   d) Music Mute: Mutes music when shorted
   e) Contact Ring: Sounds night ringer tone when customer supplied dry contacts are closed
   f) Tel Ring: sounds night ringer in response to 90V ring signal
   g) Bridging: Permits bridging of two amplifiers
8. Outputs:
   a) 25V, 25VCT, and 70V, 16 ohms balanced or unbalanced for 35/60/100 watt models. Provision for WMT1A line matching transformer
9. Controls and Indicators:
   a) Power and peak level LED indicators. Enhance, treble, bass, vox sens, ringer volume, music mute, music volume, mic volume, tel volume, alc controls (screwdriver-adjustable).
10. Operating Temperature: -4°F (-20°C) to 131°F (+55°C)
11. Finish: Black with silver lettering.

2.4 CEILING SPEAKER ASSEMBLIES

A. Speaker: Bogen coaxial loudspeaker with 4 watt transformer having available taps at .4 watts.

1. Ceiling Speaker Enclosure: Bogen RE84
2. Ceiling Steel Grille: Bogen S810T25PG8W, off-white enamel
3. Mounting Ring: Bogen MR8
4. Tile Bridge: Bogen TB8

2.5 DROP-IN CEILING SPEAKER (for 2 x 2 ceiling grid)

A. Wall Mounted Horn Loud Speaker: Bogen SPT15A horn loudspeaker with 15 watt transformer having available taps .9 watts.

2.6 VOLUME CONTROLS

A. Volume Controls: Bogen ATP10 shall be provided flush in wall in NEMA 3R enclosure adjacent to exterior speakers.

2.7 WALL MICROPHONE OUTLETS

A. Soundolier 5601-136 consisting of a Switchcraft B3F connector mount on a stainless steel plate.

2.8 MICROPHONES

A. EV #MP753 or accepted substitution, cardioid pattern microphone.

1. Each microphone shall have internal double shock mounting to isolate against mechanical and handling noises.
2. Response shall be 50 to 15,000 Hz and output level at 1kHz shall be 56 dB referencing 1MW/10 microbars.
3. Provide all necessary connectors.
4. Three button MIC, Zone 1, 2, and all call.

2.9 SPEAKER ZONE PAGING RELAYS

A. Zones to be as called for on detail on drawing.

B. Switches PSR #206 Atlas

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Install equipment in accordance with manufacturer's instructions.
2. Install equipment, cables, and speakers as required to comply with all applicable requirements of the references and/or regulatory requirements called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.
3. Install all electrical basic materials per applicable sections of these specifications.
4. Connect reproducers to amplifier with matching transformers.
5. Properly ground system per applicable sections of these specifications.
6. Support raceways and cabinets under the provisions of Section 16190, and/or as

required by manufacturer's instructions.

7. Install raceways to conform to applicable sections of these specifications.
8. Install system wiring and/or raceways away from any surface that may become hot, including and not limited to, hot water piping and heating ducts.
9. Install system wiring with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power or Class 1 circuits, separation may be reduced as described in NEC latest edition. Increase separation if so required to comply with EIA/TIA referenced standards.
10. Special Requirements for Cable Routing and Installation:
    a) The majority of speaker wiring within buildings will be installed above ceilings. All cabling used throughout this project shall comply with the requirements outlined in the National Electric Code (NEC). All cabling shall bear CMP and/or appropriate markings for the environment in which they are installed.
    b) Sealing of openings between floors, through rated fire and smoke walls, existing or created by this Contractor for cable pass through shall be the responsibility of the Contractor. Sealing material and application of this material shall be accomplished in such a manner which is acceptable to the fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor's work. Any openings created by or for this Contractor and left unused shall also be sealed as part of this work.
    c) The Contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
    d) Maintain proper separation between system cables and all power and/or unshielded cables, as required to prevent noise, crosstalk, etc.
11. Install all equipment at locations shown on drawings.
12. Connect all devices, outlets, speakers, etc. to equipment cabinet equipment as recommended by manufacturer(s).

