NEW O'REILLY AUTO PARTS STORE

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END OF DOCUMENT

SECTION 01 11 00

SUMMARY OF WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Project summary:
   1. Construction and completion of the New O'Reilly Auto Parts Store for the Owner's intended use of wholesale and retail sale of auto parts at the location described in invitation. To Bid under a single lump sum contract and quantity of time as described in the Contract.

B. Work Owner, or others, furnished and installed:
   1. Interior painted graphics.
   2. Equipment or merchandising fixtures.
   3. Exterior building signage (Electrical system and final connection by General Contractor).
   4. Security systems not indicated on drawings.
   5. Portion of toilet accessories, refer drawings.
   6. Communication systems not indicated on drawings.
   7. Temporary marketing and advertising signage.
   8. Refer to mechanical and electrical plans for utility responsibility.

C. Work Owner furnished, Contractor installed:
   1. Pre-engineered metal building components.
   2. Exterior hollow metal door package.
   3. Floor safe.
   4. Mechanical heating/cooling equipment, including thermostats.
      a. Contractor's scope of Work: Order, receive and install heating/cooling mechanical units. Provide and install duct work, supply diffusers, return air grills, brake lathe exhaust fan and duct work, restroom exhaust fan and duct work, and accessories for complete functioning system.
   5. Pre-engineered metal building insulation system.
   6. ADM Micro System.
   7. Lighting fixtures and switchgear as specified on project schedules.

D. Permits and Fees: Apply for, obtain, and pay for permits, fees, and utility company back charges required to perform the work. Submit copies and invoices to Owner for reimbursement. No overhead and profit charges are allowed.

E. Industry Standards:
   1. Applicability of Standards: Except where more explicit or stringent requirements are written into the Contract Documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into the Contract Documents. Such industry standards are made a part of the Contract Documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at project site for reference.
   2. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of Contract Documents.
   3. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.
   4. Copies of Standard: The Contract Documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also

required to be familiar with industry standards applicable to that part of the work. Copies of standards are needed for proper performance of the work; the Contractor is required to obtain such copies directly from the publication source.

5. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other Contract Documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority, or other entity applicable to the context of the text provisions.

F. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. If pertinent codes and standards conflict with any instruction, process or material stated in the Contract Documents, the more stringent shall govern. Submit copies of inspection reports, notices and similar communications to Owner.

G. Definitions:
   1. Provide: Furnish and install, complete with all necessary accessories, ready for intended use. Pay for all related costs.
   2. Approved: Acceptance of item submitted for approval. Not a limitation or release for compliance with the Contract Documents or regulatory requirements. Refer to limitations of 'Approved' in General and Supplementary Conditions.
   3. Match Existing: Match existing as acceptable to the Owner.

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

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

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION – Not Applicable To This Section

END OF SECTION

SECTION 01 20 00

PROJECT PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 PROCEDURES PRIOR TO CONSTRUCTION

A. Within 48 hours of Contractor's receipt of Notice to Proceed or letter of intent.
   1. Submit Subcontractors and Major Material Suppliers to be used for the project, (ORL-G).
B. Within 10 days upon Contractor's receipt of Notice to Proceed or letter of intent.
   1. Submit proposed progress schedule, bar-chart type, indicating a time bar for each trade or operation or work to be performed at the site. Time bar shall demonstrate planned work, properly sequenced and intermeshed, for expeditious completion of the project.
   2. Contractor's supervisory personnel.
      a. Provide Owner with name, telephone, and fax number of personnel responsible for Project.
      b. Submit and post a list of emergency telephone numbers and address for individuals to be contacted in case of emergency.
   3. Owner's supervisory personnel.
      a. Owner to provide Contractor with names, telephone numbers of personnel responsible for the project.
C. Contractor to notify Owner's field representative 48 hours prior to beginning construction.
   1. Forward copy of building permit within 48 hours of issuance by Government Agency.
D. Prior to commencing work on the project, Contractor must record Notice of Commencement or similar notices to the extent applicable in the state where the project is located. Provide copy of recorded notice to Owner.

1.03 PROCEDURES DURING CONSTRUCTION

A. Progress Payment Request Procedures: Application for payment and lien waivers to be received together on a monthly basis corresponding to the Contract date prior to Owner processing. Noncompliance may result in rejection of application and delay of payment processing. Submit electronically to OREILLYPAYME@YAHOO.COM. Refer to Article 21.2 of the General Conditions of the Contract for electronic submittal requirements.
   1. Submit Application and Certificate for Payment (AIA G702 and G703).
      a. Itemize separate line cost for each major item of work and each subcontracted item of work (use Sections under Division 2 through 26 in Table of Contents as a basis for listing).
      b. Application to include a summary of approved Change Orders.
B. Requirements for sequencing or scheduling:
   1. Coordination:
      a. Coordinate the work of all trades.
      b. Verify location of utilities and existing conditions.

c. Schedule 10 days after notice to proceed with local utility companies for installation of utility service connections.

2. Owner to schedule with Contractor 21 days prior to anticipated shipping date of Owner supplied Pre-Engineered Metal Building. Owner will provide Contractor notice 48 hours prior to final delivery.
3. Contractor to schedule with Owner's Mechanical Equipment Supplier 14 days prior to completion of building areas being prepared for installation of mechanical systems for ordering, shipping, and receiving of equipment. Orders are to be filled out and submitted by fax on Supplier provided form (ES 1.1).
4. Light fixture coordination.

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

D. Testing:
1. Contractor shall provide testing as required by General Conditions and individual sections. Refer to sections for testing types and frequency requirements.
2. Submit copies of required test reports in a timely fashion to Owner, Architect, and Entity having jurisdiction over the Project.
3. Owner and/or Architect reserve the right to have tests made when deemed necessary.
a. Tests not specified as part of a section shall be paid for by the Owner. Should test reveal a failure of the work to meet Contract Document requirements, subsequent test, related to the failure, will be paid by the Owner, with cost deducted from the Contract amount by change order.
b. Tests shall be made in accordance with recognized standards by a competent, independent testing laboratory.
c. Materials found defective or not in conformance with the Contract Document requirements shall be promptly replaced or repaired at the expense of the Contractor.

E. Field engineering:
1. Secure the services of a registered civil engineer, land surveyor, or employ qualified personnel for setting, maintaining and establishing finished elevations and lines.
2. If the site conditions indicated in the Contract Documents differ materially from those the Contractor encounters in the performance of the work, the Contractor shall within 48 hours and before such conditions are disturbed, notify the Owner and Architect in writing.

F. Construction contract administration correspondence to be submitted as follows:
1. Weekly report (ORL-R) and supporting photos, summarizing site conditions and activities for the specified period. Report to be submitted by e-mail to the Project Administrator and received not later than 9:00 am the following Monday or first available business day of Owner operations.
2. Contractor's Request for Interpretation (CSI 13.2A).
3. Contractor's Change Order Request Proposal (CSI 13.6A).
4. Contractor's Proposal Worksheet (CSI 13.6C and CSI 13.6D).

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

1.04 PROCEDURES PRIOR TO CONTRACT CLOSEOUT

A. The following are prerequisites to substantial completion. Provide the following:

1. Contractor's Punch list (ORL-H).

B. Provide the following prerequisites for final acceptance:
   1. Final payment request (AIA G702 and G703).
   2. Completed punch list (ORL-H).
   3. Occupancy Permit.

C. Provide the following closeout items:
   1. Submission of record documents.
   2. Training and turnover to Owner's store management personnel. (ORL 1)
   3. Final cleaning and touch-up.
   4. Removal of temporary facilities.

1.05 GENERAL PROCEDURES

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

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

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

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

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION – Not Applicable To This Section

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide list price for each alternate in Bid Form. Include cost of modifications to other work to accommodate alternate. Include related costs such as overhead and profit.
B. Owner will determine which alternates are selected for inclusion in the Contract.
C. Alternates are described briefly in this section. The Contract Documents define the requirements for alternates.
D. Coordinate alternates with related work to ensure that work affected by each selected alternate is properly accomplished.

PART 2 – PRODUCTS- Not Applicable To This Section

PART 3 – EXECUTION

3.01 SCHEDULE

A. List of alternates:
    1. Alternate No. 1 (Deduct Alternate) 32 11 26 – Hot Mixed Asphalt Paving: Provide hot mixed asphalt paving in lieu of concrete paving where indicated on the drawings, except for the parking area directly in front of the building where concrete paving, as originally detailed, is to extend 20 feet away from the face of sidewalk and length to extend to align with each end of the building face. At locations where hot mixed asphalt paving transitions into building foundation provide a 2-foot wide concrete paving apron consisting of 5” thick concrete with (2) #4’s cont. Provide concrete curb/gutter, dumpster pad, and drive aprons as originally detailed.
    2. Alternate No. 2 (Add Alternate) 32 80 00 – Irrigation Systems: Provide underground lawn irrigation system. System shall include separate water service, meter and tap. Provide system design as shown on drawing sheets “L3”, “L4”, part of “SU1”.

END OF SECTION

SECTION 01 33 00

SUBMITTALS AND SUBSTITUTIONS

PART 1 – GENERAL

1.01 SUMMARY

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

PART 2 – PRODUCTS

2.01 PRE-BID SUBSTITUTIONS

A. The naming of specified items on the drawings or in the specifications mean that such named items are specifically desired by the Architect and/or Owner. If the words “or acceptable equal” or “or approved equal” follows such named items, substitution request may be submitted. REQUEST FOR SUBSTITUTION MUST BE RECEIVED BY OWNER 5 DAYS PRIOR TO BID OPENING, UNLESS OTHERWISE NOTED.
B. Substitution Request Forms (Refer Section 00900): Request must be submitted on copies of form (CSI 1.5C) and must name the exact item proposed with complete information filled out and back-up data attached as specified on that form. Use separate Substitution Request Form for each item. Submit one copy of form and back-up data for architectural items and two copies of form and back-up data for engineering items. Request showing only brand name or manufacturer, or otherwise incomplete, will not be reviewed. Submit samples if requested.
C. The Owner is the sole judge as to the equality and proposed substitutions. Only written acceptances will be held valid by the Owner.
D. If any substitution will affect a correlated function, adjacent construction, or the work of other trades or contractors, the necessary changes and modifications to the affected work will be considered as part of the substitution, to be accomplished without additional cost to the Owner, if and when accepted.
E. Under no circumstances shall the Owner’s acceptance of any such substitution relieve the Contractor from timely, full and proper performance of the work.

2.02 AFTER AWARD OF CONTRACT SUBSTITUTION REQUEST

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

B. Submit request for such substitution in writing to Owner within 10 days of date of ascertaining unavailability of material or equipment specified, or that the performance cannot be warranted.
C. If any substitution will affect correlated function, adjacent construction, or work of other trades or contractor, the necessary changes and modifications to the affected work will be considered as part of the substitution, to be accomplished without additional cost to Owner, if and when accepted.
D. Approved substitutions will be affected by a Change Order. Under no circumstances shall the Owner's acceptance of any such substitution relieve the Contractor from timely, full and proper performance of the work.

2.03 SHOP DRAWINGS

A. Submit required shop drawings drawn to a scale sufficiently large to show pertinent features of item and its method of connection to work. Submit related shop drawings together; partial submittals will not be accepted. Reproduction of contract documents in any form for use as shop drawings will not be permitted. Provide manufacturer's name and model number of prefabricated items and indicate methods of attachment and clearances required relative to other trades affecting all elements of work. Identify deviations from Contract Documents if any. Check dimensions, check that trades have been coordinated and that no conflict will develop in this installation. After reviewing shop drawings, indicate Contractor's approval by signing and dating on Contractor's stamp. Failure to follow these procedures will result in rejection of submission and no additional contract time will be allowed for delay for this cause.
B. Submit one reproducible and one print of Contractor's stamped and approved shop drawings for Owners review. The Owner will review the reproducible and stamp it with indication of action as appropriate. The Owner will retain the print for his record, and will return the reproducible to the Contractor. For reproducible returned "Rejected" or "Returned for Corrections-Resubmit", correct the original drawings, make a new reproducible reproduction and print, and resubmit. For reproducible returned "Accepted Subject to Contract Requirements" or "Accepted as Noted Subject to Contract Requirements", provide such number of prints of the reproducible as may be needed for field distribution.

2.04 PRODUCT DATA AND SAMPLES

A. Submit (1) copy of product data for Owner's review for items specified in various specification sections (copies for mechanical and electrical data is specified in Divisions 20, 21, 22, 23, 25, and 26). Submit samples, where specified, along with product data. Make submissions affecting color selection within 30 days after signing the Contract. Mark data clearly to indicate exact items submitted, and note deviations from Contract Documents (if any). After reviewing the submittals, indicate approval by signing and dating on Contractor's stamp, and submit to the Owner for review.

PART 3 – EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS

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

3.02 TIMING OF SUBMITTALS

A. General: Make all submittals far enough in advance for schedule dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and re-submittal, and for placing orders and securing delivery.
B. Delays: Costs of delays due to late submittals may be back-charged as necessary and shall not be borne by the Owner.

END OF SECTION

SECTION 01 51 00

TEMPORARY FACILITIES

PART 1 – GENERAL

1.01 SUMMARY

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

PART 2 – PRODUCTS

2.01 UTILITIES

A. Temporary Utilities: Provide and pay for costs of gas, water, and electricity required for performance of the work. Make necessary arrangements with utility companies for temporary service.
   1. Gas and Water: Provide necessary temporary piping, fittings, and metering.
   2. Electricity: Provide necessary temporary electrical wiring and metering. Provide area distribution boxes so located that individual trades may use their own construction type extension cords to obtain adequate power and lighting for construction operations.
B. Telephone: Provide telephone for direct communication with Contractor's field project representative.
C. Fax Machine: Contractor's option to provide a fax machine at location sufficient to communicate with Contractor's project representative.

2.02 TEMPORARY SANITARY FACILITIES

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

2.03 FIELD OFFICE AND SHEDS

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

2.04 PROJECT IDENTIFICATION

A. Contractor's option to provide project sign.

2.05 PARKING AND STAGING AREAS

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

2.06 TEMPORARY HEAT AND VENTILATION

A. Provide temporary heat where needed for proper performance of the work, for curing or drying of work recently installed, and protection of work in place from adverse effects of low temperatures.
B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, and gases.

2.07 DEWATERING, SNOW, AND ICE REMOVAL

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

2.08 TEMPORARY FENCING

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

2.09 TEMPORARY FIRE PROTECTION

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

2.10 SECURITY

A. Provide sufficient control to prevent illegal entry or damage during nights, holidays, or other periods when work is not being executed, and such other controls as required during working hours.

2.11 CLEANING AND TRASH REMOVAL

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

PART 3 – EXECUTION

3.01 REMOVAL

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

END OF SECTION

SECTION 02 01 00

SITE PREPARATION

PART 1 – GENERAL

1.01 SUMMARY

A. Provide site preparation including:
   1. Protection of existing trees, vegetation, landscaping, and site improvements not scheduled for clearing which might be damaged by construction activities.
   2. Trimming of existing trees and vegetation as recommended by arborist for protection during construction activities.
   3. Clearing and grubbing of stumps and vegetation, and removal and disposal of debris, rubbish, designated trees, and site improvements.
   4. Topsoil stripping and stockpiling.
   5. Temporary erosion control, siltation control, and dust control.
   6. Temporary protection of adjacent property, structures, benchmarks, and monuments.
   7. Temporary relocation of fencing, and site improvements scheduled for reuse.
   8. Protection from natural resource damage.
   9. Removal and legal disposal of cleared materials.

1.02 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Use experienced workers.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Tree protection, erosion control, siltation control, and dust control materials suitable for site conditions.

PART 3 – EXECUTION

3.01 EROSION, SEDIMENTATION AND DUST CONTROL

A. Erosion and sedimentation protection:
   1. Slope drains: Temporary drains shall be provided to convey surface water down slopes. Slope drains shall be constructed of pipe, fiber mats, rubble, portland cement concrete, bituminous concrete, or plastic sheets stabilized with asphalt. Slope drains shall be provided with an apron at their tips to anchor them and direct water into them. Stone and rubble shall be placed at slope drain outlets to prevent scour at these points.
   2. Seeding and Mulching: Slopes shall be seeded and mulched with seed that will produce a fast growing cover resistant to erosion.
   3. Silt barriers: Sedimentation traps shall be constructed by the Contractor around all inlets and maintained throughout construction. Sediment accumulated behind silt barriers shall be removed when ponding capacity is reduced by one-half.
   4. Silt Fences: Silt fences shall be installed in the locations indicated on plans. Silt fences shall be installed prior to clearing operations. Silt fences shall be kept in good repair and maintained throughout construction. Sediment shall be removed when the ponding capacity is reduced by one-half.

5. Temporary Construction Entrance: Prior to the start of clearing and grubbing activities, contractor shall construct a temporary construction entrance if indicated on the drawings. Entrance shall consist of 6 inches minimum thickness of 2 to 3 inches washed stone over a geotextile fabric. Contractor may be required to wash vehicles exiting the site during wet weather conditions.

B. Stream Damage: The Contractor shall exercise precautionary measures to prevent deposits of sedimentation, construction debris, waste from construction equipment, chemicals, petroleum product spills, or other materials which can be classified as detrimental to natural resources, from entering or causing damage to natural resources.

C. Dust Control: The Contractor shall exercise precautionary measures to minimize dust emissions which will include, but shall not be limited to, periodic sprinkling or wetting of the site. The Contractor has the option of using a dust palliative.

3.02 CLEARING

A. Prevent damage to existing improvements indicated to remain including improvements on and off site. Protect existing trees and vegetation indicated to remain. Do not stockpile materials and restrict traffic within drip line of existing trees to remain. Provide and maintain temporary guards to encircle trees or groups of trees to remain; obtain approval before beginning work.

B. Existing Trees and Planting:
   1. Water vegetation as required to maintain health. Cover temporarily exposed roots with wet burlap and backfill as soon as possible. Coat cut plant surfaces with approved emulsified asphalt plant coating.
   2. Repair or replace vegetation that has been damaged or pay damages.
   3. Completely remove all improvements including stumps and debris except for those indicated to remain. Remove below grade improvements at least 12” below finish grade and to the extent necessary so as not to interfere with new construction. Remove abandoned mechanical and electrical work as required.
   4. Trees, 1-1/2” or more in diameter, designated to remain within the cleared areas shall be trimmed of branches to approximately 7 feet above finish grade. Remove all dead branches 1-1/2” or more in diameter. Limbs and branches to be trimmed shall be neatly cut close to the main trunk. Cuts more than 1-1/2” in diameter shall be painted with approved tree-wound paint.

C. Topsoil:
   1. Topsoil is defined as friable clay loam surface soil found in a depth of not less that 4”. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2” in diameter, and without weeds, roots, and other objectionable material.
   2. Strip topsoil to depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping. Where trees are indicated to remain, stop topsoil stripping a sufficient distance to prevent damage to main root system.
   3. Stockpile topsoil in storage piles in areas not to impede construction activities or encumber adjacent property. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust.

D. Disposal of waste materials:
   1. Burning on Owner’s property is not permitted.
   2. Remove waste materials and unsuitable and excess topsoil from Owner’s property and dispose of off site in a legal manner.

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY

A. Provide demolition work of existing conditions, complete, as indicated, specified, and required for new work, including removal and legal disposal of demolished materials and capping of existing utilities.
B. Building and Site Demolition: (Where indicated)
   1. Demolition of building structures.
   2. Demolition of site improvements including paving, curbing, site walls, and utility structures.
   3. Demolition of below-grade foundations and site improvements to depth to avoid conflict with new construction or site work.
   4. Removal of hollow items or items which could collapse.
   5. Protection of site work and adjacent structures.
   6. Disconnection, capping, and removal of utilities.
   7. Pollution control during building demolition, including noise control.
   8. Removal and legal disposal of materials.
   9. Relocation of pipes, ducts, conduits, other mechanical work; refer Divisions 15 and 16.
C. Selective Demolition: (Where indicated)
   1. Selective demolition of interior partitions, systems, and building components designated to be removed.
   2. Selective demolition of exterior façade, structures, and components designated to be removed.
   3. Protection of portions of building adjacent to or affected by selective demolition.
   4. Removal of abandoned utilities and wiring systems.
   5. Notification to Owner of schedule of shut-off of utilities which serve occupied spaces.
   6. Pollution control during selective demolition, including noise control.
   7. Removal and legal disposal of materials.

1.02 SUBMITTALS

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

1.03 QUALITY ASSURANCE

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

1.04 PROJECT CONDITIONS

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

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION

3.01 DEMOLITION

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

END OF SECTION

SECTION 02 60 00

HAZARDOUS MATERIALS ABATEMENT

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

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

1.03 QUALITY ASSURANCE

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

1.04 PROJECT CONDITIONS

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

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION

3.01 DEMOLITION

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

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE-CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's data with application and installation instruction for proprietary materials and items, including reinforcement and forming accessories, admixture, patching, compounds, waterstops, joint systems, chemical floor hardeners, dry-shake finish materials and others as requested by Architect.
B. Shop Drawings: Concrete reinforcement fabrication, bending and placement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement.
C. Concrete Mix Design: Submit 1 copy of concrete mix design for each strength or composition of concrete to be used.
D. Laboratory Strength Test: Submit 1 copy of all strength tests.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ACI 301, Specifications for structural Concrete for Buildings.
   2. ACI 304.2R-96, Specifications for Concrete Placement by Means of Pumping.
   3. ACI 305R-91 and ACI 306.1-90, Specifications for Hot and Cold Weather Concreting.
   4. ACI 318, Building Code Requirements for Reinforced Concrete.
   5. Concrete Reinforcing Steel Institute, Manual of Standard Practice.
   6. Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.
C. Testing: Contractor shall employ a qualified independent testing laboratory acceptable to Owner and Architect to perform material evaluation as specified under FIELD SAMPLING AND TESTING paragraph. It is recommended, but not required, to utilize same soils testing laboratory that prepared the original geotechnical report.
D. Tolerances:
   1. ACI Standards shall govern concrete work except where specified differently.
   2. Floor flatness and levelness tolerances: Subfloors Under Materials Such As Vinyl, Tile, Paint and Carpet: ACI 302.1R and ASTM E 1155, floor flatness (Ff) of 40, floor levelness (Fl) of 40.
   3. Variation from plumb:

a. 0 to 10 feet: ¼" maximum.
b. 20 feet or more: 3/8" maximum.

4. Variation in thickness: ¼" to ½", 5% for footings.
5. Variation in grade:
   a. 0 to 10 feet: ¼" standard, 1/8" for floor slabs.
   b. 10 to 20 feet: 3/8" standard, ¼" for floor slabs.
   c. 40 feet or more: ¾" standard, 3/8" for floor slabs.
6. Variation in plan:
   a. 0 to 20 feet: ½".
   b. 40 feet or more: ¾" standard, plus ½" for footings.
7. Variation in eccentricity: 2% for footings.
8. Variation in openings:
   a. Size: plus 1/8".
   b. Location: ¼".
9. Variation in stairs & landings:
   a. Consecutive steps:
      1). Treads: 1/8".
      2). Risers: 1/16".
   b. Flight of Stairs:
      1). Treads: ¼".
      2). Risers: 1/8".