B. Pathway

1. General
    a) Provide and install raceway for all penetrations of fire rating assemblies/walls/etc., where exposed to damage, interconnection of cabinets or any combination thereof, for all cables, and all areas required by applicable codes and standards or as otherwise noted/required in these specifications.
    b) Where acceptable to Authority Having Jurisdiction and all applicable codes/standards, cables above accessible ceilings may be run without raceways provided complete installation complies with all applicable codes/standards. Proper cable type, sleeves, firestopping, and support hardware must be utilized.
    c) All raceways shall meet requirement for raceway per Section 16742 - Premise Distribution System, in addition to applicable requirement of sections within Division 16 of these Specifications.
    d) All raceways shall terminate at point within 12 inches of termination point terminal

block with appropriate grounding bushing.

e) Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage sound systems.

f) Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.

g) Install raceways so no more than two 90° bends are in any raceway section without pullbox. Install additional pullboxes as required to maintain maximum of two 90° bends between pullboxes and/or termination points.

h) Label all raceway at both ends to indicate destination and sound system source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as-built (record) drawings.

i) Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.

j) Properly support cables/wire not installed in raceways.

k) Special Raceway Systems: Special raceway systems may be specified for some portions of the sound system. Refer to the drawings and other sections of these specifications to determine where or if such systems are used.

l) Fire Stop

1. Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.

2. Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.

3. Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.

2. Horizontal Cable Pathway

a) Sleeves

1. Install rigid steel conduit sleeves with bushings on both ends at penetration of all walls above ceilings. Stub-out each side of wall a minimum of 12 inches.

2. Install firestopping at sleeves and all rated firewall/smoke wall penetrations. Stub-out wall as required for routing. Firestopping assembly must comply with UL for wall routing, material and cable used.

3. Size sleeves as required by the NEC for cable installed, but in no case shall sleeve be less than 2 inch diameter, nor smaller than that required by "4)" below.

4. Sleeve size shall not be smaller than that required by EIA/TIA-569, Table 4.1-1, "Conduit Sizing."

b) Cable Support

1. Install J hooks located 48 inches to 60 inches on center above accessible ceiling areas for cable support.

2. Where large quantity of cables are congested in an area such as near CC or

CER, provide/install special supports designed to carry weight.

3. Size shall be as required to provide for cables installed plus 50% spare and still not exceed rating of support device.
4. Tie all cables to J hooks at all bends with ties accepted for use.

C. Grounding

1. Provide and install complete grounding system as required to comply with all sections of these specifications and applicable codes.
2. Connect Central Equipment to "systems" ground bus with #6 green insulated copper ground wire (in appropriate raceway).
3. Connect metal conduit (via grounding bushing) to equipment cabinet or cabinet ground bus.
4. Connect cable shields to equipment cabinet ground busbar.
5. Connect surge suppression equipment to equipment cabinet ground busbar.

D. Speakers

1. Mount ceiling speakers in or on ceiling system at locations shown on drawings as directed by ceiling system Contractor, manufacturer, and installer. Provide all required mounting hardware and/or accessories. In general, all speakers shall be recessed mounted in the ceiling system. Where speaker cannot be recessed, install surface speaker assembly.
2. Connect speakers together so that no speaker circuit exceeds either five speakers or 3.5 watt load.
3. Each speaker circuit shall have a separate, splice-free cable homerun to the termination block in the sound system equipment cabinet (or local area public address/bell signaling interface cabinet, when required).

E. Surge Suppression

1. General
   a) Provide and install surge suppression devices as specified in Section 16691 for 120 volt source to all equipment. Install on line side of equipment.
   b) Extreme care shall be taken by Contractor to assure a properly surge protected system.
   c) Surge protection equipment must be selected by Contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
   d) Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.
2. Equipment Selection
   a) Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.
3. Equipment Installation
   a) Install surge suppression equipment per manufacturer's recommendation at each

wire terminal as noted under Part 1.

b) Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.

c) Locate surge suppression equipment in terminal cabinet nearest main equipment cabinet.