1.04 FIELD SAMPLING AND TESTING

A. The following samples and test will be performed by an independent testing laboratory approved by the Architect.
B. Samples:
   1. Field samples shall be made and cured in accordance with ASTM C 31, for each concrete strength, at the rate of 3 test cylinders and one slump test for each 40 cubic yards or faction thereof, from each day's pour and record locations for report.
   2. Test cylinders shall be as follows: One (1) at 7 days, two (2) at 28 days, and reserve the remaining for testing after a longer period as required by the Architect if the 28 day test does not meet the required strength. In accordance with ASTM C 173 Volumetric Method, or ASTM C231 Pressure Method, make air content check for each set of test cylinders.
   3. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of the Architect.
   4. Additionally, test slump every 25 cu. yd. recording location for report.
   5. When early form removal is requested, field cure cylinders tested at 7 or less days to determine sufficient strength.
C. Testing:
   1. Where strength of any group of 3 cylinders or of any individual cylinder fall below minimum compressive strength specified, the Architect shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by Architect from location in structure represented by test specimen or specimens which failed.
   2. Specimens shall be secured, prepared, and tested in accordance with ASTM C 42, within a period of 60 days after placing concrete.
   3. Concrete shall be considered to meet the strength requirements of this specification if it meets the strength requirements of paragraph 5.6.4 of ACI 318.
   4. Should laboratory analysis indicate that the proper concrete mix has not been used by the Contractor, all such concrete poured using the improper mix shall be subject to rejection.
   5. The cost of cutting specimens from the structure, patching the resulting holes, and making the laboratory analysis shall be borne by the Contractor.

6. The holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned in accordance with the ACI 211 “Recommended Practice for Selecting Proportions of No-Slump Concrete”. The patching shall have the same design strength as the specified concrete.
7. If any of the specimens cut from the structure fail to meet the requirements outlined in paragraph 5.6.4 of ACI 318. The Architect shall have the right to require any and all defective concrete to be replaced and all cost resulting therefrom shall be borne by the Contractor.
8. Additional Sampling: In addition to the slump tests specified above, the Contractor shall keep a cone (mold) and rod apparatus on the job site for random testing of batches. When concrete does not meet the specified slump requirements, and when directed by the Architect or Owner, immediately perform a slump test in accordance with ASTM C 143. Concrete not meeting the slump requirements shall be removed from the job site.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Form Materials:
   1. For Exposed Finish Concrete: Plywood, metal, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
   2. For Unexposed Finish Concrete: Use plywood, lumber, metal, or other acceptable material. If lumber is used, it must be dressed on at least 2 edges and 2 sides for a tight fit.
B. Form Coatings: Commercial formulated form coating compound with maximum VOC of 350 mb/l that will not bond with, stain, nor adversely affect concrete surfaces, will not impair subsequent treatments or finishes requiring bond or adhesion, nor impede wetting of concrete surfaces by water or curing compound.
C. Steel Reinforcement:
   1. Reinforcing Bars: ASTM A 615(S1), Grade 60, deformed billet steel bars of grades as indicated on the drawings, free from loose rust, scale and other coatings that may reduce bond.
   2. Mesh or Fabric Reinforcement: ASTM A 185, welded wire fabric, of sizes and types indicated on the drawings.
   3. Fiber Reinforcement: Contractor’s option to provide engineered polypropylene fibers for secondary reinforcement of slabs in lieu of mesh or fabric reinforcement. “Fibermesh” or W.R. Grace “Grace Fibers”, (NO SUBSTITUTES), in multi-design fiber length (MD Graded), shall be applied at 1.5 pounds per cu. yd. of concrete, or 0.1% by volume, in accordance with ASTM C 1116.
   4. Accessories: Include all spacers, chairs, ties, and other devices necessary for properly spacing and fastening reinforcement in place. Use plastic protected reinforcing bar supports conforming to CRSI Class 1 specification for exposed finish concrete.
   5. Tie Wires: Soft annealed iron wire not smaller than 18 gage.
D. Concrete Materials:
   1. Portland Cement: ASTM C 150, Type I.
   2. Normal Weight Concrete Aggregates: ASTM C 33, and the following:
      a. Fine Aggregate: Clean, sharp, natural or manufacturer sand, free from loam, clay, lumps, or other deleterious substances.
      b. Coarse Aggregate: Clean, uncoated, processed, locally available aggregate, containing no clay, mud, loam, or foreign matter; maximum size 1-1/2”.
   3. Mixing Water: Clean, free from oil, acid, salt, injurious amounts of vegetable matter, alkalies, and other impurities; potable.
   4. Admixtures:

a. Water-Reducing Admixture: ASTM C 494, Type A, containing not more than 0.1% chloride ions. Euclid “Eucon WR-75”, Mater Builders “Pozzolite 344”, Sike Chemical “Plastocrete 160”, or Chem-Masters “Chemtard”.
b. Water-Reducing Retarding Admixture: ASTM C 494, Type D. Euclid “Eucon Retarder 75”, Master Builders “Pozzoith 300-R”, W.R. Grace “Daratard”, or Sika Chemical “Plastiment”.
c. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or G. Euclid “Eucon 37”, W.R. Grace “WRDA 19”, Protex “PSP”, Anti-Hydro “Super P”, Sika Chemical “Sikament”, Gifford-Hill “PSI Super”, or Master Builders “Pozzolite 400”.
d. Non-Corrosive, Water Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least one year duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Euclid “Accelguard 80”, W.R. Grace “Daraset”, or Master Builders “Pozzutec 20”.
e. Air Entrained Admixture: ASTM C 260, 5% plus or minus 1% for concrete exposed to freeze-thaw. Sika “Sika Aer”, Master Builders “MB-VR” or “MB-AE”, or W.R. Grace “Dorex AEA”.
f. Fly Ash Admixture: Use of quality fly by weight will be permitted as a cement reducing admixture by 15% maximum. Provide fly ash meeting requirements of ASTM C 618 Class C or Class F with the following special requirements. Loss on ignition in Table I shall not exceed 3%. Compliance to Table IA shall apply. Amount retained on the 325 sieve in Table 2 shall not exceed 20%. Chemical analysis of the fly ash shall be reported in accordance with ASTM C 114. Submit report indicating for a 6 month period immediately prior to submittal date, weekly test and tests results performed on concrete with fly ash admixture. The option to use fly ash must be submitted to the Architect for approval.
g. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions.
h. Certification: Provide admixture manufacturer’s written certification that chloride ion content complies with specified requirements.
i. Other Admixtures: Do not use other admixtures unless accepted in writing by Architect.

E. Curing and Sealing Materials:
1. General: Provide products compatible with finish flooring materials, special finish systems or polished concrete finish systems specified. Refer to drawing finish schedule for types and locations.
2. Comply with Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements
3. Curing Compound:
a. High Solids Curing & Sealing Compound: Clear styrene acrylate type, providing 30% solids content minimum and moisture loss of not more than 0.030 grams per sq. cm. when applied at coverage rate of 300 sq. ft. per gallon. Curecrete Distribution “Ashford Formula“, Euclid “Super Rez-Seal” or “Aqua-Cure VOX”, Master Builders “Masterseal 66”, or Sonneborn “Kure-N-Seal 30”.
b. Dissipating Resin Curing Compound: Euclid “Kurex DR”, or approved equal; ASTM C 309, Type I dissipating resin type compound with fugitive dye; film must chemically break down in two to four week period.
4. Concrete Sealer: Curecrete Distribution “Ashford Formula“, Sonneborn “Kure 1315”, Euclid “Eucopoxy Tufcoat VOX”, L&M “Dress and Seal WB 30”, or approved equal.

F. Miscellaneous Materials:
   1. Connectors: Provide all metal connectors required for placement in cast-in-place concrete, for the attachment of structural and non-structural members.
   2. Expansion Joint Filler: ASTM D 1751, non-extruding premoulded material, ½" thick, unless otherwise noted, composed of fiberboard impregnated with asphalt, except use ASTM D 1752, Type II, resin-bound cork for walks and other exposed areas. Sonneborn "Sonoflex F" closed cell polyurethane foam expansion joint filler is acceptable.
   3. Vapor Barrier: Polyethylene film, .010" thick; Visqueen or approved equal.
   4. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.
      a. Metallic: Master Builders "Embeco 885", Euclid "Hi-Mod Grout", Sonneborn "Ferrolith GDS", or L&M "Ferrogrout".
      b. Non-Metallic: Master Builders "Construction Grout", Sonneborn "Sonogrout", Euclid "Eucon-NS", or L&M "Crystex".
   5. Bonding Agent: Polyvinyl acetate, rewettable type; W.R. Grace "Daraweld C", Larsen "Weldcrete", Euclid "Eucoweld", or L&M "Everbond".
   6. Patching Mortar: Free-flowing, polymer-modified cementitous coating; BASF "MBT Underlayment – Self leveling", Euclid "ThinCoat", Sika Chemical "Sikatop 120", or Thoro "Thoro Underlayment".

2.02 PROPORTIONING OF MIXES

A. Strength: Concrete minimum ultimate strength at 28 days in accordance with ASTM C 94 shall be as follows unless otherwise noted on drawings:
   1. Building Foundations, Footings, Walls, Slabs on Grade, and Ground Supported Post-Tension Foundation Systems: 3000 psi with 5 ½ bags minimum of cement per cubic yard.
   2. Exterior Site Concrete exposed to weather including Retaining Wall Systems: 4000 psi with 5 ¾ bags minimum of cement per cubic yard.
B. Mix Design:
   1. Prepare design mixes for each type of concrete, in accordance with ACI 301 and ACI 318, except as otherwise specified.
   2. Proportion design mixes by weight for class of concrete required, complying with ACI 211, except as otherwise specified.
C. Proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test date. Proposed mix shall list the following characteristics:
   1. If trial batches are used, gross weight and yield per cu. yd. of trial mixtures.
   2. Measured slump.
   3. Air content range.
   4. Compressive strength developed at 7 days and 28 days, trial batches.
   5. Submit written reports to the Architect for design mix at least 15 calendar days prior to the start of work.
   6. Use air-entrained mixture in strict compliance with manufacturer's directions.
   7. Water/Cement Ratio: Concrete subject to freezing and thawing shall have a maximum water/cement ratio of 0.50 by weight.
   8. Admixture Usage: Concrete must contain specified water-reducing admixture or water-reducing- retarding admixture and/or specified high range water-reducing admixture (superplasticizer). Concrete slabs placed at air temperatures below 50° F shall contain specified non-corrosive non-chloride accelerator. Concrete required to be air entrained shall contain an approved air-entraining admixture. Pumped concrete, architectural concrete, concrete required to be watertight and concrete with water/cement ratio below 0.50 shall contain specified high-range water- reducing admixture (superplasticizer).
D. Slump Limits: 4" plus or minus 1". Concrete containing high-range water-reducing admixture (superplasticizer) shall have a maximum slump of 8" unless otherwise

approved by Architect. Concrete shall arrive at job site at slump of 2" to 3", be verified, then high-range water-reducing admixture added to increase slump to approved level. Other concrete shall arrive at job site at maximum slump of 3" for slabs and 4" for other members.

2.03 BATCHING AND MIXING

A. Concrete may be ready-mixed or job-mixed at the Contractor's option, in accordance with governing building code and with the referenced ACI 318. No hand mixing allowed.

PART 3 – EXECUTION

3.01 FORM WORK

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
B. Construct forms complying with ACI 347, to sizes and shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, molding, rustications, reglets, chambers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Solidly butt joints and provide back up at joints to prevent leakage of cement paste.
C. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings on forms at inconspicuous location.
E. Chamfer exposed corners and edges ¾" unless otherwise indicated. Where applicable use wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
F. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
G. Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound where applicable before reinforcement is placed.
H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such ties. Accurately place and securely support items built in to form.
I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement, if required, to eliminate mortar leaks.

3.02 PLACING REINFORCEMENT

A. Comply with the Concrete Reinforcing Steel Institute (CRSI) "Recommended Practice for Placing Reinforcing Bars", and as indicated on drawings and herein specified.
B. Clean reinforcement of loose rust, mill scale, dirt, and other materials or coatings, which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by chairs, spacers, and hangers as required. Set wire ties so ends are pointed into concrete.
D. In all cases, provide minimum concrete protection over bar reinforcement of at least 3" unless otherwise indicated on drawings.
E. Do not place bars more than 2" beyond the last leg of continuous support. Do not use supports to hold runways for conveying equipment.
F. Install mesh welded wire fabric reinforcement in as long lengths as practicable, lapping pieces at least one mesh plus 2" but in no case less than 8". Lace splices with wire. Offset end laps to prevent continuous laps in either direction. Lift mesh to middle third of slab by use of hooks.

3.03 JOINTS AND INSERTS

A. Joints: Provide slab joints, sawed joints and formed construction joints. Locate and install joints, which are not shown on drawings, so as not to impair the strength and appearance of the structure. Submit joint layout to Architect if requested.
B. Inserts: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Properly locate all embedded items in cooperation with other trades, and secure in position before concrete is placed. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

3.04 CONCRETE PLACEMENT

A. Comply with ACI 304, and as herein specified.
B. Pre-Placement Inspection: Before placing concrete, clean and inspect formwork, reinforcing steel, and items to be embedded or cast-in. Notify other crafts in ample time to permit the installation of their work, and cooperate with them in setting such work, as required. Make sure soil treatment for termite control has been applied, where required, to cushion fill before vapor barrier and concrete are installed. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.
C. Vapor Barrier: Apply directly over base. Lay with 6" wide side laps and end laps and seal watertight with manufacturers adhesive. Lay film just before reinforcement is placed and concrete is poured, and protect against punctures. Repair punctures with adhesive-applied extra sheet before proceeding.
D. Notify the Architect 24 hours before placing any concrete. Coordinate governmental inspections, if required, with agency having jurisdiction.
E. Conveying: Convey concrete from the mixer to the place of final deposit by methods that will prevent the separation or loss of materials. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design as to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials. Keep open troughs and chutes clean and free from coatings of hardened concrete. Do not allow concrete to drop freely more than 10 feet. Do not use vibrators to transport concrete inside of forms. All equipment and methods used for conveying are subject to the approval of the Architect.
F. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on hardened concrete so as to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete near or in its final location to avoid segregation due to rehandling or flowing, and displacement of the reinforcement.
G. Cold Weather Placing: Comply with the requirements of ACI 306.
H. Hot Weather Placing: Comply with the requirements of ACI 305.
I. Compaction: Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

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

3.05 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finished work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding ¼" in height rubbed down or chipped off.
B. Smooth Form Finish: For formed concrete surfaces exposed to view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smooth.
C. Smooth Rubbed Finish: Provide a smooth rubbed finish for exposed concrete surfaces and surfaces which have received smooth form finish treatment not later than one day after form removal. Moisten concrete surfaces and rub smooth with carborudum brick or other abrasive until uniform color and texture is produced. Do not apply cement grout other than that created by rubbing process.

3.06 SLAB FINISHES

A. Place, consolidate, strike off and level concrete slab to proper elevation. After the concrete has stiffened sufficiently to permit the operation, and water sheen has disappeared, float surface at least twice to uniform sandy texture.
B. Trowel Finish: After floating, trowel surface at least twice to smooth dense finish.
C. Slabs to Receive Floor Covering: Finish as in paragraph "Trowel Finish" above, except trowel to remove trowel marks and to smooth, even finish; omit second troweling.
D. Slabs to Receive Polished Concrete Floor Finish: Provide hard steel trowel finish with a minimum of 3 passes with power trowel to achieve Class 5 finish as described in ACI 302.1R to comply with minimum tolerances of Ff and Fl specified herein. Comply with additional requirements of Section 03 35 43.
E. Non-Slip Broom Finish: (At exterior walks, steps, and elsewhere as indicated), Specified in Section 32 30 00.
F. Concrete Sealer: Apply two coats in accordance with manufacturer's instructions.

3.07 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing and sealing compound, and by combinations thereof, as herein specified.
    1. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by covering concrete surface with specified

absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-cover curing by covering concrete surface with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed with waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide curing and sealing compound on interior slabs to receive resilient flooring or left exposed; and to exterior slabs, walks, and curbs, as follows:
   a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
   b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, waterproofing, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.
4. Curing Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
5. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs and other flat surfaces by application of appropriate curing compound. Final cure concrete surfaces by moisture-retaining cover, unless otherwise directed.

3.08 PROTECTION

A. No wheeling, working, or walking on finished surfaces will be allowed for 16 hours after concrete is placed.
B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.
C. Protect all exposed concrete floors, steps, and walks from paint and other materials or equipment that may mar or damage these surfaces.
D. For polished concrete floors comply with Section 03 35 43.

3.09 REMOVAL OF FORMS

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

3.10 MISCELLANEOUS ITEMS

A. Filling Holes: Fill in holes and openings left in concrete for the passage of work by other trades after their work is in place. Mix, place, and cure concrete to blend with in-place construction. Provide all other miscellaneous concrete filling required to complete work.
B. Non-Shrink Grout Application: Grout out equipment bases and other locations indicated with non-shrink grout. Provide non-metallic type where grout is exposed.
C. Drainage Items: Unless otherwise indicated, provide 3000 psi concrete for culverts and other items required for drainage installation.

3.11 CONCRETE SURFACE REPAIRS

A. General: Repair and patch defective areas with cement mortar of the same type and class as the original concrete, immediately after removal of forms. Cut out

honeycomb, rock pockets, voids over ½" diameter, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface, before placing cement mortar in the same manner as adjacent concrete. Proprietary patching compounds may be used when acceptable to the Architect.

B. Smooth, Exposed-To-View Surfaces: Blend cements so that, when dry, patching mortar will match color of surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
C. Concealed Formed Surfaces: Repair defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete.
D. Other repair methods may be used, subject to Architect's acceptance.

3.12 CLEAN-UP

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

END OF SECTION

SECTION 03 35 43

POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Product Data: Submit manufacturer's product data, installation instructions, maintenance and cleaning instructions, Material Safety Data Sheets (MSDS) and other safety requirements for each component.
C. Installer's Certification: Provide letter documenting Installer's accreditation and certification compliance as specified under quality assurance.
D. Test Reports: Provide sheen gloss reading test results conducted as specified and recorded on floor plan diagram confirming compliance with specified performance criteria.
E. Warranty: Provide 10 year product manufacturer's warranty agreeing to replace and repair defective materials that may occur within the warranty period at no cost to the Owner.
F. Pre-Installation Meeting Documentation: Submit pre-installation meeting minutes including date, project name, project number, attendance representatives, work sequencing, specification requirements and other special project conditions.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years.
B. Installer's Certification:
   1. Contact manufacturers specified for listing of approved Certified Installers.
   2. Use experienced installers who have successfully performed a minimum of 5 projects of at least 6000 square feet each. Upon request provide listing of projects and contact references.
   3. Provide letter of certification from manufacturer stating that Installer is certified applicator of polished concrete finishing system specified and is familiar with proper procedures and installation requirements required by the manufacturer.
C. Deliver, handle, and store materials in accordance with manufacturer's instructions. Maintain records of product container numbers.
D. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Owner and/or Architect.
   1. Comply with related standards indicated in Section 03 30 00 Cast-In-Place Concrete.

2. ASTM E 1155, Standard Test Method for Determining Floor Flatness and Levelness Using the F number system.
3. ASTM C779/C779M-05, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
4. ASTM C805, Standard Test Method for Rebound Number of Hardened Concrete.
5. ASTM E 430, Standard Test Methods for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry.
6. ASTM G23-81, Standard Test Method for Ultraviolet Light and Water Spray Resistance.

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

PART 2 – PRODUCTS

2.01 PROJECT SYSTEM PERFORMANCE AND APPERANCE CRITERIA

A. Concrete Mix Color: Natural without dyes or pigment additives.
B. Quality Level of Cut: Level 1 – Cream.
C. Quality Level of Sheen: Level A, Satin, Polished with 800 grit minimum, Gloss reading 45-60.
D. Abrasion Resistance: ASTM C779 – Up to 400% minimum increase in abrasion resistance.
E. Impact Strength: ASTM C805 – 20% minimum increase in impact strength.
F. Ultra Violet Light and Water Spray: ASTM G23-81 – No adverse effect to ultra violet and water spray.

2.02 MATERIALS AND MANUFACTURERS

A. GENERAL
   1. Compatibility: Provide products which are recommended by manufacturers to be fully compatible with project substrate conditions and special concrete floor finish materials, means and methods.
   2. Provide special concrete floor finish products from a single manufacturer unless otherwise approved.
   3. All products used shall comply with Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.
B. CAST-IN-PLACE CONCRETE MATERIALS
   1. Materials: Comply with Section 03 30 00. Materials and products shall be compatible with special concrete floor finish system.
C. SEALER, HARDENER AND DENSIFIER PRODUCTS
   1. Manufacturers: Contact manufacturers for listing of Certified Installers of specified products.
      a. Advanced Flooring Products, 888-942-3144.
      b. Euclid Chemical Company, 800-321-7628.
      c. L&M Construction Chemicals, 800-362-3331.
      d. Prosoco, 800-255-4255.
   2. Concrete Sealer, Hardner and Densifier: Advanced Flooring Products “RetroPlate 99”, Euclid “Euco Diamond Hard”, L&M “FGS Hardener Plus”, Prosoco “Consolideck LS”, or approved equal.
   3. Concrete Stain Inhibitor and Sealer: Advanced Flooring Products “RetroGuard Stain Inhibitor and Sealer”, Euclid “Euco Diamond Hard”, L&M “PermaGuard SPS”, Prosoco “Consolideck LS Guard”, or approved equal.
D. AUXILIERY MATERIALS
   1. Water: Potable.
   2. Joint Sealants: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control and expansion joint filler with Shore A 80 or higher hardness. Comply with Section 07 92 00. Materials and products shall be compatible with special concrete floor finish system. Use color that matches adjacent surface finish.
   3. Grinding and Polishing: Provide other related materials as recommend by manufacturer, not specifically described, but required for complete and proper system installation.
   4. Cleaning and Preparation Agents: Products recommended by manufacturer for project conditions.
   5. Protection Materials: Products recommended by manufacturer for project conditions.

PART 3 – EXECUTION

3.02 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Comply with manufacturer’s written instruction for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting installation and performance of special concrete floor finish.
   2. Coordinate scheduling with Owner to provide completion of installation of special concrete floor finish prior to 10 days minimum of installation of racking and equipment for an uninhibited continuous application of finish system.
B. Examination:
   1. Inspect substrate and report unsatisfactory conditions in writing. Verify that surfaces and site conditions are ready to receive work. Correct conditions detrimental to timely and proper installation of work. Beginning work means acceptance of substrate conditions.

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

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

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

3.03 INSTALLATION

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

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

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

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

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

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

7. Do not allow floor to be subjected to any forms of moisture, including mopping and wet foot traffic for 72 hours minimum.

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

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

3.04 PROTECTION, REPAIR AND CLEANING

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

END OF SECTION

SECTION 03 38 00

POST-TENSIONED SLABS-ON-GROUND

PART 1 – GENERAL

1.01 SUMMARY

A. Provide post-tensioned slab-on-ground systems for building foundation structure.
   1. Structural post-tensioned footings, foundations, and retaining walls.
   2. Structural post-tensioned slabs-on-ground and beam systems.
B. Tendon quantities shown in tabulated form on drawings is for convenience of Contractor only and are not guaranteed. Verify amounts shown in plans and details.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's data, certifications and installation instruction for proprietary materials and items, including prestressing steel tendons, anchorage, coupling, coating, sheathing, and forming accessories, admixture, grout, patching, compounds, joint systems and others required for complete system.
B. Laboratory Strength Test and Plant PTI Certification: Submit 1 copy to Owner for all steel tendons, anchorage and couplings used, including certified mill test reports containing a minimum of the following:
   1. Heat number and identification.
   2. Standard chemical analysis for heat of steel.
   3. Ultimate tensile strength.
   4. Yield strength at 1% extension under load.
   5. Elongation at failure.
   6. Modulus of elasticity.
   7. Diameter and net area of the strand.
   8. Type of material (stress-relieved or low relaxation).
   9. Representative load-elongation curve for each size and grade of strand supplied.
C. Jack Calibrations and Certifications: Calibration certificates for each jack and gauge used shall be available upon request. Test from an independent laboratory for each jack equipment and instrument used shall be conducted not more than 3 months prior to project stressing work.
D. Stressing Records: Submit 1 copy of complete stressing records to the structural engineer for review and approval prior to cutting of the tendon tails.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Engineer:
   1. PTI Manual of Standard Practice
   2. PTI Manual of Design and Construction of Post-Tensioned Slab-On-Ground
   3. PTI Construction and Maintenance Procedures Manual for Post-Tensioned Slab-On-Ground
   4. PTI Specifications for Unbonded Single Strand Tendons
   5. ACI 318 Building Code Requirements for Reinforced Concrete
   6. CRSI Manual of Standard Practice

C. Testing: Contractor shall employ a qualified independent testing laboratory acceptable to Owner and Engineer to perform material evaluation as specified under FIELD TESTING paragraph.

1.04 TOLERANCES

A. PTI and ACI Standards shall govern work except where specified differently.
B. Concrete and Conventional Reinforcement: Refer to Section 03300.
C. Tendon Placing Tolerances:
   1. Vertical deviations of the tendon should be ± ½ inch for slabs 5-inches thick or less and ± 10% of the slab thickness, not exceeding 1 inch for slabs greater than 5 inches. Vertical and horizontal placing tolerance for draped beam tendons is ± 1 inch. The vertical location of the anchorages should not vary more than 1 inch from the location shown on the foundation drawings if obstructions prevent it from being located exactly as shown.
   2. Horizontal deviations of up to 12 inches are allowed for slab tendons when required to avoid openings and penetrations and to meet the geometry of a particular slab provided that a smooth transition is provided and that proper coverage is maintained. A minimum radius curve of 5 feet should be used for ½ inch diameter strand.
D. Cover Requirements: The following minimum clear cover distances to the post-tension tendons and conventional reinforcing is required:
   1. Beams:
      a. Top: 2 inches
      b. Bottom: 3 inches
      c. Sides: 2 inches
   2. Slabs:
      a. Top: 1 inch
      b. Bottom: 1 ½ inch

1.05 FIELD TESTING

A. Concrete: Refer to Section 03 30 00 for requirements.
B. Tendon Stressing Measurements:
   1. Preparation: Properly seat wedges on tendon ends prior to stressing operation. Place initial reference mark equally spaced on both ends of tendon from anchor. Mark should be clear and accurately measured. Reference tendon location and record dimension in orderly tabulated form.
   2. Gauge Pressure: Stress each tendon as specified and record jack gauge pressure and identify jack used. Record value on stressing record form. Never stress tendons to a gauge reading which is higher than specified by the equipment manufacturer's calibration chart for the size of tendon elongated.
   3. Measurements: Remove stressing device and measure the distance from the reference mark to the nearest 1/8" with the tendon tail straight. Record value on the stressing record form. Measured elongation should compare within ± 5% of the calculated elongation. Discrepancies exceeding ± 5% shall be resolved with the Engineer.
   4. All ½ inch diameter tendons shall be post-tensioned to an initial force of 33,000 lbs. each. The post-tensioning shall not be applied until the concrete has attained a minimum compressive strength of 75% of the 28 day design strength of 2,500 psi minimum. Stressing should occur between 3 days and 10 days after concrete placement unless sufficient strength is not met. The initial stress shall provide a minimum 0.08 inches of elongation of the tendon length for every foot of tendon length unless otherwise specified by the manufacturer or approved by the Engineer.

5. Tendon stressing shall conform to the following:
    a. Maximum jacking stress: 0.80 fpu
    b. Maximum tendon stress immediately after anchoring: 74 fpu
    c. Maximum anchor stress immediately after anchoring: 0.70 fpu

C. Recording:
1. Use the stressing record form supplied by the post-tensioning material supplier or inspection company used to record actual elongations.
2. The stressing record should contain the following information:
    a. Project identification:
        1). Project location and address
        2). Name of Owner and Contractor
        3). Designing Architect and Engineer
    b. Date of stressing
    c. Equipment identification:
        1). Serial number or other identifying number of the stressing jack and gauge.
        2). Required gauge pressure corresponding to the jacking force required for the tendon size provided per the calibration chart supplied by the post-tension supplier.
    d. Name of operator.
    e. Tendon identification mark and calculated elongation.
    f. Measured elongation.
    g. Any special data or remarks related with the stressing.
3. Record the measurement and compare it with the calculated elongation.
4. If the measured elongation falls within the allowable variance, move to the next tendon and continue the stressing operation.
5. If the measurement elongations do not fall within the allowable variance, discontinue stressing, until the cause has been identified and a solution resolved. Check for possible causes of improper elongations. Consult post-tension material supplier and Engineer for recommendations.
6. Submit complete stressing record immediately to Engineer for review.

1.06 DEFINITIONS

A. Non-corrosive Environments: Structural system areas not normally exposed to direct or indirect applications of de-icer chemicals, soils containing less than 0.06% sulfate, seawater, or in the immediate vicinity of coastal salty air and further defined as coastal areas with building code wind speeds are less than 80 mph.
B. Corrosive Environments: Structural system areas exposed to direct or indirect applications of de-icer chemicals, soils containing equal to or more than 0.06% sulfate, seawater, or in the immediate vicinity of coastal salty air and further defined as coastal areas with building code wind speeds of 80 mph or greater.

1.07 HAZARD & SAFETY CONSIDERATIONS

A. Comply with General Conditions, all applicable government safety regulations, and PTI recommendations for installation of slab penetration locations, stressing operations, and repair of post-tension system.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Forms, Form Coatings, Steel Reinforcement, Concrete Materials, Admixtures and Other Miscellaneous Materials: Refer to Section 03 30 00 for requirements.

B. Pre-stressing Tendons:
   1. Tendons shall be ½ inch diameter, single strand unbonded conforming to ASTM A 416 and ASTM E328, Grade 270 (270,000 psi), 7-wire regular stress relived or low relaxation strand, greased and sheathed with plastic sleeve. Variations in diameter measured across the crowns of wire shall be +0.026 inches maximum and –0.006 inches minimum of the nominal size. No strand joints or splices in any length of installed stand will be allowed.
   2. Low relaxation strand shall be provided with a mill applied continuous permanent physical marking to permit field identification.
   3. Material shall be packaged at the source in a manner to prevent physical damage to the stand during transportation and protects the material from deleterious corrosion during transit and storage.

C. Anchors and Couplings:
   1. Tendon anchorages and coupling shall be designed to develop the static and dynamic strength requirements of 95% of the actual ultimate strength of the pre-stressing steel tested in an unbonded state without exceeding anticipated set and ASTM standards.
   2. Anchors shall be arranged so that the pre-stressing force in the tendons may be verified prior to removal of the stressing equipment. Fittings shall be provided to allow the complete grouting of all coupling components. Castings shall be nonporous and free of sand, blow holes, voids, and other defects.
   3. Wedge type anchorages, the wedge grippers shall be designed to preclude premature failure of the pre-stressing due to notch or pinching effects under the static and/or dynamic test load conditions stipulated for both stress relieved and low relaxation pre-stressing steel materials.
   4. Couplings shall only be used at locations specified on the drawings or approved by the Engineer. Couplings shall be coated with the same corrosive preventative coating used on the strand and shall be enclosed in sleeves, which permit necessary movements during stressing.
   5. Anchorages intended for use in corrosive environments shall include design features permitting a watertight connection of the sheathing to the anchorage, and watertight closing of the wedge cavity, for stressing and non-stressing (fixed) anchorages. Intermediate stressing anchorages shall be designed to permit complete watertight encapsulation of the pre-stressing steel.

D. Sheathing: The tendon sheathing shall be made of a material with the following properties:
   1. Sufficient strength to withstand unrepairable damage during fabrication, transport, installation, concrete placement and tensioning.
   2. Water-tightness over the entire sheathing length.
   3. Chemical stability, without embrittlement or softening over the anticipated exposure temperature range and the service life of the structure.
   4. Non-reactive with concrete, steel, and the tendon corrosion preventive coating.
   5. Minimum thickness of the sheathing used in normal (non-corrosive) environments shall not be less than 0.025 inches for medium and high density polyethylene or polypropylene. Sheathing thickness for tendons used in corrosive environments shall have not less than 0.040 inches of medium or high density polyethylene or polypropylene.
   6. Sheathing shall have an inside diameter at least 0.010 inches greater than the maximum diameter of the strand.
   7. For applications in corrosive environments, the sheathing shall be connected to all stressing, intermediate and fixed anchorages in a watertight fashion, thus providing a complete encapsulation of the pre-stressing steel.
   8. All damage or breaks in sheathing shall be repaired per manufacturer's recommendations, and approved by Engineer, to prevent tendon deterioration or contact with concrete.

E. Corrosive Preventive Coating:
   1. The corrosion preventive coating material shall have the following properties:
      a. Provide corrosion protection to the pre-stressing steel.
      b. Provide lubrication between the strand and the sheathing.
      c. Resist flow from the sheathing within the anticipated temperature range of the exposure.
      d. Provide a continuous non-brittle film at the lowest anticipated temperature of exposure.
      e. Chemically stable and non-reactive with the pre-stressing steel, the sheathing material, and the concrete.
   2. The film shall be an organic coating with appropriate polar, moisture displacing and corrosion preventive additives.
   3. Minimum weight of coating material on the pre-stressing strand shall be not less than 2.5 pounds of coating material per 100 feet of 0.5 inch diameter strand, and 3.0 pounds of coating material per 100 feet of 0.6 inch diameter strand. The amount of coating material used shall be sufficient to ensure essentially complete filling the annular space between the strand and the sheathing. The coating shall extend over the entire tendon length.
   4. Test performance in accordance with PTI-Post-Tensioning Manual (Fifth Edition), Table 3.2.1 ASTM criteria and requirements shall be provided for the corrosion preventive coating material.

F. Miscellaneous Connection Materials: Refer to Section 05 50 00 for requirements.
   1. Steel Plate: ASTM A 283, Grade C.
   2. Steel Shapes: ASTM A 36.
   3. Anchor Bolts: ASTM A 307.
   4. High Strength Threaded Fasteners: ASTM A 324.
   5. Steel Finish: ASTM A 153 galvanizing for exposed steel; primed for non-exposed steel.
   6. Bearing Pads: Elastomeric or TFE to suit bearing stresses.

PART 3 – EXECUTION

3.01 GENERAL

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Comply with PTI standards, and as herein specified.
C. Under slab utilities shall pass a minimum of 6" beneath stiffening beams where possible. Oversize sleeving is required for utilities, which must cross through the beams and shall only be provided with written approval from the Engineer.

3.02 FORM WORK, CONCRETE, & STANDARD REINFORCEMENT

A. Installation of Concrete Forms, Form Coatings, Steel Reinforcement, Concrete Materials, Admixtures and Other Miscellaneous Materials: Refer Section 03 30 00 for requirements.

3.03 ANCHORAGES

A. Stressing Anchorages:
   1. Stressing anchorages shall be installed perpendicular to the tendon axis. Curvature in the tendon profile shall not be closer than three (3) feet from the stressing anchorage.
   2. Stressing anchorages shall be attached to forms by either bolts, nails, or threaded pocket former fittings. The connections shall be sufficiently rigid to avoid

accidental loosening due to construction traffic or during concrete placement. Minimum cover for the anchorage shall not be less than the minimum cover to the reinforcement at other locations in the structure.

3. Pocket formers used to provide a void form at stressing and intermediate stressing anchorages shall positively preclude intrusion of concrete or cement paste into the wedge cavity during concrete placement. The depth of the pocket former from the edge of the concrete to the face of the anchorage shall not be less than 1-½ inches for normal environments nor 2 inches for corrosive environments.

B. Intermediate Anchorages:
   1. Intermediate anchorages may be installed either embedded in concrete or bearing against the hardened concrete at the construction joint. In the latter case, the anchorage shall have a flat bearing side and the concrete bearing area shall be smooth and without ridges.
   2. When placing intermediate anchorages against already hardened concrete, special attention must be paid to the perpendicularity between the form and the tendon during tendon placement. This type of anchorage is not allowed in corrosive environments.
   3. Minimum cover shall conform to stressing anchorage requirements.
C. Fixed Anchorages:
   1. Fixed end anchorages shall be installed on the tendon at supplier's plant prior to shipment to project.
   2. For wedge type anchorages, the fixed end wedges shall be seated, with a load of not more than 80% of the minimum ultimate tensile strength of the tendon for stress relieved strand or for low relaxation strand. The seating load shall be sufficient to ensure adequate capacity of non-stressing anchorages.
   3. Fixed end anchorages shall be placed in the formwork at the locations shown on drawings and securely fastened to the reinforcing steel. Minimum cover shall conform to stressing anchorage requirements.
   4. Fixed end anchorages intended for use in corrosive environments shall be closed or capped at the wedge cavity side with a water-tight cover. This cover shall be shop installed after filling the void around the wedge grips with corrosion preventive coating material comparable to that used over tendon.

3.04 TENDONS

A. Stressing:
   1. Tendons shall be securely supported on chairs at 4'-6" on center maximum and tied at all intersections to prevent displacement during concrete placement.
   2. Hydraulic stressing rams used to stress unbonded single strand tendons shall be equipped with stressing grippers which will not notch the strand more severely than normal anchoring wedges.
   3. Stressing rams and gauges shall individually be identified and calibrated against known standards at intervals specified. Calibration certificates for each jack used shall be available upon request.
   4. Stressing of tendons and elongation measurements shall be made at each stressing location as specified under FIELD TESTING paragraph. Stress slow enough to allow the strand to overcome as much friction as possible prior to seating.
   5. Tendons greater than 100 feet in length shall be post-tensioned from each end.
B. Finishing:
   1. Trim excess tendon length as soon as possible after tendon tensioning and stressing records have been submitted and approved by Engineer. The tendon length protruding beyond the wedges after cutting shall be between 0.75 inches and 1.25 inches. The tendon may be cut by means of either oxyacetylene cutting, abrasive wheel or hydraulic shears. In case of oxyacetylene cutting of the tendon, care shall be taken to avoid directing the flame toward the wedges.

2. For tendons used in corrosive environments, the exposed strand and wedge areas shall be coated with the tendon coating material comparable to that used over the length of the tendon and a watertight cap shall be applied over the coated area. Prior to installation of grout, the inside concrete surfaces of the pocket shall be coated or sprayed with a resin-bonding agent.
3. Clean pocket former recesses of any dirt, grit, oil or other materials affecting good bond of grout and concrete.
4. Stressing pockets shall be filled flush with 1 inch minimum thick cover of non-shrink grout attaining a minimum compressive strength equal to the concrete slab, as soon as practical after tendon cutting. Under no circumstances shall the grout used for pocket filling contain chlorides or other chemicals known to be deleterious to the pre-stressing steel.
5. Where cutting of the tail results in less than 1 inch of grout cover from the face of concrete, provide tendon tail caps or equivalent device that will result in a minimum of 1 inch cover of the exposed strand end, but in no case shall there be less than 1/8 inch grout cover.

3.05 JOINTS AND INSERTS

A. Concrete Joints: Refer Section 03 30 00. Where sawed joints are provided, caution shall be taken to avoid cutting or damaging tendons.
B. Inserts: Install pre-manufactured inserts, caps, fasteners, wedges, couplers, extensions and recess formers per manufacturer's recommendations and approved submittals.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 – GENERAL

1.01 SUMMARY

A. Provide concrete and brick masonry construction work where indicated. Include insulation where indicated in exterior multi-wythe cavity walls.

1.02 SUBMITTALS

A. Product data: None required unless submitting for approved equals.
B. Samples: None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Field Construction Mock-up: Not required for this project.
C. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. Brick Institute of America Standards and Specifications.
   2. National Concrete Masonry Association Standards and Specifications.
D. Tolerances:
   1. Variation from Plumb: For vertical lines and surfaces of columns, walls and arises do not exceed ¼-inch in 10 feet, or 3/8-inch in a story height not to exceed 20 feet, nor ½-inch in 40 feet or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed ¼-inch in any story of 20 feet maximum, nor ½-inch in 40 feet or more.
   2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed ¼-inch in any bay or 20 feet maximum, nor ¾-inch in 40 feet or more.
   3. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed ½-inch in any bay or 20 feet maximum, nor ¾-inch in 40 feet or more.
   4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed – ¼-inch nor + ½-inch.

PART 2 – PRODUCTS

2.01 MASONRY - GENERAL

A. Manufacturer: Obtain each type of unit from one manufacturer, cured by one process, and of uniform texture and color.
B. Color, finish, and texture to be as indicated on drawings or to be selected from manufacturer's standard samples for approved equals.
C. Provide special shapes where required for corners, lintels, jambs, sash, control joints, headers, bonding, cap, and other special conditions. Provide full 8" face units at CMU corners. Refer to drawings for typical unit types, sizes, shapes and coursing. Comply with referenced standards and other specified requirements for each type of masonry unit required.

2.02 FACE BRICK

A. Face Brick:
   1. Manufacturer: Acme, Belden Brick, Boral Brick, Endicott Clay Products, Glen-Gery Corp., Hebron Brick, Richtex or approved manufacturer.
   2. Grade: ASTM C 216, Type FBS, Grade SW, severe weathering type for areas subject to freeze-thaw.

2.03 CONCRETE MASONRY UNITS

A. Load-bearing Concrete Masonry Units:
   1. Manufacturer: No submittal required.
   2. Grade: Solid or hollow load bearing block, Grade N, Type 1 – Moisture Controlled, ASTM C 90, 1500 fm minimum compressive strength, normal weight.
   3. At fire rated assemblies provide block design and classification required for compliance with assembly rating and type indicated on drawings. Submit certificate upon request from Underwriters Laboratories or other recognized testing agency, as evidence that material supplied meets or exceeds rating and classification standards required.
B. Concrete Brick:
   1. Manufacturer: Submit manufacturer and samples for approval.
   2. Grade: Solid or hollow veneer block, Grade N, Type 1 – Moisture Controlled, ASTM C 55, 3000 fm minimum compressive strength, normal weight.

2.04 MORTAR AND GROUT

A. Grout Mix: ASTM C 476.
B. Mortar Mix:
   1. ASTM C 270, Type S, for reinforced masonry, masonry below grade and masonry in contact with earth.
   2. ASTM C 270, Type N, for above-grade load-bearing and non-load-bearing walls and parapet walls and for interior load-bearing and non-load-bearing partitions.
   3. Measure and batch materials either by volume or weight, such that required proportions can be accurately controlled and maintained. Measurement of sand exclusively by shovel will not be permitted. Mix mortars with the maximum amount of water consistent with workability to provide maximum tensile bond strength within the capacity of mortar. Mix ingredients for a minimum of 5 minutes in a mechanical mixer. Do not use mortar or grout that has began to set, or if more than 2-1/2 hours has elapsed since initial mixing. Re-temper mortar during 2-1/2 hour period as required to restore workability. Do not add air-entraining agents or other admixtures to mortar or grout materials.
C. Portland Cement: ASTM C150, Type I, except Type III may be used for cold weather construction. Provide natural color or white as required to produce mortar color.
D. Hydrated Lime: ASTM C207, Type S.
E. Aggregate for Mortar: Sand, conforming to ASTM C144 or ASTM C404, Size No. 2.
F. Aggregate for Grout: ASTM C404, Size No. 8 or Size No. 89.
G. Colored Mortar Pigments: Natural or synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars. Manufactured by Lehigh, Atlas, Solomon or approved equal. Color as selected by Architect.
H. Water: Clean and potable.
I. Integral Waterproofing: Aqua Stop Plus, AcmeSheild, Sonneborn “Hydrocide Powder”, W.R. Grace “Dry-Block”, or approved equal.

2.05 REINFORCING

A. Vertical Reinforcing Bars: ASTM A 615, Grade 60, deformed billet bars of sizes and spacing as indicated on drawings, free from loose rust, scale and other coatings that may reduce bond.

B. Horizontal Joint Reinforcing: Provide welded wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements below:
   1. Manufacturer: Dur-O-Wall, AA Wire Products, National Wire Products, or approved equal.
   2. Side and Cross Rod Wire Size: 9 gage (0.1875-inch diameter) galvanized steel for each 2 square feet of wall area. Vertical spacing shall not exceed 16-inches.
   3. Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8-inch on joint faces exposed to exterior and ½-inch elsewhere.
   4. Single-Wythe Masonry: Provide type as follows with single pair of side rods:
      a. Ladder or truss type design with perpendicular or diagonal cross rods spaced not more than 16-inches on center.
   5. Multi-Wythe Masonry: Provide type as follows:
      a. Ladder design for backup wythe with eyes or tabs welded at nominal 16-inches on center and side rods for each face of shell.
   6. Tab design with single pair of side rods and rectangular box type cross ties spaced not more than 16-inches on center, with side rods spaced for embedment within each face shell of back-up wythe and ties extending to within 1-inch of exterior face of facing wythe.

C. Ties and Anchors: Provide cavity wall ties sufficient to engage backing and veneer and shall be completely embedded 2-inches minimum into mortar and extend within 5/8-inch of joint face exterior and shall meet the following requirements:
   1. Manufacturer: Dur-O-Wall, AA Wire Products, National Wire Products, or approved equal.
   2. Ties in alternate courses shall be staggered. Maximum vertical distance between ties shall not exceed 24-inches and maximum horizontal distance between ties shall not exceed 36-inches. Additional wall ties shall be provided within 12-inches from edge of openings.
      a. Fixed Type Ties: There shall be at least 3/16-inch diameter wall tie for each 4.5 square feet of wall area. For cavity walls with greater than 3-inches of air space, there shall be at least 3/16-inch diameter wall tie for each 3 square feet of wall area.
      b. Adjustable Type Ties: There shall be at least 3/16-inch diameter wall tie for each 1.77 square feet of wall area regardless of air space width.
   3. At Metal Studs or Metal Panels: 12 gauge steel screw on anchor, ¾-inch wide by 9-inches long, mill galvanized, and triangle tie, ¼-inch wire, mill galvanized, length as required by wall conditions.
   4. At Cavity/Composite Masonry Walls: Double eye adjustable truss, with eye sections spaced 16-inches on center, mill galvanized; eye and pintle length as required by wall conditions.
   5. At Concrete Foundations: 1-inch wide by 1-inch deep by ¾-inch throat, 24 gage mill galvanized dovetail anchor slot, and dovetail triangle with ¼-inch wire tie and 12 gage mill galvanized dovetail.
   6. At Steel Frames: 9-inch long by ¾-inch wide, 12 gage, flat continuous adjustable weld on anchor, mill galvanized, and 3/16-inch gage square nosed beam tie, mill galvanized.
   7. Screws: ASTM C 954 organic polymer coated steel drill screws.