4. Ground Installation

a) Ground Bus Connections:

1. Provide "local" ground bus in equipment cabinet housing surge protection equipment (with lugs, etc. as required).

2. Bond "local" ground bus to equipment cabinet with minimum #6 copper wire.

3. Connect terminal cabinet "local" ground bus to "systems" ground bus installed per Section 16170 Grounding and Bonding with minimum #6 copper insulated wire (unless otherwise noted) in conduit.

4. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.

b) Surge Suppression Equipment Grounding:

1. Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer.

c) Conductors:

1. Conductors shall meet requirements of Section 16123 Building Wire and Cable.

2. Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.

3. Do not bundle unprotected conductors with protected conductors.

4. Conductors shall be kept as short as possible.

5. Conductors shall be secured at 12" intervals with an accepted copper clamp.

6. Grounding conductors shall be properly connected to the building service ground by accepted clamps.

d) Grounding Connectors:

1. Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or UL for the purpose.

2. All connectors and fittings shall be of the Nicopress crimp or compression set screw type.

3. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

F. Cable/Wire:

1. Splice cable only at terminal block units.

2. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at building surge protection devices and at amplifier and/or as otherwise required by applicable codes.
3. Install input circuits in separate cables and raceways/pathways from output circuits.
4. Install all cables no closer than 12" from any wire/cable installed for Premise Distribution System, power system cable/raceway, or fluorescent/ballasted light fixtures.
5. Leave 12 inches excess cable at each termination at speaker and termination blocks.
6. Leave 2 feet excess cable at each termination at system equipment/rack.
7. Provide protection for exposed cables where subject to damage.
8. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use J hooks to support cables. Do not share J hooks of Premise Distribution System. Provide quantity of J hooks as required to provide 50% spare capacity at all J hooks.
9. Use suitable cable fittings and connectors.
10. Install appropriate cable to match application, i.e., plenum, riser, etc. All cables shall bear CMP and/or appropriate marking for the application in which they are installed.
11. Cables routed through rated walls, floors and assemblies shall be routed via appropriate fireproofing system as accepted by UL.
12. Label cable at both ends indicating the originating and terminating location of each end. This labeling/identification shall be fully documented in as-built (record) drawings.

G. Speaker Zone Selective Relays:

1. Install adjacent to system mixer/power amplifier.
2. Connect into amplifier output. Connections/schematic diagrams on drawings/details are schematic only and are not intended to be complete nor point-to-point wiring diagrams. Connect system(s) as required to provide performance specified herein. Switches are to provide selection of speaker zones (1 and 2) so that any zone or zones may be selected by user for distribution of program material (microphone input or auxiliary input device).

3.2 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services.

B. Include making or supervising final wiring connections, inspection and adjusting of completed installation and systems demonstration.

C. Certify that installation is complete and performs according to specified requirements.

3.3 FIELD QUALITY CONTROL

A. Test per applicable sections of these specifications.

B. Measure and record sound power level.

3.4 ADJUSTING

A. Adjust transformer taps for appropriate sound level.

3.5 DEMONSTRATION

A. Demonstrate system to designated Owner personnel as required by applicable sections of these specifications.

B. Conduct walking tour of project. Briefly describe function, operation, and maintenance of each component.

C. Provide detailed operation and maintenance instruction and training.

D. Use submitted operation and maintenance manual as reference during demonstration and training.

END SECTION 16770

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensors, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system as described herein.

B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.

C. The Occupancy Sensor System shall sense the presence of human activity within the desired space and fully control the "On" / "Off" function of the lights.

D. Time Delay settings shall be factory set at 10 minutes, and shall not be field adjusted unless specifically instructed by Engineer. This delay selection is based on lamp life vs. energy savings and sensor performance. Automatic adjustments to this delay period by the sensor shall not be permitted.

E. In high humidity or cold environments, the sensors must be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

F. Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay field adjustments shall be provided as needed.

G. The installer shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.4 DESIGN REQUIREMENTS

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

1.5 EQUIPMENT QUALIFICATION

A. All components shall be UL listed and offer a five year warranty.

1.6 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings showing actual field conditions for this project's installation.