2.06 MASONRY ACCESSORIES

A. Flashing: Flexible sheet flashing formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color, 20 mils thick. Lap joints 4-inches minimum and provide mastic and sealant; type as recommended by flashing manufacturer.
B. Weeps: 3/8-inch diameter cotton sash cord or rope, length to produce 2-inch exposure on exterior and 12-inches in cavity.
C. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended by compatibility with sealant by sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.
D. Joint Sealant: Refer Section 07 92 00 for requirements.
E. Preformed Control Joints: Polyvinyl chloride material. Provide with corner and tee accessories, cement fused joints. Dur-O-Wall model “D/A A2002”, Greenstreak Model “673”, or approved equal.
F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, recommended by masonry unit manufacturer.
G. Water Repellents: Refer Section 07 19 00 for requirements.
H. Steel Lintels: Refer Section 05 50 00 for requirements.
I. Anchor Bolts (where shown on drawings): ASTM A 307, Grade A, galvanized.
J. Insulation (where shown on drawings): Refer Section 07 21 00 for requirements.

PART 3 – EXECUTION

3.01 GENERAL

A. Install materials and systems in accordance with manufacturer’s instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Comply with standards as follows:
    1. Comply with PCA Recommended Practices for Laying Concrete Block, Brick Institute of America (BIA) Tech Notes, and NCMA TEK Bulletins.
    2. Comply with cold weather and warm weather protection procedures as recommended in BIA Tech Notes.

3.02 PREPARATION

A. Brick: Wet clay brick having ASTM C67 absorption rates greater than 0.025 ounce per square inch/minute.
B. CMU: Do not wet concrete masonry units.
C. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

3.03 INSTALLATION

A. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to fit adjoining work neatly. Use full size units without cutting wherever possible.
B. Keep cavities clean of mortar droppings and other materials during wall construction. Strike joints flush facing cavity.
C. Provide weeps in exterior wythes of walls located immediately above ledges and flashing, space 32-inches on center unless otherwise indicated.

D. Install flashing complying with manufacturer's instructions and as indicated on drawings. Seal projections through sheet and lap and seal seams. Bond as recommended by manufacturer.
E. Coursing: Install masonry per tolerances specified. Lay in running bond with vertical joint in each course centered on units in course above and below, except where other coursing is indicated. Do not tooth corners.
F. Joints: Maintain uniform joint width of 3/8-inch. Provide full bed, head and collar joints except at weeps. Do not slash head joints. Use as dry a mortar mix as practicable and compress joints as much as possible to produce a dense tight joint.
    1. Concealed Joints: Strike flush.
    2. Exposed Brick Joints: Tooled.
    3. Exposed CMU Joints: Raked.
G. Fill vertical and horizontal cells of CMU solidly with grout where indicated. Fill space between hollow metal frames and masonry solidly with grout.
H. Install lintels and accessories in masonry construction as indicated on drawings.
I. Install reinforcing as specified and indicated on drawings.
J. Provide expansion and control joints in accordance with BIA and NCMA recommendations and as indicated on drawings. Install sealants per manufacturer's instructions.

3.04 REPAIR, POINTING AND CLEANING

A. Remove and replace damaged units.
B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up joints at corners, openings, and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.
C. Clean brick using bucket and brush method, BIA Tech Note 20.
D. Clean concrete masonry by dry brushing, NCMA TEK No. 28.
E. Install water proofing per manufacturer's instructions.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SUMMARY

A. Provide structural steel for building construction including sub-framing units which are part of the general framing system. Include related anchors, fasteners, and connectors.

B. Modify existing structural steel systems and components to accommodate remodeling and new work where indicated.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit for approval shop drawings, product data, test reports.

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1. Submit shop drawings including complete details and schedules for fabrication and shop assembly of the members, details, schedules, procedures and diagram showing the sequence of erection. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.

2. Perform design under direct supervision of a professional structural engineer licensed in the state where the project is located. Drawings shall be sealed, signed and dated.

1.03 QUALITY ASSURANCE

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

B. Standards: Comply with the following:

1. AISC “Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings:
2. AISC “Code of Standard Practice for Steel Buildings and Bridges”, Paragraph 4.2.1 is modified by deletion of the following sentence: “This approval constitutes the Owner’s acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings”.
3. AISC “Specifications for Structural Joints using ASTM A325 or A490 Bolts” approval by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation”.
4. AWS D1.1 “Structural Welding Code”.

C. Testing and Inspection:

1. The Contractor shall employ an independent testing laboratory acceptable to the Architect to inspect welded and bolted connections. The following items will be included in testing

laboratory inspections:
   a. Visual inspection of welded and bolted connections for quality.
   b. Check by ultrasonic or radiographic means approximately 10% each column field weld splices and beam to column welds.
   c. Test approximately 10% of high strength bolts for correct nut tightness.
2. Correct as directed, at Contractor's expense, connections that are found unsatisfactory by testing agency.

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Materials:

1. Structural Steel Shapes, Plates, and Bars: ASTM A 36.
2. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
3. Hot-Formed Steel Tubing: ASTM A 501.
4. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501.
5. Steel Castings: ASTM A 27, Grade 65-35.
6. Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 or 1020.
7. Anchor Bolts: ASTM A 307, nonheaded type.
8. Unfinished Threaded Fasteners: ASTM A 307, Grade A.
9. High-Strength Threaded Fasteners: ASTM A 325 or ASTM A 490, as applicable.

B. Auxiliary Materials:

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

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate and assemble structural assemblies in accordance with AISC and AWS codes and specifications, and as indicated on final shop drawings.

B. Connections Design: All structural framing connections shall be designed by the steel fabricator

to support at least one half the total uniform load capacity shown in the “Tables of Uniform Constants”, Part 2 of the AISC Manual of Steel Construction 8th edition, for the given beam, space and grade of steel specified.

C. Fabricate work to shape and size with sharp lines and angles and smooth surfaces. Securely weld or bolt with bearing type connections, unless otherwise indicated. Dress welds smooth on exposed surfaces. Provide rabbets, lugs, and brackets so that work can be assembled in a neat substantial manner. Smooth exposed ends and edges of metal and form joints exposed to weather to exclude water.

D. Architecturally exposed steel: Fabricate with special care using materials carefully selected for best appearance. Store materials off ground and keep clean. Cut, fit and assemble work with surfaces smooth, square and with complete contact at joints. Weld all work continuously; grind smooth and flush to make seams not visible after priming.

E. Punch or drill structural steel and/or furnish all clips required to accommodate work of other trades, where supported on or secured to structural steel.

3.02 ERECTION

A. Verify that field conditions are acceptable. See that anchor bolts in concrete are properly set to template.

B. Set structural steel members to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

C. Allow for erection loads. Provide temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.

D. Field weld or bolt component connections as indicated on final shop drawings. Weld in compliance with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welded work.

E. Alterations to Structural Framing: Do not field cut or alter structural members without approval of Architect/Engineer.

1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
2. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to the Architect/Engineer. Finish gas-cut sections equal to a sheared appearance when permitted.

F. Grout bearing plates on concrete to exact level required with grout and support on steel wedges until grout has set hard. Clean concrete and masonry bearing surfaces and roughen to improve bond. Clean the bottom of base plate contact surfaces.

3.03 PAINTING:

A. Shop Painting:
1. Shop paint only structural steel work exposed to view. Paint embedded steel which is partially exposed on the exposed portions and the initial 2" of embedded areas only. Do not paint surfaces which are to be welded.

2. Surface Preparation: Before painting, thoroughly clean all surfaces of all grease, rust, welding droppings and loose mill scale by methods conforming to SSPC-SP-1 and SSPC-SP-3. After erection, wire-brush and touch-up welded or abraded areas. Touch-up with primer.
3. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide a uniform dry film thickness of 2.0 mils. Use painting methods which will result in full coverage of joints, corners, edges and all exposed surfaces.

B. Touch-up Painting:
1. Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on structural steel is included in Section 09 90 00.

C. Touch-up field welds and abraded areas with shop primer.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacture's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except otherwise noted or specified, or as accepted or directed by the Architect.
   1. AISI, Specification for Design of Cold-Formed Steel Structural Members.
   2. AWS D1.3, Structural Welding Code.
   3. ASTM C 645, Specifications for Non-Load (Axial) Bearing Steel Studs, Runners (Tracks), and Rigid Furring Channels for Screw Application of Gypsum Board.
   4. ASTM C 754, Specifications for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.

1.04 LOADING AND DEFLECTION CRITERIA

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

1.05 TOLERANCES

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

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Marino, Dietrich, Dale/Incor, Superior, USG, Gold Bond, Unimast, or approved equal.
B. Cold-Formed Metal Framing Materials: Refer to drawings for specific member requirements:
   1. Exterior Framing: C-shaped load-bearing steel studs with 1.625-inch flange and flange return lip.

2. Interior Framing: C-shaped load-bearing steel studs with 1.625-inch flange and flange return lip.
3. Shaftwall Framing: I-shaped nonload bearing steel studs.
4. Runner Channel: U-shaped with 1.25-inch minimum flange.
5. Joist Framing: C-shaped load-bearing steel joists with 1.625-inch flange and flange return lip.
6. Furring Channel: W-shaped load-bearing steel furring channels.
7. Deflection Channel: Single slip track design with 2.0-inch minimum flange length.
8. Units 16 gage (.0598-inch) and heavier: ASTM A 446, yield point 50,000.
9. Units 18 gage (.0358-inch): ASTM A 446, yield point 33,000 psi.
10. Units 20 gage (.0329-inch): ASTM A 446, yield point 33,000 psi.
11. Finish: Galvanized, ASTM A 525, G60.

C. Framing Accessories: With each type of metal framing required, provide manufacturers standard accessories as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system, including:
1. Supplementary framing.
2. Lateral bracing, bridging, and solid blocking.
   a. Strap: 1-1/2" x 20 gage.
   b. Channels: 1-1/2" x 20 gage.
3. Web stiffeners.
4. Gusset plates.
5. Deflection track and vertical side clips.
6. Stud kickers and girts.
7. Joist hangers and end closures.
8. Reinforcement plates.
9. Anchors, clips, and fasteners.

PART 3 – EXECUTION

3.01 GENERAL

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
B. Comply with requirements of ASTM C 1007 for installation of steel studs and accessories and Metal Lath/Steel Framing Association Lightweight Steel Framing Systems Manual.
C. Make provisions for erection stresses. Provide temporary alignment and bracing. Framing components may be prefabricated into panels prior to erection. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly. Wire tying of framing components is NOT permitted.

3.02 INSTALLATION

A. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to the layout at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24-inches on center spacing for nail or power driven fasteners, nor 16-inches on center for other types of attachment. Provide fasteners at corners and ends of tracks.
B. Wall Studs: Install at 24-inches on center, unless otherwise indicated.
1. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
2. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges. Erect horizontal and vertical load bearing studs one piece full length. Splicing of studs is NOT permitted. Punch-outs shall be 10-inches minimum from ends of studs.

3. Allow for deflection, directly below horizontal building framing for non-load bearing framing as indicated on drawings.
4. Install horizontal stiffeners in stud system, spaced vertically at not more than 4 feet on center. Fasten at each stud intersection.
5. Construct corners using minimum 3 studs. Double stud wall openings, door and window jambs with opening larger than 2 feet square, except where indicated in manufacturers instructions. Install runner tracks and jamb studs with stud shoes or by welding and space jack studs same as full height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
6. Install supplementary framing, blocking, and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishing, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight of loading resulting from the items supported.
7. Where stud system abuts structural columns or walls, anchor ends of stiffeners to supporting structure.
8. Install diagonal racking bracing at each corner where walls are free standing and not attached to structure.
9. Frame both sides of expansion and control joints, with separate studs; DO NOT bridge the joint with components of the stud system.

C. Joist: Install at 24-inches on center, unless otherwise indicated.
1. Place joist as shown on drawings; not more than 2-inches from abutting walls. Connect joist to supports using fasteners or welding
2. Set joist parallel and level, with lateral bracing and bridging.
3. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track. Punch-outs shall be 10-inches minimum from ends of joist.
4. Provide web stiffeners at reaction point and/or as shown on drawings.
5. Provide double joist at floor openings exceeding 2 feet and at interruption of one or more spanning members.
6. End blocking shall be provided where joist ends are not otherwise restrained from rotation.

D. Restore damaged components. Protect work from damage.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. Submit for approval shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Indicate welded connections using standard AWS A2.0 welding symbols.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

A. Ferrous Materials:
   1. Steel Plates, Shapes and Bars: ASTM A 36.
   2. Steel Pipe, Black Finish: ASTM A 53.
   3. Steel Tubing: ASTM A 500 or A 501.
   4. Rolled Steel Floor Plates: ASTM A 786.
   5. Reinforcing Bars: ASTM A 615, Grade 60.
   6. Concrete Inserts: Threaded or wedge type.
   7. Welding Rods and Bare Electrodes: AWS specifications.

B. Fasteners:
   1. Bolts and Nuts: Hexagon head type, ASTM A 307, Grade A.
   2. Lag Bolts: Square head, FS FF-B-561.
   3. Machine Screws: Cadmium plated steel, FS FF-S-92.
   4. Wood Screws: Flat head carbon steel, FS FF-S-111.
   5. Plain Washers: Round carbon steel, FS FF-W-92.
   6. Drilled-In Expansion Anchors: FS FF-S-325.
   7. Toggle Bolts: Tumble-wing type, FS FF-B-588.
   8. Lock Washers: Spring type carbon steel, FS FF-W-84.
   9. Zinc-Coating: Fasteners in exterior assemblies or exterior walls.

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

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION

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

3.02 MISCELLANEOUS METAL FABRICATIONS

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

B. Ladder: Steel bars, rods and shapes of sizes and designs indicated, and securely anchored to floor and wall.

C. Steel Supports: provide structural steel lintels, channels, braces, angles, etc., as indicated and assemble as detailed. Secure all connections to provide rigid supports of all items required including supports not specifically specified in other sections.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Lumber Standards and Grade Stamps: US Product Standard PS 20, American Softwood Lumber Standard and inspection agency grade stamps. Factory mark each piece of lumber or plywood with type, grade, mill, and grading agency identification or submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on material surface.
C. Construction Panel Standards: PS 1, US Product Standard for Construction and Industrial Plywood; APA PRP-108.
D. Preservative Treatment: AWPA C2 for lumber and AWPA C9 for plywood; waterborne pressure treatment. Label each piece of pressure treated lumber and plywood with the quality control mark.
E. Fire-Retardant Treatment: AWPA C20 for lumber and AWPA C27 for plywood; non-corrosive type. Identify material with appropriate classification marking of Underwriters Laboratories, Inc., US Testing, Timber Products Inspection, or other testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 – PRODUCTS

2.01 MATERIALS

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

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

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

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

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

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

PART 3 – EXECUTION

3.01 INSTALLATION

A. Wood Framing: Comply with recommendations of NFPA manual for House Framing, NFPA Recommended Nailing Schedule, and NFPA National Design Specifications for Wood Construction.
B. Plywood: Comply with recommendations of APA Design and Construction Guide-Residential and Commercial.
C. Provide nailers, blocking, and grounds where required. Set work plumb, level, and accurately cut.
D. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction. Coordinate with other work.
E. Comply with manufacturers requirements for cutting, handling, fastening, and working treated materials.
F. Securely attach carpentry work to substrate by anchoring and fastening as indicated and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood, pre-drill as required.
G. Restore damaged components. Protect work from damage.

END OF SECTION

SECTION 07 19 00

WATER REPELLENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide water repellents for vertical and horizontal exposed surfaces where indicated:
   1. Exterior concrete.
   2. Interior concrete (Not receiving floor tile).
   3. Exterior brick masonry.
   4. Exterior concrete unit masonry.
   5. Exterior insulation and finish system.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Provide five year warranty for water repellent coating, guaranteeing installation, waterproofing, and watertight, except for structural cracks or opening caused by settling, expansion, or contraction.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: ProSoCo SureKleen "Weather Seal Siloxane PD", Sonneborn "Penetrating Sealer 20", L & M "Hydropel WB", or approved equal.
B. Water Repellents:
   1. Appearance: Clear, non-gloss, non-yellowing.
   2. Vapor Transmission: Breathing type, non-vapor barrier.
   3. Penetrating Sealers (NOT Visible): Solvent-based siloxane.
   4. Application Rate: (2) Coats suitable for substrate and project conditions.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions. Install materials with uniform appearance. Coordinate with work of other sections.
B. Clean substrate of substances, which might interfere with penetration/adhesion of water repellents. Test for moisture content in accordance with repellent manufacturer's instructions to ensure that surface is sufficiently dry.
C. Coordinate with sealants where feasible, delay application of water repellents until installation of sealants has been completed in joints adjoining surfaces to be coated.
D. DO NOT proceed with the application (except with the written recommendation of the manufacturer) when ambient temperature is less than 50° F; or when rain or

temperatures below 40° F are predicted for a period of 24 hours; or within 3 days after surfaces become wet from rainfall or other moisture sources.

E. First Coat: Apply heavy, saturation-type, flood coat from bottom up with sufficient material applied to produce a 6-inch to 8-inch rundown below contact point of spray pattern with surface. Apply in overlapping pattern and coverage controlled to approximate recommendation by manufacturer. Allow first coat application to penetrate surface (approximately 3 to 5 minutes).
F. Second Coat: Apply in same saturating manner as first coat.

END OF SECTION

SECTION 07 46 00

SIDING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide fiber cement board siding system complete, including trim, edges, moldings, revels, reglets, closures, flashings, counter flashings and accessories for exterior walls.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: None required unless submitting for approved equal.

C. Samples: None required.

1.03 QUALITY ASSURANCE

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

B. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM E 119 – Standard Test Method for Fire Tests of Building Construction and Materials.

D. ASTM D 5206 – Standard Wind Load Resistance Test.

E. ASTM C 1185 – Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards.

1.04 WARRANTY

A. Manufacturer's 50 year warranty. Warranty shall be transferable from original Owner to subsequent Owner.

PART 2 - PRODUCTS

2.01 FIBER CEMENT MATERIALS

A. Performance Requirements:

1. Fire Resistance: Provide fiber cement siding products that meet or exceed the following Class A Rating: Flame Spread 0-25, Smoke Development 0-450, per ASTM E 84.

2. Wind Load (Comply with local governing codes and regulations): Positive Avg. 148.03 psf, Negative Avg. 120.29 psf.

3. Linear Variation and Change in Moisture Content: M.D. -0.006 in./ft., C.D. 0.003 in./ft.

4. Wet Flexural Strength: Avg. 1155.51 psi.

5. Water Tightness: No water droplets observed.

6. Freeze-Thaw: No damage or defects observed.

7. Warm Water: No evidence of cracking, delamination, swelling, or other defects observed.

8. Heat-Rain: No crazing, cracking, or other deleterious effects, surface or joint changes observed.

9. Mean Coefficient of Linear Thermal Expansion: Avg. 3.18*10 – 6 in./ft. F.

10. Water Penetration: No water leakage observed into wall cavity.

11. Weather Resistance: No cracking, checking, crazing, erosion, or other detrimental effects observed.

B. Fiber Cement Siding:

1. Manufacturers: Nichiha, or approved equal. Note contact information for: Nichiha USA, Inc., 6659 Peachtree Industrial Blvd., Suite AA, Norcross, GA 30092 Ph: 770-805-9466, Fx: 770-805-9467 (www.nichiha.com) Account Manager: **Chris Tate, Nichiha USA, Inc., Phone: 404-538-1261**
Email: ctate@nichiha.com.

2. Type: Formed Fiber Cement Siding, ASTM C 1185.

3. Size (Minimums): 1” thickness x 1’-6” width x 6’-0” length.

4. Colors, Textures and Finish: To be selected from manufacturer’s standard samples by Architect, (Refer to drawing exterior finish schedule).

C. Accessories:

1. Corners, Closures, and Trim: Manufacturer’s standard profiles for project specific conditions. Weather proof assembly required.

2. Door and window casings: Manufacturer’s standard profiles for project specific conditions. Drainage type as required.

D. Fasteners: Aluminum nails as supplied by siding manufacturer.

1. Extruded aluminum 4” length clips, used to fasten panels to substrate and extruded aluminum 20” length clips, used to fasten panels at vertical stud joints when panel edges meet between two studs. 10’ length steel starter strips.

2. Fasteners: Stainless steel ring shank nails in fiinish and color compatible with siding and accessories. Length shall be sufficient to penetrate wood framing 1 ½ inches minimum and penetrate steel framing 3/8” minimum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Underlayment: Install underlayment, infiltrations barriers or moisture barriers where indicted on drawings. Comply with Section 07 21 00. Install in weatherboard fashion, lap horizontal joints 2 inches minimum, lap vertical joints 6 inches minimum. Install per underlayment manufacturer’s recommendations for specific job conditions.

B. Flashing and Sheet Metal: Comply with Section 07 60 00. Install approved corrosion resistant flashing in accordance with local building codes to prevent penetration of water into the wall cavity and to direct water out of the wall cavity at the base of the wall.

C. Fiber Cement Siding: Install materials and systems in accordance with manufacturer's instructions and approved submittals. Provide accessories and trim where shown on drawings and where otherwise necessary for a complete, weathertight installation. Allow for expansion and contraction. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

D. Sealants: Comply with Section 07 92 00. Colors to match siding material. Use concealed beads where practicable. Do not use exposed beads of sealant except where concealed application is not possible. Install sealant as recommended by siding manufacturer.

E. Restore damaged components. Clean and protect work from damage.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide firestopping at the following locations where indicated:
   1. Penetrations through fire-resistance-rated floor and roof construction.
   2. Penetrations through fire-resistance-rated walls and partitions.
   3. Penetrations through smoke barriers and construction enclosing compartmentalized areas.
   4. Sealant joints in fire-resistance-rated construction.

1.02 SUBMITTALS

A. None required unless submitting for approved equal.

1.03 QUALITY ASSURANCE

A. Comply the governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Fire Performance: ASTM E 119, ASTM E 814, and local regulations.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Bio Fireshield is specified, unless otherwise indicated; equivalent materials by Metalines/Matacaulk, 3M, Dow Corning Fire Stop, Tremco, USG, or approved equal.
B. General:
   1. Provide materials that are asbestos free.
   2. Provide materials with minimum flame (F) and temperature (T) rating of one hour, but not less than fire resistance rating of assembly being penetrated, as tested per ASTM E 814.
   3. Provide materials conforming to governing codes.
C. Firestop Sealant: Biotherm Firestop Sealants; single component silicone, gun grade for walls and overhead applications (Biotherm 100) and self-leveling for floor applications (Biotherm 200).
D. Firesafing Insulation (batt or board): Mineral wool fiber insulation or hydrous calcium silicate-inorganic, unfaced, thickness required to achieve assembly performance. Johns Manville "Super Firetemp Board", USG "Thermafiber", Fibrex or approved equal.
E. Firestop Pillows: Fiberglass cloth bags filled with high temperature mineral wool coated with intumescent material.
F. Firestop Mortar:
   1. Novasit K-10 Firestop Mortar; single component portland cement fly as mortar.
   2. K-2 Firestop Mortar; portland cement based mortar.
G. Firestop Sleeve: Prefabricated, steel casing lined with intumescent material.
H. Firestop Intumescent Caulk: Biostop 500 single component water based acrylic caulk.
I. Crash Foam System: Stainless steel housing lined with intumescent compound, with spring-loaded shutoff mechanism.

J. Accessories:
   1. Dam Material: Mineral fiberboard, plywood, or particleboard, sheet metal, or other approved material.
   2. Retainers, Clips: As recommended by firestop manufacturer.
   3. Mineral Fiber Matting: Safing.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Review extent of work with authorities having jurisdiction and obtain approval of installation thickness and methods.
B. Sequence work to permit firestopping materials to be installed after adjacent and surrounding work is complete to avoid need for removal of firestopping by work of other trades.
C. Clean surfaces and substrates of dirt, oil, loose material and other foreign materials, which may affect proper bond and installation of firestop. Provide primers required for various substrates. Maintain temperatures of substrate materials and ambient air temperatures as recommended by manufacturer. Provide ventilation in areas to receive solvent cured materials.
D. Comply with manufacturer's instructions and recommendations. Securely anchor insulation with safing clips. Install firestops without gaps or voids. Tool and trowel exposed surfaces. Remove excess firestop material promptly as work progresses and upon completion.
E. Protect, inspect and repair work until final acceptance.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

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

2.02 ELASTOMERIC JOINT SEALANTS

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

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

2.03 ACRYLIC EMULSION SEALANT

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

2.04 MISCELLANEOUS MATERIALS

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

PART 3 – EXECUTION

3.01 JOINT TYPES AND USAGE

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

3.02 JOINT SURFACE PREPARATION

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

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

3.03 INSTALLATION

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

END OF SECTION

SECTION 08 11 19

STEEL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide steel doors and frames.
   1. Exterior and interior steel doors.
   2. Hollow metal steel frames.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ANSI/SDI-100, Recommended Specifications for Standard Steel Doors and Frames.
   2. SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames".
   3. Fire-Rated Assemblies: NFPA 80, and acceptable testing agency listing.
   4. Thermal-Rated Assemblies at Exterior: ASTM C 236 or ASTM C 976.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Amweld Building Products, Ceco Door Products, Curries Co., Mesker Door, Steelcraft, Republic Steel Co., Fenestra Corp., Kewanee Corp., or approved equal.
B. Provide metal doors and frames from a single manufacturer.

2.02 MATERIALS

A. Fabrication: Fabricate steel doors and frames rigid, neat in appearance and free from defects, warp, or buckle. Provide clean cut, straight, and true molded members, well formed and aligned miters, dressed and ground smooth, and where applicable, concealed fasteners. Reinforce at corners as required to prevent sagging. Accurately form metal to required sizes and profiles including astragals. Fit, assemble, and weld units at factory or shop.
B. Anchors, Fasteners, Accessories: Manufacturers standard, hot-dipped galvanized at exterior. Provide not less than 3 anchors per jamb.
C. Fire Rated Units: Provide fire-rated units complying with NFPA 80 "Standard for Fire Doors and Window", and units tested, listed, and labeled in accordance with NFPA 252 "Standard Methods of Fire Test of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction. Labels must be affixed to the frame. DO NOT paint labels.

D. Steel Doors:
   1. Exterior Doors: ANSI/SDI-100, Grade II, heavy-duty, minimum 18 gage (.0358 inch) cold-rolled sheet steel, 1-3/4 inches thick with face sheets zinc coating (ASTM A 525 G60), mill phosphatized. Provide thermally improved doors with maximum U-value of 0.24 BTU/hr./sq. ft/degree F (ASTM C236), "R" factor 14.97, STC rating 26 (ASTM E 90 and ASTM E 413).
   2. Interior Doors: ASNI/SDI-100, Grade II, heavy-duty, minimum 18 gage (.0358 inch) cold-rolled steel, 1-3/4 inches thick. Provide acoustically improved doors with minimum STC of 33 (ASTM E 90 and ASTM E 413) where indicated.
   3. Cores: Continuously reinforced with a full core of resin-impregnated kraft honeycomb with 1-inch nested, hexagonal-shaped cells. Bond core to inside of both face sheets or polystyrene insulated panel core.
   4. Channel Fillers: Flush steel channel fillers for top channel of exterior doors.
   5. Vision Panels: Provide glazing stops/moldings for glazed panels. Glass and glazing is specified in Section 08 80 00.
   6. Astragals: Provide T and U astragal for pairs of exterior and fire-rated doors and as indicated on door schedule.

E. Steel Frames:
   1. Exterior and Interior Frames: Welded type, 16 gage (.0598 inch) sheet steel oil or cold rolled. At exterior openings provide frames with ASTM A 525 G60 zinc coating, mill phosphatized. Joints to be mitered or coped corners.
   2. Accessories: Door silencers and plaster guards, minimum 3 on strike jamb.
   3. Glazing Frames: Provide manufacturers standard steel channel or tubular stops, predrilled for screws and factory finished as specified for doors and frames. Glass and glazing is specified in Section 08 80 00.

2.03 HARDWARE

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

2.04 FINISH

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

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install doors and frames in compliance with SDI-100. Set frames accurately in position, plumb and aligned, and securely anchor to adjacent construction.
B. Install hardware, adjust as required to provide smooth and proper operation with secure latching or locking.
C. Erect fire doors and frames in compliance with NFPA 80 and requirements of authorities having jurisdiction.

D. Clearances: Provide clearances of not more than 1/8-inch at jambs and heads, and not more than ¾-inch from floor or 3/16-inch from thresholds. Exterior doors provide 3/8-inch undercut for accessibility threshold standards.
E. Touch-up damaged coatings and leave ready to receive finish painting.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

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

2.02 HARDWARE

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

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

2.03 FINISH

A. Finish: Factory primed and field finished. Provide manufacturers standard primer compatible with finish paint specified in Section 09 90 00. DO NOT prime or finish testing agency labels.

PART 3 – EXECUTION

3.01 INSTALLATION

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

END OF SECTION

SECTION 08 17 23

PREASSEMBLED WOOD DOOR AND FRAME UNITS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide preassembled interior hollow wood door and frame units.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Algoma, Ampco, Eggers, Mohawk, Summit, or approved equal.
B. Interior Preassembled Hollow Core Doors:
   1. Grade: Economy.
   2. Construction: Hollow core with expanded honeycomb or corrugated ladder infill.
   3. Top and Bottom Rails: Mill option of 5-inch wood or particleboard.
   4. Stiles: Mill option of 1-inch or 1-1/2 inch kiln dried hardwood or 2-ply edge strips with outer ply compatible to or same species as face veneer.
   5. Thickness: 1-3/4 inch thick.
   6. Lock Blocks: Mill option of 4" x 20" min. wood or particleboard.
   7. Faces: Mill option of 3-ply skins of foreign and domestic species. Face veneer of rotary-sliced birch or red oak, 0.020" min thickness. 12% max. moisture content.
   8. Adhesive: Mill option of type I or type II adhesive
C. Frames:
   1. Type: Mill option of factory preassembled split jamb or field assembled components.
   2. Material: Mill option of standard wood species with density equal to or greater than Douglas Fir for compatible finish with door.
   3. Size: ¾-inch minimum thickness at jamb and 1-1/4 inch minimum thickness at stop. 3-3/4 inch minimum width or as required for rough framing stud size. Stop offset dimension of 1-7/8 inch.
D. Casing:
   1. Material: Mill option of standard wood species with density equal to or greater than Douglas Fir for compatible finish with door.
   2. Size: Mill option of profile with minimum size of ½" x 1-1/2".
E. Finish: Factory primed and field finished. Provide manufacturers standard primer compatible with finish indicated on drawings and specified in Section 09 90 00. DO NOT prime or finish testing agency labels.

2.02 HARDWARE

A. Manufacturer: Manufacturers standard preassembled hardware components complying with Section 08 71 00- Door Hardware.
B. Components: Refer to drawing Door Hardware Schedule.
C. Preparation: Prepare wood door units to receive concealed finished hardware, including cutouts, reinforcing, drilling and tapping in accordance with door hardware schedule and templates provided by the hardware supplier. Reinforce wood door units to receive surface-applied hardware. Drilling and tapping for surface-applied hardware will be done on the job site.
D. Location of Hardware: Locate finish hardware as indicated in door hardware supplier templates and/or in compliance with Door and Hardware Institute publication "Recommended Location for Builders Hardware".

PART 3 – EXECUTION

3.01 INSTALLATION

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

END OF SECTION

SECTION 08 36 13

SECTIONAL OVERHEAD DOORS

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Overhead Door Corp. "591" Series. Equivalent by Raynor Garage Door Co., Wayne/Dalton Corp., Clopay Building Products, Advanced Door Technologies, or approved equal.
B. Sectional Overhead Doors:
   1. Panel Thickness: 1-5/8 inch.
   2. Exterior Surface: Ribbed, textured.
   3. Exterior Steel: 0.016 inch, hot-dipped galvanized.
   4. End Styles: 16 gage.
   5. Standard Spring: 10,000 cycles (High cycles).
   6. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
   7. Thermal Values: R-value of 14.86; U-value of 0.067.
   8. Air Infiltration: 0.08 cfm at 15 mph; 0.13 cfm at 25 mph.
   9. High-Usage Package: Required.
C. Finish and Color: Two-coat baked-on polyester with white exterior and white interior. Field paint as indicated on drawings, refer to Section 09 90 00 for requirements.
D. Wind Load Design: ANSI/NAGDM 102 standards in conformance with local code requirements.
E. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
F. Lock: Interior mounted slide lock engaging both jamb tracks with single action.
G. Weatherstripping: EPDM rubber tube seals fitted inside joints between sections. EPDM rubber bulb-type strip at bottom. Header and jamb weatherstripping.
H. Track: Provide lift clearance type track as recommended by manufacturer to suit loading required and clearances available.
I. Operation: Manual pull rope.
J. Attachment: Provide secondary framing and fasteners as required by manufacturer for proper operation.

PART 3 – EXECUTION

3.01 INSTALLATION

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

END OF SECTION

SECTION 08 44 12

GLAZED ALUMINUM CURTAIN WALLS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide glazed aluminum curtain walls, complete, including the following:
   1. Exterior entrance doors.
   2. Frames for entrances.
   3. Curtain wall type framing system.
   4. Transoms.
   5. Sidelights.

1.02 SUBMITTALS

A. Submit for approval shop drawings, product data, test reports.
   1. Comply with Section 01 33 00.
   2. Submit shop drawings including complete details and schedules for fabrication of shop and field assembly of the members including details, schedules, procedures and diagram showing the sequence of erection. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.
   3. Perform design under direct supervision of a professional structural engineer licensed in the state where the project is located. Drawings shall be sealed, signed, and dated.

1.03 QUALITY ASSURANCE

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

1.04 TEST PROCEDURES AND PERFORMANCE

A. Provision for Thermal Movements: System performance to provide for expansion and contraction within system components caused by temperature cycling resulting from a surface temperature ranging from 0° F to 180° F without causing buckling, stressing on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects. Operating doors and windows shall function normally over this temperature range.
B. Test Procedures and Performance:
   1. Air Infiltration:
      a. Test units in accordance with ASTM E 283 at static air pressure difference of 6.24 psf.
      b. Air infiltration shall not exceed 0.06 cmf/ft maximum per square foot of fixed wall area.
   2. Water Resistance:
      a. Test unit in accordance with ASTM E 331.
      b. There shall be no water leakage at a static test pressure of 15.0 psf.

3. Uniform Load Deflection:
    a. Test in accordance with ASTM E 330.
    b. Design and size members to withstand not less than **60 psf** minimum positive and negative design wind pressure normal to the plane of the wall, unless greater loads are required by local code requirements.
    c. Deflection under design load shall not exceed L/175 of the clear span.
4. Structural Uniform Load:
    a. Test in accordance with ASTM 330 at not less than 1.5 times the design wind pressure specified, minimum **90 psf**.
    b. At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, storefront parts, or any other damage would cause the storefront to be defective.
    c. Seismic Performance: Test unit in accordance with AAMA 501.4.
5. Condensation Resistance Factor:
    a. Test unit in accordance with ASTM 1503.1.
    b. Condensation Resistance Factor (CRF) shall not be less than 61.
6. Thermal Transmittance:
    a. Test unit in accordance with ASTM 1503.1.
    b. Conductive thermal transmittance (U-Value) shall not be less than 0.63 BTU/hr/degree F/SF.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Glazing: Meeting requirements of Section 08 80 00 and as scheduled on drawings.
B. Manufacturers: EFCO “5600” Thermal, outside glazed specified. Equivalent products by Kawneer of Vistawall approved.
C. Glazed Aluminum Curtain Walls:
    1. Framing:
        a. Size: 2-1/4” x 6” x (0.93” to 0.125”) wall thickness. Provide additional manufacturers’ standard concealed reinforcement systems as required to accommodate structural design loading criteria.
        b. Aluminum: 6063 T5 or T6 alloy and tempered, meeting requirements of ASTM B 221, alloy GS 10A-T5.
        c. Construction: Frame components shall be mechanically fastened by means of extruded aluminum shear block connections per manufacturers’ standards.
        d. Glazing Stops: Outside dry glazed with an exterior aluminum pressure plate and snap cover with interior and exterior dense EPDM gaskets. Units shall be 1-inch insulated double glazed consisting of ¼-inch exterior pane, ½-inch air space, ¼-inch interior pane install from exterior side.
        e. Fasteners: Aluminum or non-magnetic stainless steel. Concealed fastenings shall be cadmium or zinc-plated steel.
    2. Door Type:
        a. Size: As scheduled. EFCO series D300 specified.
        b. Aluminum: 6063 T5 or T6 alloy and tempered, meeting requirements of ASTM B 221, alloy GS 10A-T5.
        c. Stiles & Top Rails: 3-1/2” x 1-3/4” x 0.125” thick, plus or minus 0.005, glazing stop section 0.050” wall thickness.
        d. Bottom Rail: 10” minimum x 1-3/4” x 0.125” thick, plus or minus 0.005, glazing stop section 0.050” wall thickness.
        e. Construction: Manufacturer’s standard.
        f. Glazing Stops: Snap-in type with “Dry” EPDM or neoprene bulb-type glazing. Units shall be double glazed, 1” insulated unit, from exterior side.
        g. Weatherstripping: Neoprene bulb-type, replaceable.

3. Finish: Organic, AA-M12-C42-R1X, Kynar 500/Hylar 5000 Fluropon, in accordance with AAMA 605.2. Color as selected from manufacturer's standards and scheduled on drawings.
4. Door Hardware: Refer to drawing door hardware schedule and Section 08 71 00.

D. Auxiliary Materials:
1. Provide all other materials, not specifically described but required for a complete, weathertight, and proper installation of doors and framing systems, subject to acceptance by the Architect.
a. Deflection channels: As recommended by system manufacturer.
b. Continuous sill flashing sheet metal: 0.040-inch thick aluminum sheet, finish to match mullion sections where exposed.
c. Continuous subsills as required to provide positive drainage away from building at specific project conditions.
d. Column cladding sheet metal: 0.040-inch thick aluminum sheet, finish to match mullion sections where exposed.
e. Thermal Barrier: Barrier material shall be poured-in-place two part polyurethane. A NONSTRUCTURAL THERMAL BARRIER IS UNACCEPTABLE.

PART 3 – EXECUTION

3.01 INSTALLATION

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

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

A. Provide door hardware where indicated.

1.02 SUBMITTALS

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

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

A. Schedule: Refer to drawing door hardware schedule. Furnish in amounts and finish indicated or as required for complete and operable facility.
B. Manufacturers: Products of the following manufacturers will be considered acceptable provided products are of equivalent weight, function, materials, and design. Submit others for prior approval by Architect.
    1. Locksets and Cylinders: Schlage (NO Substitutes).
    2. Deadbolts and Deadlock Levers: Adams Rite (NO Substitutes).
    3. Panic Devices with Alarms (battery powered): Detex, Corbin Russwin, Von Duprin.
    4. Panic Devices without Alarms: Yale, Dorma.
    5. Hinges and Butts: Hager, Soss, Stanley, PBB.
    6. Closers: LCN, Norton, Reading, Cal Royal.
    7. Storefront Pivots: Rixon.
    8. Storefront Push/Pulls: EFCO, Kawneer, Vistawall.
    9. Stops, Bumpers, Weatherstripping, Sweeps, and Thresholds: Pemco, Rockwood, Trimco, Reese, National Guard, Hager.
    10. Knox box for fire emergency keys: As required and approved by local governing agency.

2.02 KEYING

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

2.03 FASTENINGS

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

PART 3 – EXECUTION

3.01 INSTALLATION

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

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Perform work in accordance with FGMA Glazing Manual, Laminators Safety Glass Association- Standards Manual for Glazing Installation Methods.
C. Provide safety glass (tempered, laminated) complying with requirements of ANSI Z97.1 and CPSC 26 CFR 1201 CII. Label each piece of glass indicating compliance with requirements. DO NOT remove label prior to installation.

1.04 WARRANTY

A. Provide five year warranty including coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: PPG, AFG Industries, Cardinal, Libby Owens Ford, Viracon, or approved equal
B. Schedule: Refer to drawings door schedule and glazing schedule for glazing types, combinations, and locations.

2.02 GLASS

A. General: Comply with ASTM C 1036, ASTM C 1048, and ASTM E774, of the types, classes, and forms specified.
B. Float Glass: Type I, Class 1 (transparent), Quality q3 (glazing select); thickness as indicated.
C. Tinted Glass: Type I, Class 3 (light reducing), Quality q3 (glazing select); tint and thickness as indicated. PPG "Solex" or approved equal.
D. Reflective Tinted Glass: Tinted glass as specified with reflective pyrolytic metal oxide coating on one surface; PPG "Solarcool (2) Azurlite" or approved equal.

E. Security Glass: One-way vision (transparent) inside with chemical vapor deposit on one side for a reflective coating, ¼-inch thickness, safety type where indicated.
F. Wire Glass: Type II, Class I (translucent) Form 1 (wired and polished both sides), ¼-inch thick welded square mesh.
G. Tempered Glass: Types specified, heat-strengthened (after cutting to final size) to 4 times normal strength, by process designed to eliminate tong marks or by vertical process if glass is installed to conceal tong marks.
H. Sealed Insulated Units: 1-inch thick, composed of ¼-inch thick exterior pane of glass type specified, ½-inch air space, and ¼-inch thick clear interior pane of glass type specified. Air space purged dry hermetic air. Edge with elastomer edge seal.
I. Mirror Glass: Type 1, Class 1 (transparent), Quality q2 (mirror), with silver coating, copper protective coating complying with CS27, and 2 mil thick painting coating; ¼-inch thick.

2.03 GLAZING MATERIALS

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

PART 3 – EXECUTION

3.01 PERFORMANCE REQUIREMENTS

A. Watertight and airtight installation of each piece of glass is required. Each installation must withstand normal temperature changes, wind loading, impact loading without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, and other defects in work.

3.02 INSTALLATION

A. Comply with FGMA “Glazing Manual” and manufacturer’s instructions and recommendations. Use manufacturers recommended spacers, blocks, primers, sealers, gaskets and accessories.
B. Clean channel surfaces and prime as recommended by sealant manufacturer.
C. Cut glass to size as required for measured opening, provide adequate edge clearance and glass bite all around. Cut prior to tempering.
D. DO NOT install sheets which have edge damage or face imperfections. Install glass with uniformity of pattern, draw, bow, and roller marks.
E. Miter-cut and bond (weld) ends of channel gaskets at corners to provide a continuous gasket.

F. Install sealants to provide complete wetting and bond and to create a substantial wash away from glass.
G. Seal face gaskets at corners with liquid elastomeric sealant to close openings and prevent withdrawal of gaskets from corners.
H. Remove and replace damaged glass and glazing. Wash, polish and protect all glass supplied under this section.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Tolerances: Not more than 1/16-inch difference in true plane at joints between adjacent boards before finishing. After finishing, joints shall not be visible. Not more than 1/8-inch in 10 feet deviation from true plane, plumb, level, and proper relation to adjacent surfaces in finished work.
C. Fire Resistant for Fire Rated Assemblies: Where work is indicated for fire-resistance ratings, provide materials and installations identical with assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspection organization acceptable to authorities having jurisdiction.
D. Performance: Structural and seismic performance meeting requirements of building code and local authorities.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers of Gypsum Board: Domtar Gypsum, Georgia-Pacific Corp., National Gypsum Co., United States Gypsum Co., or approved equal.
B. Gypsum Board:
   1. Gypsum Wallboard: ASTM C 36, Type X fire-rated type, 5/8-inch typical thickness, tapered edges.
   2. Water Resistant Gypsum Backing Board: ASTM C 630, Type X fire-rated type, 5/8-inch typical thickness, tapered edges.
   3. Exterior Gypsum Sheathing: ASTM C 931, asphalt gypsum core encased in brown water repellent paper on both sides and long edges, Type X fire-rated type, 5/8-inch typical thickness, V-shaped T&G long edges.
   4. Shaftwall Coreboard: ASTM C 442, Type X fire-rated type gypsum core with additives to enhance fire resistance of core, surfaced with water repellant paper on front, back, and long edges, 1 inch typical thickness, beveled edges, width required for blind installation in framing spacing and type indicated.

C. Joint Treatment Materials: ASTM C 475 and ASTM C 840, 2-coat joint compound, and other materials, paper, or fiberglass tape.
D. Trim Accessories: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for attachment, and beaded for concealment of flanges in joint compound. Provide all corner beads, edge trim-beads, and one-piece control joint beads. Provide decorative profiles factory primed of types indicated.
E. Fasteners: ASTM C 1002, self-drilling, self tapping screws for power driving with special head design for gypsum board attachment (Type S), producing surface depression for proper concealment; 1-inch long for single ply, 1-5/8-inch long for double ply, 2-inch long for multiple plies. Use other fasteners as required.
F. Water Resistant Sealer: Type recommended by gypsum wallboard manufacturer for sealing cut edges and holes in water resistant gypsum board.
G. Laminating Adhesive: Type recommended by gypsum wallboard manufacturer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Inspection: Coordinate with carpenter and insulator in placing of backing, blocking, bracing, and insulation where required in walls for acoustical treatment, millwork, fixtures, fittings, and accessories. Examine substrates for proper application of gypsum board systems. Beginning work means acceptance of conditions.
B. Install gypsum board assemblies in compliance with ASTM C 840 and GA 216, Recommended Specifications for the Application and Finishing of Gypsum Board. Install gypsum board assemblies true, plumb, level, and in proper relation to adjacent surfaces.
C. Provide fire-rated systems where indicated and where required by authorities having jurisdiction.
D. Partitions: Install boards vertically parallel to studs. DO NOT allow butt-to-butt joints and joints that do not fall over framing members. Arrange gypsum board joints on opposite sides of partitions to occur on different studs.
E. Ceilings and Soffits: Install boards across framing members in manner which minimizes number of end-butt joints and which avoids end joints in central area of each ceiling and soffit. Stagger end joints at least 24-inches.
F. Fastening: Fasten gypsum board to metal studs with specified screws spaced 16-inches on center for walls and 12-inches on center for ceilings of single layer application, 24-inches on center for wall and 16-inches on center for base layer, and 16-inches on center for wall and 12-inches on center for ceilings of double layer applications.
G. Expansion/Control Joints: Install expansion/control joints in ceilings exceeding 2500 sq. ft. in area and in partition and wall runs exceeding 30-feet unless otherwise indicated. DO NOT exceed a distance of 50-feet in either direction, between ceiling control joints and install a control joint where ceiling framing of furring changes direction. DO NOT exceed a distance of 30-feet between control joints in walls unless otherwise indicated.
H. Transitions, Trim, and Corners:
    1. Provide casing beads where edges of gypsum board meet dissimilar materials.
    2. Treat all internal angles formed by the intersection of either wallboard surfaces with metal trim and/or a taped joint system as indicated or required.
    3. Treat all vertical and horizontal external corners with metal bead corner reinforcement applied in accordance with manufacturer's recommendations.
    4. Where new partitions meet existing construction, remove existing corner beads to provide a smooth transition.