B. Product Data:

1. Submit data sheets on sensors, control units and all junction boxes and mounting accessories, including all wiring diagrams (standard).

C. Submit manufacturer's installation instructions.

1.7 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual location of each sensor and control unit.

B. Revise diagrams included in Drawings to reflect actual control device connections.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit instructions for operation, use, and adjustment of system.

B. Submit recommended preventive maintenance procedures and materials.

C. Submit parts list.

1.9 WARRANTY

A. Contractor shall warrant all equipment furnished in accordance with this Specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications.

B. The supplier's obligation shall include repair or replacement and testing of all parts of equipment found to be damaged, defective or non-conforming and returned to the supplier. This shall be at no cost to the Owner.

C. Warranty on sensor and control units will be for a period of five years.

D. The warranty shall commence upon the Owner's acceptance of the project.

E. Warranty on labor shall be for a minimum period of one year.

1.10 INSTRUCTION TO OWNER

A. The Contractor shall provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

PART 2 – PRODUCTS

2.1 OCCPANCY SENSORS

A. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens with grooves-in to eliminate dust and residue build-up.

B. Ceiling mount sensors shall provide a minor motion coverage range of 150 to 1300 square feet with an overall 1/2 step coverage range from 300 to 2000 square feet.

C. Occupancy sensors shall provide coverage of 90 to 100% of the controlled area.

D. All sensors shall be capable of operating normally with electronic ballast and PL lamp systems.

E. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

F. All sensors shall have readily accessible, user adjustable controls for time delay and sensitivity. Controls shall be recessed to limit tampering.

G. In the event of failure, a bypass manual "override on" feature shall be provided on each sensor. When bypass utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. The override feature shall be designed for use by building maintenance

personnel and shall not be readily achieved by building occupants.

H. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.005% tolerance to assure reliable performance.

I. Ultrasonic microphone receiver frequency shall be 25 KHz or greater and shall be temperature and humidity resistant.

J. All sensors shall provide an LED indication light to verify that motion is being detected and that the unit is working. All sensors shall be Watt Stopper model numbers:

1. Ceiling sensors: W-500A, W-1000A, W-2000A, W-2000H, WPIR, DT-100L, CI-100.

K. All ultrasonic sensors shall comply with the State of California Safety and Health Requirements. Decibel levels for ultrasonic sensors shall comply with the following California Energy Commission criteria. The contractor shall certify in writing that installed sensors comply with the specified California Energy Commission criteria for ultrasonic sound:

Mid frequency of Sound Pressure Third Octave Band (KHz)	Maximum dB level within Third Octave Band in dB Reference 20 micropascals)
Less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

L. All sensors shall have no leakage current in OFF mode and shall have voltage drop protection.

M. All sensors shall have UL rated, 94V-0 plastic enclosures.

N. All sensors shall be California Energy Commission Title 24 accepted and certified.

O. Sensors shall be suitable for N.E.C. 725 Class 2 wiring and use plenum cable when required.

2.2 CIRCUIT CONTROL HARDWARE - CU

A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to mount on external J boxes and be integrated self-contained unit consisting internally of load switching control relay and a transformer to provide low-voltage power to a minimum of two (2) sensors.

B. Relay Contacts shall have ratings of:
1. 20A - 120 VAC Ballast

C. Relay contacts shall be isolated.

D. Control units shall be U.L. listed.

2.3 Between sensors and controls units shall be three (3) conductors, 18 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable accepted for use in plenums.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and equipment in accordance with manufacturer's instructions.

B. It shall be the Contractor's responsibility with the supplier's assistance to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas.

C. Rooms shall have ninety to one hundred percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within

in the room(s).

D. The locations and quantities of sensors shown on the Drawings are diagrammatic and indicate only rooms which are to be provided with sensors.

E. The Contractor shall provide additional sensors if required to properly and completely cover the respective room.

F. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components

END OF SECTION 16910