I. Finishing:
   1. Apply joint treatment at joints (both directions); flanges of corner bead, edge trim, and control joints, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for finish.
   2. Pre-fill open joints and beveled edges using setting-type joint compound.
   3. Apply joint tape at joints between gypsum board, except where trim accessories are indicated.
   4. Finish by applying joint compound in two coats (not including pre-fill) and sand between coats and after last coat. Leave ready for finish painting or wall treatment.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL TILE CEILINGS

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.
B. Provide 1 lot of extra replacement tile matching each type of material provided to Owner at substantial completion.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 ACOUSTICAL LAY-IN PANELS

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

2.02 SUSPENSION SYSTEM MATERIALS

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

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

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

2.03 MISCELLANEOUS MATERIALS

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

PART 3 – EXECUTION

3.01 INSTALLATION

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

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide resilient flooring.
B. Provide vinyl base, trim, edge strips, and transitions.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.
B. Provide 2% extra stock matching each type of different material provided at substantial completion.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Performance: Fire performance meeting requirements of building code and local authorities.
C. Provide materials and adhesives which do not contain asbestos.

PART 2 – PRODUCTS

2.01 VINYL COMPOSITION TILE

A. F-1: (Refer drawing finish schedule).
   1. Manufacturers: Armstrong (NO substitutes).
   2. Series: Standard Excelon.
   3. Color: Sandrift White # 51858.
   4. Type: ASTM F 1066, Composition 1, non-asbestos formulated, Class 2- through pattern.
   5. Size: 12 x 12 inches by 1/8-inch thick.
   6. Fire/Smoke Rating: ASTM E 662, flame spread rating 25 or less, smoke development rating 450 or less.

2.02 VINYL BASE AND TRANSITIONS

A. Vinyl base B-1: (Refer drawing finish schedule.)
   1. Manufacturers: VPI specified; equivalent by Johnsonite, Roppe, Afco, or approved equal.
   2. Color: Jet #01.
   3. Type: ASTM FS SS-W-40A, Type II, Vinyl.
   4. Size: 4-inches by 1/8-inch thick, cove toe.
   5. Fire/Smoke Rating: ASTM F 1861-98 and ASTM E 662, flame spread rating 25 or less, smoke development rating 450 or less.
B. Vinyl Transitions:
   1. Manufacturers: VPI specified; equivalent by Johnsonite, Roppe, Afco, or approved equal.
   2. Color: Jet #01.

3. Type: ASTM FS SS-W-40A, Type II, Vinyl.
4. Size: Manufacturer's standard as required for flooring type transitions, not less than 1-inch wide.
5. Fire/Smoke Rating: ASTM F 1861-98 and ASTM E 662, flame spread rating 25 or less, smoke development rating 450 or less.

2.03 MISCELLANEOUS MATERIALS

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

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions and recommendations. Install in proper relation to adjacent work.
B. Examine the areas and conditions under which resilient tile and accessory work is to be placed. Moisture content of concrete slabs, building air temperature, and relative humidity must be within limits recommended by flooring manufacturer. DO NOT proceed until unsatisfactory conditions have been corrected. Maintain minimum temperature of 70° F for minimum of 48 hours prior to installation. Maintain 70° F temperature continuously during and after installation as recommended by manufacturer, but in any case not less than 48 hours.
C. Prepare surfaces by cleaning, leveling, and priming as required. Test adhesive for bond before general installation. Level to 1/8-inch in 10 foot tolerance.
D. Tile Flooring:
   1. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room are of equal width. Adjust as necessary to avoid use of cut widths less than ½ tile at room perimeters. Lay tile square to room axis, unless otherwise indicated.
   2. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures to produce neat joints, laid tight, even, and straight. Extend flooring into toe spaces, door revels, and into closets and similar openings.
   3. Lay tile in checkerboard pattern with grain reversed on alternate tiles unless otherwise indicated. Broken, cracked, chipped, or deformed tile are not acceptable.
E. Resilient Base: Apply resilient base to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is indicated. Install base in as long lengths as practicable. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces. DO NOT stretch resilient base during installation.
F. Resilient Edge Strip: Place edge strips tightly butted and secured to flooring with adhesive. Install edge strips at all unprotected edges of flooring unless otherwise indicated.
G. Clean with a damp mop. Do not wash or scrub for at least 4 days after installation. Protect floor with building paper as necessary. On total completion of building, thoroughly clean resilient flooring and accessories with mild soap and water.
H. Apply wax to vinyl composition floors in compliance with manufacturer's instructions and buff with heavy mechanical polisher.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: ICI-Devoe & Raynolds, Glidden Co., Benjamin Moore, Pratt and Lambert, Sherwin Williams or approved equal. First-line commercial-quality products for all coating systems.
B. Coatings: Ready mixed except field catalyzed coatings of good flow and brushing properties, capable of drying or curing free of streaks or sags.
C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners, and other materials required to achieve the finishes specified.

2.02 FINISHES

A. Refer to drawing interior and exterior finish schedules to types, colors, and locations.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Examine the areas and conditions under which painting work is to be preformed. DO NOT proceed with the work until unsatisfactory conditions have been corrected. Starting of painting work will be construed as acceptance of the surfaces within any particular areas.
B. Perform all preparation and cleaning procedures in strict accordance with the coating manufacturer's instructions and as herein specified. Remove all hardware, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Re-install the removed items by workmen skilled in the trades involved, after painting is complete.

C. Cementitious Materials: Prepare cementitious surfaces to be painted by removing all chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate test. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint.
D. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those surfaces exposed to view and dust off. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, etc. Scrape and clean small, dry seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.
E. Gypsum Wall-Board: DO NOT paint over gypsum wallboard work until taped joints are thoroughly dry.
F. Ferrous Metals: Touch-up shop applied prime coats which have damaged or bare areas. Wire-brush, solvent clean, and touch up with the same primer as the shop coat.
G. Galvanized Surfaces: Clean free of oil and surface contaminates with an acceptable non-petroleum based solvent.
H. Aluminum: Remove film of oil and grease before painting by washing with mineral spirits.
I. Existing Materials to Remain: At existing areas to be re-painted, remove blistered or peeling paint to sound substrates. Remove chalk deposits and mildew and wash all surfaces with mild detergent. Perform related minor preparation including caulk and glazing compounds. Spot prime bare areas before priming and painting as specified.
J. Split Face and Smooth Face Applications: Individual job applications will require that the Contractor pay particular attention to the weather conditions prior to and during applications of products. A cold weather application is given if the temperatures are such that it is necessary for installation. All manufacturers' application data should be followed on temperature and humidity installation.
Upon installation, the Contractor shall confirm a pin hole free surface is achieved of the coating system. After application, the Contractor shall peer down on the wall from the top of the building to make sure all of the ledges are covered and are pin hole free. It is recommended that the products are sprayed up, down and side-to-side. It is also recommended that the application be back rolled as well for proper coverage. Contractor must also verify mil thickness at each coating prior to applying succeeding coatings.

3.02 APPLICATION

A. Apply paint by brush, roller, spray, or other acceptable practice in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers or carpet, velvet back, or high pile sheep wood as recommended by the manufacturer for material and texture required.
B. The number of coats and paint film thickness required is the same regardless of the application method. DO NOT apply succeeding coats until previous coat has completely dried. Sand between each enamel or varnish coat application with fine sand paper, or rub surfaces with pumice stone where required to produce an even smooth surface in accordance with coating manufacturer's directions.
C. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.
D. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent of that of flat surfaces.

3.03 SCHEDULE OF TREATMENTS

A. Interior gypsum board or plaster walls and ceilings:
   1. One coat of latex primer sealer.
   2. Two coats of acrylic latex paint.
B. Interior Wood- Transparent:
   1. Filler coat (for open grained wood only).
   2. One coat of stain.
   3. One coat of sealer.
   4. Two coats of varnish, satin.

C. Exterior and Interior Wood- Painted:
   1. One coat of acrylic primer sealer.
   2. Two coats of exterior acrylic paint.
D. Exterior and Interior Ferrous Metal:
   1. One coat of rust-inhibiting primer.
   2. Two coats exterior alkyd paint.
E. Exterior and Interior Galvanized Metal:
   1. Chemical wash.
   2. Galvanized iron primer.
   3. Two coats exterior alkyd paint.
F. Exterior and Interior Concrete, Concrete Block:
   a. General Application
      1. One coat interior/exterior latex block filler.
      2. Two coats elastometric coating.
   b. Cold Weather Application
      1. One coat Acrylic resin block surfacer.
      2. Two coats solvent borne masonry coating (waterproof sealer).

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide toilet accessories and metal framed mirrors.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

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

PART 3 – EXECUTION

3.01 INSTALLATION

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

END OF SECTION

SECTION 10 80 00

MISCELLANEOUS SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

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

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 FIRE EXTINGUISHERS

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

2.02 INTERIOR SIGNS

A. Manufacturers: Seton specified; equivalent by ASI, APCO, Best, Kroy, Kaltech, Mohawk, National Signage, or approved equal.
B. Interior Signs:
   1. Model: Refer drawing toilet accessories schedule.
   2. Type: Raised or engraved acrylic or plastic.
   3. Size: 8 inch by 8 inch.
   4. Color: Manufacturers standard colors contrasting from background and as indicated on drawings or selected by Architect.
   5. Copy: Helvetica Medium 5/8-inch height lettering, Braille, and accessibility graphics meeting requirements of ADA and CABO/ANSI A117.1 specifications.
   6. Fasteners, Tape, and Adhesive: As recommended by sign manufacturer for substrate attached.

2.03 EXTERIOR VINYL BUILDING ADDRESS LETTERING

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

PART 3 – EXECUTION

3.01 INSTALLATION

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

END OF SECTION

SECTION 13 34 18

PRE-ENGINEERED METAL BUILDING SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide pre-engineered metal building system and erection.
   1. Structural steel main building frames, secondary framing, bracing, including purlins and girts, engineered and fabricated by the building systems supplier.
   2. Steel wall and roof system including mechanical equipment roof curbs, roof penetration flashing, soffits, trim, closures, flashing, counterflashing, fasteners, accessories, gutters, downspouts, engineered and fabricated by the building system supplier.

1.02 SUBMITTALS

A. Submit pre-engineered metal building shop drawings, anchor bolt sizes and patterns, product data, and structural load reactions.
B. Submit pre-engineered metal building warranty.
C. Where required by local building official, submit for review field test and inspections of high-strength bolting installation as outlined under FIELD TESTING AND INSPECTIONS paragraph.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Use experienced installers. Receive, handle, store, and install materials in accordance with manufacturer's instructions.
B. Structural Design: Certified by registered engineer licensed in jurisdiction of project.
C. Standards: Comply Section 05 12 00 - Structural Steel Framing and with the provisions of the following specifications and standards, except as otherwise noted, specified, or as directed by the Architect.
   1. AISC- Specifications for Structural Steel Buildings.
   2. AISC- MB (Category- Metal Building) Standards.
   3. MBMA Low Rise Building Systems Manual.
   4. AWS D1.1-94 Structural Welding Code- Steel.
   5. ASTM A36-92 Specification for Structural Steel.
   6. ASTM A325-92A Specification for High Strength Bolts for Structural Steel Joints.

1.04 FIELD TESTING AND INSPECTIONS

A. Where required by local building official, Contractor shall employ and pay for a qualified independent testing laboratory to perform periodic field testing and inspection on approximately 10% of the A-325 high-strength bolting (in accordance with nationally recognized standards and per local code requirements) to determine that the requirements for bolts, nuts, and washers are installed and tightened per manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Armco, Behlen Manufacturing Co., Butler Manufacturing, Ceco Building Systems, Varco-Pruden, or approved equal.

B. Framing:
   1. Structural Framing: Comply with Section 05 12 00 Structural Steel Framing for quality, fabrication and construction of assemblies of structural shapes, primary, secondary, and endwall framing including columns, beams, purlins, girts, struts, and bracing.
C. Siding Panels: Match existing unless otherwise indicated.
   1. Type: Field-assembled panels for exposed fastening, unless matching existing.
   2. Material: Aluminum-coated steel sheets.
   3. Siding Panel Finish: Fluoropolymer, Kynar 500.
D. Roofing Panels: Match existing unless otherwise indicated.
   1. Type: Factory-formed standing-seam roof panel system.
   2. Material: Zinc-coated steel sheets.
   3. Roofing Panel Finish: Natural finish.
E. Related Materials: Match existing unless otherwise indicated.
   1. Gutters and downspouts.
   2. Caulking and sealants.
   3. Mechanical equipment roof curbs.
   4. Fasteners.
   5. Sealants.
   6. Sheet metal flashing, counterflashing, trim, closures, and accessories.

PART 3 – EXECUTION

3.01 GENERAL

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Contractor shall verify that field measurements of foundation, floor slab, anchor bolt size, and placement are as indicated on pre-engineered metal building erection drawings.
C. Field modification of parts shall be in accordance with the best standard procedures and require the approval of the manufacturer's Engineer, and be the responsibility of the Contractor.

3.02 ERECTION- FRAMING

A. Erect framing in accordance with MBMA Low Rise Building Systems Manual, Common Industry Practices.
B. The erector shall furnish temporary guys and bracing where needed for squaring, plumbing, and securing the structural frame against loads, such as wind loads. Acting on the exposed framing and seismic forces, as well as loads due to erection equipment and erection operations, but not including loads resulting from the performance of work by others. Bracing furnished by the manufacturer for the metal building system cannot be assumed to be adequate during erection. The temporary guys, braces, falsework, and cribbing are the property of the erector, and the erector shall remove them immediately upon completion of erection.
C. Do not field cut or alter structural members without approval of the metal building manufacturer engineer.
D. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION- WALL AND ROOFING SYSTEMS

A. Install in accordance with manufacturer's instructions.
B. Exercise care when cutting pre-finished material to ensure cuttings do not remain on the finish surface.

C. Fasten cladding system to structural supports, align level and plumb.

3.04 ERECTION- ACCESSORIES

A. Install gutters and downspouts in strict accordance with manufacturers' instructions.
B. Field break and install manufacturer's sheet metal stock as required at flashing, counter-flashing, trim, closure, and other locations where preformed parts are not provided by the pre-engineered metal building manufacturer. Install per SMACNA standards (latest revision).
C. Seal wall, roof, and trim accessories weather tight.

END OF SECTION

SECTION 20 01 00
GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. The work to be performed under this Division shall include all labor, materials, equipment, and transportation necessary to provide a complete and satisfactory system ready to use. The words "the Contractor" or "this Contractor" refers to the Contractor for the work specified in that Section. This Contractor shall examine all Drawings and all Sections of the Specifications and shall be responsible for ascertaining to what extent other Drawings and Sections affect the work herein specified.

B. Unless noted on the drawings otherwise, work shall also include:
   1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
   2. All fees and direct expenses involved in any inspection required for the project.
   3. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
   4. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
   5. All lights, guards, and signs as required by safety regulations applicable to the work.
   6. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.

C. The work shall include revisions, modifications, and rework of existing work as required for installation of new work, and as required for connections of new work to existing systems, and as required for connections of existing work to new systems.

1.03 CODES, REGULATIONS, AND STANDARDS

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

1.04 ABBREVIATIONS

A. All equipment, apparatus and systems shall be rated, tested, fabricated and/or installed in accordance with the applicable industry standard mentioned. The following list will serve to clarify abbreviations that appear in other sections of this specification:
   1. AABC-Associated Air Balance Council
   2. FS-Federal Specifications
   3. ADC-Air Diffusion Council
   4. NFPA-National Fire Protection Association
   5. AGA-American Gas Association
   6. NSC-National Safety Council
   7. ASHRAE-American Society of Heating, Refrigerating and Air Conditioning Engineers
   8. ASME-American Society of Mechanical Engineers

9. IEEE-Institute of Electrical and Electronics Eng.
10. NSF-National Sanitation Foundation
11. AMCA-Air Moving and Conditioning Assoc.3. ASE-Association of Safety Engineers
12. ASTM-American Society for Testing and Matl
13. MCAA-Mechanical Contractors' Association of Amer.
14. AWWA-American Water works Association
15. ANSI-American National Standards Institute
16. SMACNA-Sheet Metal and Air Conditioning Contractors National Association
17. NEBB-National Environmental Balancing Bureau
18. ARI-Air Conditioning and Refrigeration Inst.
19. UL-Underwriters Laboratories
20. NEMA-National Electrical Manufacturers Assoc.
21. OSHA- Occupational Safety & Health Administration
22. EPA-Environmental Protection Agency

1.05 SUBMITTALS

A. See also Division 01, 01 33 00 Section "SUBMITTALS" for requirements for shop drawings and product data.
B. Before beginning the fabrication of any material or the installation of any equipment, a complete schedule of the materials and equipment proposed for installation shall be submitted to the Engineer for approval. This schedule shall include manufacturers' names, catalog data, diagrams, drawings and other descriptive data as required or requested by the Engineer.
C. All items of materials and equipment used for the project shall be submitted.
D. Refer to General Conditions of the specifications for format and number of copies required.

1.06 SUBSTITUTION OF EQUIPMENT

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

1.07 CONTRACT DRAWINGS

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

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ROUGH-IN

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

3.02 MECHANICAL INSTALLATIONS

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

3.03 DEFECTIVE WORK AND MATERIAL

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

3.04 COOPERATION AND COORDINATION

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

3.05 CUTTING AND PATCHING

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

3.06 PROTECTION OF EQUIPMENT AND SYSTEMS

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

END OF SECTION 20 01 00

SECTION 20 05 00
VALVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

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

1.03 RELATED WORK

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

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

1.04 QUALITY ASSURANCE

A. Single Source Responsibility.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Valves:
   1. Bell and Gossett
   2. Conbraco (Apollo)
   3. Crane
   4. Flowdesign
   5. Grinnell
   6. Jomar
   7. Keystone
   8. Nibco
   9. Stockham
   10. Victaulic
   11. Watts

2.02 VALVE FEATURES - GENERAL

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

2.03 GATE VALVES

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

2.04 BALL VALVES

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

2.05 CHECK VALVES

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

PART 3 - EXECUTION

3.01 VALVE ENDS SELECTION

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

3.02 VALVE INSTALLATIONS

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

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

3.03 FIELD QUALITY CONTROL

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

3.04 ADJUSTING AND CLEANING

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

END OF SECTION 20 05 00

SECTION 22 00 00
PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

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

B. Fees, permits and licenses; see Section 20 01 00, 1.02 "Work Includes".

1.03 RELATED WORK

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

1.04 SUBMITTALS

A. None required unless submitting for approved equals.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with current edition of following:
   1. Pipe and fittings shall conform to applicable ANSI, AWWA, ASTM, and USASI standards referenced for those products.

B. No plumbing fixture, special equipment, device or piping shall be installed which will provide cross connection or interconnection between distributing supply for drinking water or domestic water and polluted supply or waste so as to make possible backflow or back-siphonage of sewage or polluted water into potable water supply system.

C. Where possibility of back-siphonage exists, water supplied to fixture shall be introduced through a suitable vacuum breaker installed at code minimum distance above fixture.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Water Hammer Arrestors
   1. Souix Chief.

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

2.02 DOMESTIC COLD AND HOT WATER PIPING SYSTEMS

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

2.03 PIPE AND TUBE MATERIALS

A. See Part 3 Article "Pipe and Fittings Applications" for the application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems:
   1. Hard Copper Tube: ASTM B 88, Types K, and L, water tube, drawn temper.
   2. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
   3. Hubless, Cast-Iron Soil Pipe: CISPI 301.
   4. Poly(Vinyl Chloride (PVC) Plastic, DWV Pipe: ASTM D 2665, Schedule 40 or PVC-DWV "Foam Core" - ASTM-F-891; plain ends.
   5. Schedule 40 Black Steel: A53 ERW, Grade B.
   6. Schedule 10 Black Steel: A135 ERW or A795 ERW, Grade B.

2.04 PIPE AND TUBE FITTINGS

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

2.05 JOINING MATERIALS

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

2.06 PIPE SPECIALTIES

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

2.07 GAS PIPING

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

2.08 TRAPS

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

2.09 WATER HEATER - ELECTRIC

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

ASME pressure and temperature relief valve.

PART 3 - EXECUTION

3.01 PIPE AND FITTINGS APPLICATIONS

A. The following applications are for only inside and below the building and ending at a point 5'-0" outside the perimeter building walls. For piping from 5'-0" outside the building to the utility point of connection (POC), see Section 33 00 00 "Site Piping".

B. Use pipe, tube, fittings, and joining methods for piping systems according to the following applications:
   1. Domestic Water Distribution Piping Below Ground: Use the following:
      a. All interior domestic water piping shall be type "K" hard drawn copper tubing (SIL-FOS 2, FOS-FLO 7 or other silver brazing material). This is required for the water service line from the shut-off valve in the building to a point 5 feet outside the building.
      b. All copper piping shall be installed with wrought copper fittings. Field-fabricated "T-Drill" taps are acceptable on piping 1" and larger, if silver-brazed (above-ground piping only).
      c. Soft temper copper tubing may be used for small pipe in concealed spaces only to permit bends for roughing in.
      d. Do not use tin-lead solder on domestic water piping. Use only approved lead-free solder or brazing material.
   2. Domestic Water Distribution Piping Above Ground: Use the following:
      a. Hard copper tube, Type L; wrought-copper or cast-copper-alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy Sn95 solder.
      b. Fittings Option: Mechanically formed outlets, brazing filler alloy, and brazed joints.
      c. Fittings Option: Grooved fittings for copper piping.
   3. All Exterior Domestic Water Piping Below Ground:
      a. From 5'-0" outside the building to the utility water main, see Section 33 00 00 "Site Piping"
   4. Soil, Waste, and Vent Piping Below Ground: Use either of the following:
      a. Schedule 40 poly vinyl chloride (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
   5. Soil, Waste, and Vent Piping Above Ground: Use either of the following:
      a. Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
      b. Poly vinyl chloride (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
      c. PVC piping is not permitted in air-handling ceiling spaces, use only cast-iron or ductile iron pipe in these locations. See paragraph 5.a. above for cast-iron pipe specifications.
   6. All Exterior Soil and Waste Piping Below Ground:
      a. From 5'-0" outside the building to the utility sewer main: See Section 33 00 00 "Site Piping".

3.02 JOINTING OF PIPING

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

3.03 EXPANSION AND CONTRACTION

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

3.04 INSTALLATION OF PIPING

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

3.05 DISINFECTION OF DOMESTIC WATER SYSTEMS WITHIN THE BUILDING

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

3.06 FLUSHING WATER PIPING

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

3.07 SOIL, WASTE, AND VENT SYSTEMS

A. Size of soil, waste and vent stacks and branch piping shall be as indicated on the drawings, but in no case less than required by the provisions of the applicable codes.
B. Where possible, sewers and branches shall pitch down 1/4" per foot, but not less than 1%. Branches, arms and connections, shall be sloped 1/4" in 1'-0" where possible and provide with adequate hangers as specified elsewhere.
C. Interior underground, underfloor or on-ground piping, shall be continuously bedded with depressions for hubs on compacted sand or gravel to undisturbed soil for a minimum depth of 6" under pipe.
D. Connections to soil, waste and drain stacks shall be at 45 degrees; those to vent stacks may be at 45 degrees or 90 degrees except vent stacks shall be connected at 45 degrees to soil, waste or drain stack.
E. Connections to stacks and sewers shall be arranged so that operation of any fixture will not cause fluctuation of water level in traps of other fixtures.
F. Interior downspout shall be connected to roof drains; and provided with ample offsets or expansion joints below or integral with roof drains.
G. All thread joints shall be made up with red lead applied to male thread only. Threads exposed after joints are made up shall be painted with red lead to prevent rust. Teflon tape may be used at Contractor's option.
H. Junctions of screwed pipe to bell and spigot cast iron shall be made with ring or half coupling screwed to end of galvanized pipe to form spigot end.
I. Junctions in all drainage lines shall be made with "Y" branches or 1/8" bends, unless closeness of connection prevents it, in which case, where direction of flow is from horizontal to vertical, sanitary tees may be used upon the approval of the Engineer's superintendent.
J. Compression joint installation for cast iron soil pipe:
    1. Fold and insert the one piece neoprene rubber gas-ket into the hub which has been properly cleaned.
    2. Apply gasket lubricant to the spigot and inside of the gasket.
    3. Push, draw or drive the spigot into the gasketed hub with a pulling tool or suitable device.
K. Do not install pvc piping in air-handling ceiling spaces.

3.08 STACKS

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

3.09 VENTING

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

3.10 ROOF FLASHINGS

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

3.11 CLEANOUTS

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

3.12 INSTALLATION OF WATER HEATER

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

END OF SECTION 22 00 00

SECTION 22 07 19
PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

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

1.03 CODES AND STANDARDS

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

1.04 DEFINITION

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

1.05 PROTECTION

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

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Insulation
   1. Certain-Teed/Saint Gobain Corp.
   2. Owens-Corning Fiberglass Corp.
   3. Manville Corp.
   4. Knauf Fiberglass.
C. Closed Cell Elastomeric
   1. Armstrong.
   2. Halstead Industrial Products.

B. Adhesives, Lagging, and Sealers
   1. Benjamin Foster.
   2. Insul-Coustic.
   3. Chicago Mastic Co.
D. PVC Premolded Fitting , and PVC JacketingValve Covers
   1. Insul-Coustic Corp.
   2. Zeston, Inc.
   3. Certain-Teed/Saint Gobain Corp.
   4. P.I.C. Plastics

E. Cellular Glass Insulation

1. Pittsburg Corning Corporation (PCC)
5. Ceel-Co.
6. Johns-Manville

2.02 COLD AND HOT WATER PIPING AND EQUIPMENT INSULATION

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

2.06 ADHESIVES, LAGGING, AND SEALERS

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

2.05 PREMOLDED FITTING AND VALVE COVERS

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

PART 3 - EXECUTION

3.01 PREPARATION/GENERAL REQUIREMENTS

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

3.02 PIPING INSULATION

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

Type of System or Pipe	Insulation Thickness	
	Runouts up to 2"	Mains
1. Domestic cold water piping, domestic hot water piping, tempered water piping	½"	1"

B. Runouts are individual branches to units/fixtures, not exceeding 12'-0" in length.
C. Installation of insulation shall be as follows:
1. Pipe: Butt all joints firmly together. Cover joints with 3" butt strips. Smoothly secure all jacket laps and joints strips with adhesive. Self-sealing laps shall be applied according to manufacturers recommendations. Ends of pipe insulation shall be sealed off with a vapor barrier coating at all fittings and valves and at intervals of 21 feet on continuous runs.

END OF SECTION 22 07 19

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

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

1.03 SUBMITTALS

A. None required unless submitting for approved equals.

1.04 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Brass
   1. American Standard.
   2. Moen Commercial.
   3. Chicago Faucet.
   4. T & S Brass.
B. Drench Shower and Eyewash Units
   1. Bradley.
   2. Haws.
C. Electric Water Coolers
   1. Elkay.
   2. Halsey-Taylor.
   3. Oasis.
D. Mop Service Basins
   1. Fiat.
   2. Williams.
E. Seats
   1. Beneke.
   2. Olsonite.
   3. Church.

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

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

2.02 PLUMBING FIXTURES AND TRIM

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

2.03 WATER CLOSET-HANDICAPPED

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

PART 3 - EXECUTION

3.01 PLUMBING FIXTURES AND TRIM

A. All fixtures shall be set firm and true, connected to all piping services ready for use.
B. Fixtures shall be installed per manufacturers recommendations.
C. Fixtures intended to meet ADA requirements shall be installed at recommended heights and with appropriate clearances.
D. Sinks and lavatories for handicapped access shall be installed with offset tailpieces and insulated traps.

3.02 OWNER FURNISHED EQUIPMENT

A. Provide rough-ins and final connections to all Owner furnished equipment including shut off valves, piping, traps, etc. necessary to connect up equipment after it has be installed in place.

END OF SECTION 22 40 00

SECTION 23 05 93
TESTING ADJUSTING & BALANCING OF HVAC SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

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

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.01 TESTING, ADJUSTING, AND BALANCING OF HVAC

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

END OF SECTION 23 05 93

SECTION 23 11 00
GAS PIPING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

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

1.03 RELATED WORK

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

1.04 SUBMITTALS

A. No submittals required when using specified materials. Otherwise, comply with Division 26 Section 26 00 10 "SUBMITTALS" and "SUBSTITUTION OF EQUIPMENT".
B. Test reports specified in "Field Quality Control" Article in Part 3, Section 23 11 00.
B. Maintenance data for gas specialties and special-duty valves for inclusion in Operating and Maintenance Manuals specified in Section 20 02 00 – "Contract Close-Out and Commissioning".
C. Test reports specified in "Field Quality Control" Article in Part 3.

1.05 QUALITY ASSURANCE

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

1.06 DEFINITIONS

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

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Gas Pressure Regulators
   1. American Meter Co.
   2. Jordan Valve Div., Richards Industries, Inc.
   3. Fisher Controls.
   4. Lancaster by National Meter Parts, Inc.
   5. Gas Energy, Inc., Subsid., Brooklyn Union Gas.
   6. Maxitrol Co.

B. Low-Pressure Gas Stops
   1. Hammond Valve Corp.
   2. Lancaster by National Meter Parts, Inc.
   3. Jomar International, Ltd.
   4. Rockford-Eclipse Div., Eclipse, Inc.

C. Gas Valves, 2 Inches and Smaller
   1. Homestead by Olson Technologies, Inc.
   2. Mueller Co., A Grinnell Co.
   3. Lancaster by National Meter Parts, Inc.
   4. Mueller Steam Specialty Div., Core Industries, Inc.
   5. Lunkenheimer Co.
   6. Nordstrum Valves, Inc.
   7. Milliken Valve Co., Inc.
   8. Rockford-Eclipse Div., Eclipse, Inc.

D. CSST (Corrugated stainless steel tubing)
   1. Titeflex.

2.02 PIPES AND TUBES

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

2.03 PIPE AND TUBE FITTINGS

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

2.04 JOINING MATERIALS

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

2.05 VALVES

A. Manual Valves: Conform to standards listed, or where appropriate, valves according to ANSI Z21.15 and ANSI Z21.15a.
B. Low-Pressure Gas Stops, 2 Inches and Smaller: AGA- certified design for 2 psig or less gas, with AGA stamp, plug or ball type, bronze body and bronze plug or chrome-plated brass ball. Include flat head, square head, or lever handle and threaded ends.
C. Gas Valves, 2-1/2 Inches and Larger: MSS SP-78, Class 125 or 175 WOG, lubricated plug type, semisteel body, wrench operated, with flanged ends.

2.06 PIPING SPECIALTIES

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

PART 3 - PRODUCTS

3.01 PREPARATION

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

3.02 SERVICE ENTRANCE PIPING

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

3.03 PIPE APPLICATIONS

A. Flanges, unions, transition and special fittings, and valves with pressure ratings same or higher than system pressure rating may be used in applications below, except where specified otherwise.
B. Low-Pressure Gas Systems, above Ground within or outside Building: Use the following:
   1. 2 Inches and Smaller: Steel pipe, malleable-iron, threaded fittings, and threaded joints.
   2. 2-1/2 Inches and Larger: Steel pipe, butt-welding fittings, and welded joints.
C. Low-pressure gas systems, below ground within the buildings: Use the following:
   1. 1 inch and smaller: CSST tubing inside a schedule 40 PVC plastic sleeve.
D. Medium pressure (greater than ½ PSI up to 10 PSI) Gas Systems, Below Ground outside the buildings:
   1. 1/2 " and larger: Polyethylene, ASTM D2513.
E. Medium pressure (greater than ½ PSI up to 10 PSI) gas systems above ground within the building and/or on the roof:
   1. Steel pipe, butt-welding fittings, welded joints

3.04 VALVE APPLICATIONS

A. Use low-pressure gas stops, tapered plug or ball type, for shutoff to appliances with 2-inch or smaller low-pressure gas supply.
B. Use gas valves for shutoff to appliances. Where the appliance input exceeds one million BTUH, use a lubricated plug valve.
C. Use gas valves of sizes indicated for other gas shut-off applications where indicated.

3.05 JOINT CONSTRUCTION

A. For steel pipe, refer to Section 20 03 00 - "MATERIALS AND METHODS" for basic piping joint construction.
B. Use materials suitable for gas service.
C. Joints and connections in underground polyethylene gas piping shall be made by butt-fused heat fusion methods, only by qualified personnel.

3.06 PIPING INSTALLATIONS

A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for basic piping installation requirements.
B. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces (subject to approval of the authority having jurisdiction), whether or not such spaces are used as a plenum. Do not locate valves or unions in such spaces.
1. Prohibited Locations: Do not install gas piping in or through circulating air ducts, chimneys or gas vents (flues), or ducts.
2. Concealed locations: Gas piping may be installed in concealed (inaccessible) locations as permitted by the International Mechanical Code only if all joints in the piping are welded.
C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of gas meters. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.
   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
D. Install gas piping at a uniform grade of 1/4 inch in 15 feet, upward toward risers. Install piping upward from the service point to equipment.
E. Connect branch piping from top or side (not bottom) of horizontal piping.
F. Install unions in pipes 2 inches and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

G. Anchor piping to ensure proper direction of piping expansion and contraction. Install expansion joints, expansion loops, and pipe guides as indicated.
H. Install vent of gas pressure regulators pointing down, in accordance with manufacturer's instructions.

3.07 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for hanger and support devices.
B. Install hangers for horizontal piping at 10' on centers or otherwise as called for on the drawings.
C. Do Not support gas piping by extending it to stand on the floor.
D. Install vent of gas pressure regulators pointing down, in accordance with manufacturer's instructions.

3.08 VALVE INSTALLATION

A. Install valves in accessible locations, protected from physical damage.
B. Install a gas valve upstream of each gas pressure regulator.

3.09 CONNECTIONS

A. Install gas piping near gas-utilizing equipment and appliances so as to allow servicing and maintenance.
B. Connect gas piping to gas-utilizing equipment and appliances with shutoff valves and unions. Make connections downstream of valves and unions, with flexible connectors where indicated.

3.10 TERMINAL EQUIPMENT CONNECTIONS

A. Install a gas valve upstream and within 6 feet of each gas-utilizing appliance. Install a union or flanged connection downstream from the valve to permit removal of controls.
B. Sediment Traps: Install as described above, as close as practical to gas appliance inlets, downstream of the shut-off valve for the appliance.

3.11 ELECTRICAL BONDING AND GROUNDING

A. Install above-ground portions of gas piping systems that are upstream from equipment shutoff valves, electrically continuous and bonded to a grounding electrode according to NFPA 70.
B. Do not use gas piping as a grounding electrode.

3.12 FIELD QUALITY CONTROL

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

3.13 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 23 11 00

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Refrigerant piping used for air conditioning applications.
B. Special duty valves.
C. Pipes, tubing, fittings, and specialties.
D. Refrigerants.

1.03 RELATED WORK

A. Division 07, Section 07 09 00 "JOINT PROTECTION" for materials and methods for sealing pipe penetrations through basement walls and fire/smoke barriers.
B. Section 20 03 00 - "MATERIALS AND METHODS".
C. Section 20 06 00 - "MECHANICAL IDENTIFICATION".
D. 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.

1.04 SUBMITTALS

A. Product data for the following products:
   1. Each type valve specified.
   2. Each type refrigerant piping specialty specified.
B. Maintenance data for refrigerant valves and piping specialties, for inclusion in Operating and Maintenance Manual specified in Division 01, and Section 20 01 00 - "GENERAL PROVISIONS."

1.05 QUALITY ASSURANCE

A. 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.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Refrigerant Valves and Specialties
   1. Alco Controls Div, Emerson Electric.
   2. Henry Valve Company.
   3. Danfoss Electronics, Inc.
   4. Parker-Hannifin Corp., Refrig. and A/C Div.
   5. EATON Corporation, Control Div.
   6. Sporlan Valve Company.

2.02 PIPE AND TUBING MATERIALS

A. 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.

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. All valves shall be incorporated in the mechanical equipment.

2.06 REFRIGERANT PIPING SPECIALTIES

A. 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. 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. 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. 410A, in accordance with ASHRAE Standards.

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 ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Mechanical fittings (crimp or flare) are not permitted.
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. 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 with 3/4" "Armaflex" or equal. Liquid line is not required to be insulated, except where 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. 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 installed level.
H. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
I Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
J. 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.
K. Locate groups of pipe parallel to each other, spaced to permit applying insulation and servicing of valves.
L. 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.
M. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity.
N. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
O. 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.
P. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.
Q. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.
R. 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 Section 20 03 00 - "MATERIALS AND METHODS." 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.
C. Install hangers with the following minimum rod sizes and maximum spacing:

NOM. PIPE SIZE	MAX. SPAN - FT.	MIN. ROD SIZE - INCHES
1 7	7	3/8
1-1/2	9	3/8
2	10	3/8

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 not apply heat near the bulb of the expansion valve.
B. Fill the pipe and fittings during brazing, with an inert gas (i.e., 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 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.

3.07 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.

3.08 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 Section 20 03 00 - "MATERIALS AND METHODS" Article "Pipes and Pipe Fittings".
C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.09 COMMISSIONING

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

END OF SECTION 23 23 00

SECTION 23 30 00
AIR DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide all ductwork with extractors, dampers, turning vanes, hangers, etc., as indicated on the drawings, as specified and as required to complete this portion of the work in conjunction with the air distribution system.
B. Provide factory fabricated units, exhaust fans, wall louvers, access doors, fire dampers, security grilles, grilles, registers, diffusers, etc., as specified and as shown on the drawings.
C. Provide control dampers, fire dampers, and balancing dampers as shown on drawings or as required for proper duct system operation.

1.03 SUBMITTALS

A. No submittals required when using specified materials, otherwise: Submit shop drawings in accordance with Section 20 01 00 - "GENERAL PROVISIONS" for the following equipment:
   1. Registers, grilles and diffusers.
   2. Duct liner.
   3. Fire dampers.
   4. Sealing materials
   5. Exhaust fans.
   6. Fire stopping materials.
B. NFPA Compliance: Comply with the following:
   1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Duct lining materials, separately and in combination shall be UL listed and shall have maximum fire hazard classifications of flame spread 25 and smoke development 50.
B. Units shall be factory assembled and tested. Fan ratings to be based on current AMCA Standards.
C. Roof exhaust fans shall bear AMCA seal.
D. Fire dampers shall conform to requirements of National Fire Protection Association and the state and local fire marshal.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Grilles and Registers
   1. Anemostat.
   2. Titus.
   3. Carnes.
   4. Tuttle and Bailey.
   5. Price.
B. Louvers and Dampers
   1. Airline.
   2. Louvers & Dampers Co.
   3. Carnes.
   4. Nailor.
   5. Greenheck.

C. Flexible Ducts
   1. Atco.
   2. Wiremold.
   3. Thermoflex.

D. Acoustical Duct Lining
   1. Certain-Teed "Ultralite Duct Liner".
   2. Owens-Corning "Aeroflex Type 200".
   3. Johns-Manville "Mircolite Duct Liner".

E. Duct Wrap Insulation
   1. Certain-Teed Standard Duct Wrap.
   2. Owens-Corning 0 All-Service/100

F. Branch Duct Fittings
   1. Buckley #BMD. (Bellmouth type for rectangular duct)
   2. Air-Tite #CATDR (Commercial saddle type for round duct)

G. Fire Dampers
   1. Air Balance.
   2. Ruskin.
   3. Cesco.
   4. Vent Products.

H. Air Filters
   1. Airguard Industries - DP-40-2.
   2. Continental Filters Company - Areopleat.
   3. American Air Filter - AM AIR 300X.
   4. Farr - 30/30.

I. Fans
   1. Cook
   2. Greenheck
   3. Carnes
   4. Penn

2.02 DUCTS - GENERAL

A. Ductwork, unless otherwise shown, shall be galvanized steel sheets (F.S. QQ-S-775 Type 1, Class e) or aluminum alloy 3003 (F.S. QQ-A-250/2c Temper H-14).
B. Exposed ducts that are noted as painted, use "Paint-Grip" galvanized steel.
C. Ducts, unless otherwise approved by the Engineer, shall conform accurately to the sizes indicated on the drawings and shall be straight and smooth on the inside, with joints neatly finished.
D. Ducts shall be securely anchored to the building in an approved manner and shall be installed so as to be completely free from vibration under all conditions of operation.
E. Turning vanes shall be installed in all elbows, in both supply and return ducts.
F. Do not install any radiused elbows (applies to fabricated rectangular duct only).
G. Sheet metal ducts shall be properly braced and reinforced.
H. Specific ducts require sealing of joints. See paragraph "Duct Sealing"

2.03 DUCTS - RECTANGULAR

A. Rectangular ducts shall be lined as per Paragraph 23 30 00, 2.08 "Acoustical Duct Lining".
B. Ducts (unless noted otherwise on drawings) shall be constructed in accordance with SMANCA low pressure duct construction standards for 1" w.c. pressure. For convenience, they may be constructed per the following table:

DIMENSION	GAUGE	REINFORCING	MAX SPACING
0" - 12"	26	None	
13" - 26"	26	1" standing "S"	5'0"
27" - 42"	24	1" standing "S"	4'0"
43" - 60"	22	1" x 1" x ⅛" angle	2'6"

Install reinforcing on four sides of duct where depth exceeds 16"; install on two sides only where duct depth is 16" or less.

C. All rectangular duct with dimensions over 12" shall be cross-broken to prevent "oil-canning."
D. At the Contractor's option, the rectangular ducts may be assembled with transverse joints made with the "Ductmate" system or an approved equal. If used, the Ductmate joints shall be assembled with corners, cleats and gasket tape per the manufacturer's instructions. Additional duct sealant is not required with the "Duct Mate" system. Duct metal gauges may be reduced per the ductmate recommendations.

2.04 DUCTS - ROUND

A. Round low-pressure ductwork shall be galvanized steel "Snaplock" pipe, insulated as per Paragraph 23 30 00, 2.09 "Duct Wrap Insulation". Tape all transverse joints. See also "DUCT SEALING."
B. Round ducts:
   1. This section supersedes the latest SMACNA standards.
   2. Construct round ducts from steel sheets of the following U.S. gauge thickness, using the seam method shown:

INNER DIAMETER DIMENSION	GAUGE	SEAM TYPE
3" to 8"	28 gauge	Longitudinal
9" through 26"	26 gauge	Longitudinal

2.05 FLEX DUCT

A. UL listed Class I preinsulated flex duct (sheathed in a seamless vinyl jacket) may be used, subject to approval of submittals. It shall be used only for runouts to supply or return diffusers and only in lengths of 8' or less. Provide nylon, self-extinguishing, locking clamps to secure flexible duct.

2.06 EXHAUST DUCTS

A. Exhaust ducts shall be round or rectangular galvanized steel as shown on the plans. Flexible duct is not permitted. Do not line or insulate exhaust ducts, except as called for on the drawings and as specified below.

2.07 DUCT SEALING

A. All transverse duct joints shall be sealed during or after assembly with "United" "Uni-Seal" (synthetic elastometric duct sealer or equal. No leakage shall be detectable when the duct is pressurized to 1" water column above the maximum working pressure to be experienced by the system. Un-Sealed duct joints are not acceptable.
B. Duct tape, if used, shall be equal to "Venture Tape" #1502, silver. Metalized, polyethylene cloth tape with pressure sensitive adhesive. Minimum 10 mil. Thickness.
C. See PART 3 -EXECUTION, "DUCT SEALING", for application.

2.08 ACOUSTICAL DUCT LINING (RECTANGULAR DUCTS)

A. Acoustical duct lining shall be 1" thick 1 ½ lb./cu. ft. density.

2.09 DUCT WRAP INSULATION (ROUND DUCTS)

A. Duct wrap insulation shall be 1 ½ " thick, 1 lb./cu. ft. density, fiber glass type, with foil scrim kraft facing. The insulation shall have an r-value of 5.7 @ 75°F. mean temperature. FLEXIBLE CONNECTIONS
B. Where sheet metal connections are made to fan or where ducts of dissimilar metal are connected, a noncombustible flexible connection of approved noncombustible material approximately 6 inches in width, conforming to ASTM Specification D1571-67, shall be installed.

2.10 INSPECTION AND ACCESS DOORS

A. Doors shall be 15" x 15" unless otherwise indicated. Where size of duct will not accommodate this size, the doors shall be made as large as possible without weakening duct. Man-size access doors shall be rigid, and shall be provided with airtight neoprene gaskets. Doors shall be provided with galvanized piano hinges and two Camlock brass fasteners. Man-size access doors shall be provided with door handles operable from both sides. Doors in insulated ducts shall be of the insulated type.

2.11 HANGERS AND SUPPORTS FOR DUCTS

A. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," Tables 4-1 through 4-3 and Figures 4-1 through 4-8.
B. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.
C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
D. Upper attachments to structures shall have an allowable load not exceeding ¼ of the failure (proof test) load but are not limited to the specific methods indicated.

2.12 REGISTERS AND GRILLES

A. Registers and grilles shall be of the size indicated on the drawings. Registers and grilles shall have vanes slanted to prevent direct sight into grille.
B. Anything visible through grille in customer contact and office areas shall be painted flat black.
C. Provide anti-smudge rings on all ceiling diffuser located in gypsum board and lay-in ceilings. Where ceiling height permits.

2.13 BELLMOUTH FITTINGS

A. Supply air branch duct bellmouth fittings with dampers shall be of the locking quadrant type and shall clearly indicate damper position. Extension rods shall be installed where necessary. Each branch duct shall be provided with a bellmouth fitting damper. Bellmouths shall be heavy-duty galvanized steel with neoprene gasket and low-leak 26 gauge galvanized damper.
B. "Spin-in" fittings or job-fabricated units are not acceptable for supply air ducts.

2.14 FIRE DAMPERS

A. Fire dampers shall have the following features:
   1. UL #555 listed and labeled to close, if activated, even if air distribution system is in operation.
   2. One piece steel frame.
   3. Steel blades with interlocking joints. Blades in airstream.
   4. Stainless steel negator closure spring if required for horizontal mounting.
   5. 160 degree F. U.L. listed fusible links and blade locks.

2.15 FANS

A. Inline Exhaust:
   1. Ceiling ventilator shall be direct drive, forward curved, centrifugal blower type. Fan wheel shall be constructed of galvanized steel and shall be dynamically balanced. The housing shall be constructed of galvanized steel and acoustically insulated for quiet operation. An integral aluminum backdraft damper shall be standard. Blower and motor assembly shall be easily removable from the housing without disturbing the ductwork. The motor shall be permanently lubricated with built-in thermal overload protection and shall be factory tested prior to shipment. The unit shall be supplied with an internal wiring box and receptacle. The discharge position shall be adjustable by moving interchangeable panels supplied with removable fasteners.
   2. Ceiling ventilators shall be certified and licensed to bear the AMCA Seal for Air and Sound Performance. Ceiling ventilator performance shall be based on tests and procedures performed in accordance with AMCA publication 211 and comply with the requirements of the AMCA Certified Ratings Program. Fan sound power level ratings shall be based on tests and procedures performed in accordance with AMCA publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Ceiling ventilators shall be UL Listed.

2.16 AIR FILTERS

A. Air filters shall be 2" thick medium efficiency, pleated disposable type. Each filter shall consist of cotton media wire bonded to a heavy duty paperboard frame. Filters shall have not less than 4.25 sq. feet of gross media area per sq. ft. filter area.
B. Filters shall have an average efficiency of 25-35% when tested in accordance with ASHRAE 52-76 standard.
C. Initial clean resistance shall be no more than 0.14 inches W.G. when passing air at the rate of 300 feet per minute.
D. The air filters shall be listed by Underwriters Laboratories as UL Class 2.
E. Provide clean set of air filters prior to final acceptance and complete extra set left on site.
F. Install filters in filter grilles and remove filters from units so equipped, but only at completion of construction.

PART 3 - EXECUTION

3.01 DUCTWORK

A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.
B. Ducts shall be of the internal dimensions shown on the Drawings. In no case shall the Contractor change the indicated size of the ductwork without approval of the Engineer. Wherever necessary to change the shape of the duct, it shall be done gradually and the full area retained.
C. Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. All joints shall be sealed with duct sealant. Align ductwork accurately at connections, within ⅛" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
D. Ducts 24 inch or greater in width or height shall be stiffened with galvanized structural angle reinforcing, not to exceed 4 ft. on centers and on all four surfaces, to prevent sagging or buckling and to provide a rigid installation and freedom from vibration and noise. Where angle cleats are made of same gauge metal as ducts (or heavier) the angle cleats will serve as reinforcing members on two surfaces of the ducts at joints in the ducts. Additional reinforcing angles shall be provided adjacent to branch duct connections which are of less width or depth than the surface of the main duct at point of connection, and at all other locations as necessary to make the duct work free from noise and vibration when fans are operating.
E. This Contractor shall carefully check the arrangement of ducts and dimensions for all working spaces at the building so that there will not be interference with the running of ducts.
F. Where ducts pass through walls and ceilings (exposed and concealed), this Contractor shall provide bent angle collar (as required to cover annular space) having flanges at corners lapped and riveted and the other leg of angle cut short and bent around corner of duct. Collars shall serve to confine sound barrier packing and shall fit tight around ducts. Where more than one duct passes through the same opening the collars shall form a complete seal of the spaces between and around all such ducts. This shall apply to concealed ductwork as well as exposed ductwork. The space between the duct and wall shall be packed with fiberglass duct-seal to provide an effective sound and dust barrier. Where the bent angle collar in any wall opening must support masonry in the wall above the opening, the top member of the bent angle collar shall be reinforced with rolled section steel angles suitable for the weight to be carried as approved by the Engineer and placed so as to be concealed in the wall in all locations where exposed in finished rooms.

3.02 FLEXIBLE CONNECTIONS

A. Flexible connections shall be securely fastened by zinc-coated iron clinch-type draw bands, for round ducts. For rectangular ducts, flexible connections locked to metal collars shall be installed using normal duct construction methods.

3.03 ACCESS DOORS

A. Access doors in ductwork shall be provided at all fire dampers, motorized dampers, and where indicated on the drawings. Unless otherwise indicated, doors shall swing so that fan pressure or suction holds the door closed. Access doors in ductwork with duct liner or insulation shall be insulated.

3.04 HANGING OF DUCTS

A. Horizontal ducts shall be supported with angle and rod or strap iron trapeze hangers. Strap iron hangers shall be placed around sides and bottom of ducts with sheet metal screws in sides and bottom. Trapeze hangers shall be securely fastened to ducts and to the construction above. Horizontal duct supports shall be spaced not to exceed 8 ft. apart and not less than one trapeze support per section of duct.
B. Special hanging systems, where indicated, will be installed in lieu of duct supports specified above.
C. No equipment or ductwork shall be hung from roof deck.

3.05 BELLMOUTH FITTING

A. Install bellmouth fitting with damper in each supply air branch takeoff. Mark damper open and closed positions on side of duct with black paint.
B. Fittings shall be secured in duct with screws. Operators shall be outside the duct system. All holes shall be carefully covered and sealed.

3.06 FIRE DAMPERS

A. Fire dampers shall be installed as required by NFPA 90A, and as indicated on the drawings. Fire dampers must be installed in 10 ga. sleeve above ceiling terminal air devices or in masonry wall. Steel retaining angles, 10 ga., shall be bolted or welded to sleeve on both sides of wall, with duct connected to sleeve on both sides with slip connector held with not less than one No. 8 sheet metal screw on each vertical side of duct.

3.07 INSTALLATION OF EQUIPMENT

A. Install all fans, fire dampers, registers, grilles, etc., per manufacturer's recommendation and instructions.
B. Care shall be taken with installation of roof exhaust fans and roof vents to prevent damage. Any fan or vent dented or damaged in any other way during construction shall be repaired or replaced.

3.08 DUCT TAPE AND SEALANT - INSTALLATION

A. Duct Tape shall be installed at the following locations:
   1. All.
B. Duct Sealant shall be installed on all transverse joints at the following locations:
   1. All sheet metal rectangular ducts.
   2. All medium and high pressure round metal ducts.

3.09 ACOUSTICAL DUCT LINING – INSTALLATION (RECTANGULAR DUCT ONLY)

A. Acoustically line sheet metal rectangular supply, outside, and return air ducts and return air plenums with duct-liner and install as called for in latest edition of manufacturer's installation manual and/or as called for or shown on pages 2-25 to 2-29 of the SMACNA HVAC Duct Construction Manual - 1985.
B. Adhere liner with coated side toward air stream to all interior sides of duct with 100% coverage of fire-resistant insulation bonding adhesive. Adhesive shall completely cover sheet metal at each end of each section of ductwork. Provide Z bar liner retainer on leading edge of liner in the first fitting downstream of any fan.
C. When duct width or height exceeds 12" further secure the liner to these surfaces with mechanical fasteners at 16" o.c.
D. Velocities - 1500 to 4000 FPM: Install as above but additionally paint all joints of liner and butter the edges of liner where sections of ductwork will be joined with fire-resistant mastic.
E. Note: All duct sizes shown are inside of linings. Increase sheet metal sizes as required.
F. Acoustical duct lining shall be installed at the following locations:
   1. All sheet metal rectangular supply, outside, and return air ductwork.

3.10 DUCT WRAP – INSTALLATION (ROUND DUCTS ONLY)

A. Wrap all round supply, return, and outside air ducts with duct wrap and install as called for in latest edition of manufacturer's installation manual and/or as called for or shown on pages 2-25 to 2-29 of the SMACNA HVAC Duct Construction Manual - 1985.
B. Adhere duct wrap with vapor barrier outward to all sides of duct with 100% coverage of fire-resistant insulation bonding adhesive. Adhesive shall completely cover sheet metal at each end of each section of ductwork.
C. When duct width or height exceeds 24" further secure the duct wrap to these surfaces with mechanical fasteners at 16" o.c.
D. Duct wrap shall be installed at the following locations:
   1. All round return, supply, and outside air ducts.

3.11 EXHAUST DUCTS - UNINSULATED

A. Exhaust ducts shall not be insulated or lined.

3.12 ADJUSTING AND CLEANING

A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Section 23 05 93 - "TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS" for requirements and procedures for adjusting and balancing air systems.

END OF SECTION 23 30 00

SECTION 23 54 13
ELECTRIC FURNACE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. This Section includes units and accessories listed below, complete with controls.
1. Electric Furnace – Indoor Air Handling Unit.

1.03 RELATED WORK

A. Section 23 30 00 - "AIR DISTRIBUTION".

1.04 SUBMITTALS

A. None required on owner furnished equipment.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70, "National Electrical Code ."
B. NRTL Listing: Provide electrical components specified in this Section that are listed and labeled.
1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.06 DEFINITIONS

A. Control Wiring: Wire, conduit, and miscellaneous materials for mounting and connecting electric control devices.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carrier Air Conditioning; Div. Carrier Corp.

2.02 HVAC CONDENSATE PIPING

A. See Section 20 03 00 – Materials and Methods, Part 2, "HVAC Condensate Piping", for the type of condensate piping materials.

2.03 UNITS AND ACCESSORY ITEMS

A. Provide unit types and minimum ratings and capacities as indicated.
B. Provide units that are factory assembled, piped, wired, and tested.

C. Cabinet: Steel with foil-faced, glass fiber interior insulation. Lift-out panels expose all items requiring access for maintenance.
D. Main Fan: Factory-balanced, resilient-mounted, and isolated from fan housing.
E. Fan Motor: 3-speed motor on all sizes.
F. Efficiency:
   1. 100%, minimum.
G. Automatic Fan Thermal Switch: Delays fan start until discharge air is heated. Delays fan shutdown until air cools to comfort threshold.
H. DX Coil: Copper tubing, aluminum fins, fully wettable.
I. Condensate Pan: Hi-impact thermoplastic with primary and secondary drain connections with brass inserts.
J. Electric Heater: Factory or field installed, (fused, circuit breaker or non-fused as noted on the drawing).
K. Time Delay Relay.
L. Single Point Electrical Connection.
M. Air Filter: Cleanable permanent type.
N. Control Transformer: 120 V a.c./24 V a.c.

2.04 CONTROLS

A. Include control components required for satisfactory operation of units and auxiliary equipment in all seasons, including:
   1. Control Transformer: 24 V a.c. output, factory installed, and wired in furnace.
   2. Thermostat: 24 V a.c. single stage heating only wall mounting unit with fan on-automatic selector (where shown).
   3. Relays: As required to achieve specified operation.

2.05 FINISHES

A. External Casings and Cabinets: Baked enamel over corrosion-resistant treated surface.

PART 3 - EXECUTION

3.01 INSTALLATION AND CONNECTION

A. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level.
B. Controls: Conform to Section 25 00 00 - "CONTROLS AND INSTRUMENTATION."
C. Connect ducts in accordance with Section 23 30 00 - "AIR DISTRIBUTION."

3.02 COMMISSIONING

A. Test functions, operations, and control sequences and protective features. Adjust to assure operation is in accordance with specification.
B. Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.03 CLEANING AND ADJUSTING

A. Cleaning: Upon completion of installation, inspect units and associated components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
B. Adjusting: Make control and other adjustments for optimum heating performance and efficiency. Adjust heat distribution features, including shutters, dampers, and relays to provide optimum heating performance and system efficiency.

END OF SECTION 23 54 13

SECTION 23 54 16
FURNACES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. This Section includes units and accessories listed below, complete with controls.
   1. Gas-Fired Furnaces.

1.03 RELATED WORK

A. Section 23 30 00 – "AIR DISTRIBUTION".
B. Section 23 81 26 -"CONDENSING UNITS".

1.04 SUBMITTALS

A. None required on owner furnished equipment.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70, "National Electrical Code."
B. NRTL Listing: Provide electrical components specified in this Section that are listed and labeled.
   1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.06 DEFINITIONS

A. AFUE: Minimum annual fuel utilization efficiency certified by an independent testing agency in accordance with US Department of Energy Test Procedures.
B. Control Wiring: Wire, conduit, and miscellaneous materials for mounting and connecting electric control devices.

1.07 WARRANTY – LABOR ONLY

A. Warranty: Provide written labor only warranty, signed contractor, agreeing to replace/repair, within warranty period, inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period.
   1. Warranty Period: 1 year from date of substantial completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carrier Air Conditioning; Div. Carrier Corp.

2.02 HVAC CONDENSATE PIPING

A. See Section 20 03 00 – Materials and Methods, Part 2, "HVAC Condensate Piping", for the type of condensate piping materials.

2.03 GAS-FIRED UNITS AND ACCESSORY

A. AGA Approval: Units shall bear the label of the American Gas Association.
B. Type of Gas: Units shall be listed for use with the type of gas being delivered.
C. Provide unit types and minimum ratings and capacities as indicated.
D. Provide units that are factory assembled, piped, wired, and tested.
E. Cabinet: Heavy, galvanized steel with foil-faced, glass fiber interior insulation. Lift-out panels expose burners, and all other items requiring access for maintenance.
F. Main Fan: Factory-balanced, resilient-mounted in an acoustically insulated fan compartment.
G. Efficiency:
   1. AFUE 90%, minimum - condensing/direct vent type.
H. Automatic Fan Thermal Switch: Delays fan start until discharge air is heated. Delays fan shutdown until air cools to comfort threshold.
I. Automatic Gas Control: Single-stage or 2-stage as specified, 24 V a.c. valve.
J. Ignition: Hot surface ceramic igniter with flame sensor.
K. Venting: Power venting, using integral centrifugal fan.
L. Control Transformer: 120 V a.c./24 V a.c.
M. Heat Exchanger: Aluminized steel.
N. Combustion Air Source:
   1. Direct connection of air intake pipe for "condensing/direct vent type ".

2.04 CONTROLS

A. Include control components required for satisfactory operation of units and auxiliary equipment in all seasons, including:
   1. Control Transformer: 24 V a.c. output, factory installed, and wired in furnace.
   2. Thermostat: 24 V a.c. single stage heating only wall mounting unit with fan on-automatic selector (where shown).
   3. Relays: As required to achieve specified operation.

2.05 FINISHES

A. External Casings and Cabinets: Baked enamel over corrosion-resistant treated surface.

2.06 FLUES, VENTS, AND CHIMNEYS

A. See Section 20 03 00 - "Materials and Methods," Part 2.

PART 3 - EXECUTION

3.01 INSTALLATION AND CONNECTION

A. Installation and connection of gas-fired units and associated fuel and vent features and systems shall be in accordance with NFPA 54, the International Mechanical Code (latest edition), applicable local codes and regulations, and manufacturer's published installation instructions.
   1. Connect gas piping in accordance with Section 23 11 00 – "GAS PIPING SYSTEMS."
B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level.
C. Controls: Conform to Section 25 00 00 – "CONTROLS AND INSTRUMENTATION."

D. Connect ducts in accordance with Section 23 30 00 – "AIR DISTRIBUTION."

3.02 COMMISSIONING

A. Test functions, operations, and control sequences and protective features. Adjust to assure operation is in accordance with specification.
B. Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.03 CLEANING AND ADJUSTING

A. Cleaning: Upon completion of installation, inspect units and associated components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
B. Adjusting: Make control, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat distribution features, including shutters, dampers, and relays to provide optimum heating performance and system efficiency.

END OF SECTION 23 54 16

SECTION 23 55 00
FUEL FIRED HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. This Section includes units and accessories listed below, complete with controls.
1. Gas unit heaters.
2. Infra-red radiant heaters.

1.03 RELATED WORK

A. Section 23 30 00 - "AIR DISTRIBUTION".

1.04 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
1. Product data including weights and dimensions and data on features and components. Include plan and elevation views of units, minimum clearances, and data on ratings and capacities.
2. Maintenance data for products for inclusion in "Operating and Maintenance Manual" specified in Division 01.
3. Wiring diagrams from manufacturers detailing electrical requirements for power and control wiring for furnaces. Include ladder-type wiring diagrams for interlock and control wiring required for field installation. Differentiate between portions of wiring that are factory installed and portions that are to be field installed.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70, "National Electrical Code."
B. NRTL Listing: Provide electrical components specified in this Section that are listed and labeled.
1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.06 DEFINITIONS

A. AFUE: Minimum annual fuel utilization efficiency certified by an independent testing agency in accordance with US Department of Energy Test Procedures.
B. Control Wiring: Wire, conduit, and miscellaneous materials for mounting and connecting electric control devices.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Gas Unit Heaters
1. Lennox Industries, Inc.
2. The Trane Co.; Div. American Standard, Inc.
3. Reznor Corporation.

B. Infra-red Radiant Heaters

1. Co-Ray-Vac.
2. Reflect-O-Ray.
3. Perfection-Schwank.

2.02 GAS-FIRED UNITS AND ACCESSORY ITEMS

A. NFPA 54, "National Fuel Gas Code."
B. AGA Approval: Units shall bear the label of the American Gas Association.
C. Type of Gas: Units shall be listed for use with natural gas.
D. Provide unit types and minimum ratings and capacities as indicated.
E. Provide units that are factory assembled, piped, wired, and tested.
F. Main Fan: Factory-balanced, resilient-mounted.
G. Efficiency:
   1. AFUE 80% minimum - fan assisted combustion type.
   2. AFUE 98% minimum - condensing/direct vent type.
H. Automatic Fan Thermal Switch: Delays fan start until discharge air is heated. Delays fan shutdown until air cools to comfort threshold.
I. Automatic Gas Control: Single-stage or 2-stage as specified, 24 V a.c. valve.
J. Ignition: Electric spark or hot surface ceramic igniter with flame sensor.
K. Venting: Power venting, using integral centrifugal fan.
L. Control Transformer: 120 V a.c./ 24 V a.c.
M. Heat Exchanger: Aluminized steel.
N. Combustion Air Source:
   1. Ambient air at location of heater for "fan assisted combustion type".
   2. Direct connection of air intake pipe for "condensing/direct vent type".

2.03 UNIT HEATERS ELECTRIC PROPELLER FAN

A. Provide electric propeller fan unit heaters as manufactured by Reznor. The units shall be completely packaged and arranged for ceiling suspension, with threaded suspension mounting sockets, wall or ceiling mounting brackets, horizontal louvers.
B. The electric heating elements are to be low temperature, enclosed-style made of steel and monel with the spiral fin copper-brazed to the element.
C. Unit shall utilize a line voltage control circuit and include an automatic high limit. The units are to be provided with propeller fan(s) and permanently lubricated fan motor(s) with internal overloads.
D. Each unit shall be design-certified by Underwriters Laboratories and be UL listed.

2.04 INFRA-RED RADIANT HEATERS

A. System capacities and layouts shall be as indicated on the drawings.
B. Heaters shall be equipped with a 100% shut-off, direct spark ignition system utilizing an electronic flame rectification control to accomplish flame safety supervision. A self-checking vacuum proving switch shall prevent activation of the gas valve and ignition system in the event of blockage or breakage of the tube assembly; or the presence of vacuum or switch malfunction upon energizing the heater. Power to each unit shall be 120 VAC, 60 Hz. Burners shall be 100% fire tested at the factory.
C. Radiant pipe shall be aluminized steel.
D. The reflectors shall be aluminum.
E. The heaters shall employ burner units which can be easily removed for servicing. The burner shall be constructed of cast iron and shall be provided with combustion air filters if combustion air passes through the control cabinet. The burner unit shall have a flame view port and lights which indicate "fan running" and "burner on."
F. The heaters shall be AGA certified for indoor or outdoor used. They shall also be AGA certified for mounting from horizontal to 55° from horizontal. Heaters shall be furnished and installed according to manufacturer's instructions and applicable codes.
G. The manufacturer shall inspect each heating system after installation and certify in writing that each heating system is installed and operating properly before Owner acceptance.

2.05 CONTROLS

A. Include control components required for satisfactory operation of units and auxiliary equipment in all seasons, including:
   3. Control Transformer: 24 V a.c. output, factory- installed, and wired in furnace.
   4. Thermostat: 24 V a.c. single-stage heating only wall mounting unit with fan on-automatic selector (where shown).
   5. Relays: As required to achieve specified operation.

2.06 FINISHES

A. External Casings and Cabinets: Baked enamel over corrosion-resistant treated surface.

2.07 FLUES, VENTS, AND CHIMNEYS

A. See Section 20 03 00 - "Materials and Methods," Part 2.

PART 3 - EXECUTION

3.01 INSTALLATION AND CONNECTION

A. Installation and connection of gas-fired units and associated fuel and vent features and systems shall be in accordance with NFPA 54, applicable local codes and regulations, and manufacturer's published installation instructions.
   1. Connect gas piping in accordance with Section 23 11 00 - "GAS PIPING SYSTEMS."
B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level.
C. Controls: Conform to Section 25 00 00 - "CONTROLS AND INSTRUMENTATION."
D. Connect ducts in accordance with Section 23 30 00 - "AIR DISTRIBUTION."

3.02 COMMISSIONING

A. Test functions, operations, and control sequences and protective features. Adjust to assure operation is in accordance with specification.
B. Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.03 CLEANING AND ADJUSTING

A. Cleaning: Upon completion of installation, inspect units and associated components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
B. Adjusting: Make control, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat distribution features, including shutters, dampers, and relays to provide optimum heating performance and system efficiency.

END OF SECTION 23 55 00

SECTION 23 81 43
HEAT PUMP - INDOOR

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. This Section includes units and accessories listed below, complete with controls.
   1. Heat pump - Indoor Blower Unit.

1.03 RELATED WORK

A. Section 23 30 00 – "AIR DISTRIBUTION".
B. Section 23 23 00-"REFRIGERANT PIPING".

1.04 SUBMITTALS

A. None required on owner furnished equipment.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70, "National Electrical Code."
B. NRTL Listing: Provide electrical components specified in this Section that are listed and labeled.
   1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.06 DEFINITIONS

A. Control Wiring: Wire, conduit, and miscellaneous materials for mounting and connecting electric control devices.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carrier Air Conditioning; Div. Carrier Corp.

2.02 HVAC CONDENSATE PIPING

A. See Section 20 03 00 – Materials and Methods, Part 2, "HVAC Condensate Piping", for the type of condensate piping materials.

2.03 UNITS AND ACCESSORY ITEMS

A. Provide unit types and minimum ratings and capacities as indicated.
B. Provide units that are factory assembled, piped, wired, and tested.

C. Cabinet: Steel with foil-faced, glass fiber interior insulation. Lift-out panels expose all items requiring access for maintenance.
D. Main Fan: Factory-balanced, resilient-mounted.
E. Efficiency:
   1. Electric Heat = 100%, minimum.
F. Automatic Fan Thermal Switch: Delays fan start until discharge air is heated. Delays fan shutdown until air cools to comfort threshold.
G. Control Transformer: 120 V a.c./24 V a.c.

2.04 CONTROLS

A. Include control components required for satisfactory operation of units and auxiliary equipment in all seasons, including:
   1. Control Transformer: 24 V a.c. output, factory- installed, and wired in furnace.
   2. Thermostat: 24 V a.c. single-stage heating only wall mounting unit with fan on-automatic selector (where shown).
   3. Relays: As required to achieve specified operation.

2.05 FINISHES

A. External Casings and Cabinets: Baked enamel over corrosion resistant treated surface.

PART 3 - EXECUTION

3.01 INSTALLATION AND CONNECTION

A. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level.
B. Controls: Conform to Section 25 00 00 – "CONTROLS AND INSTRUMENTATION."
C. Connect ducts in accordance with Section 23 30 00 – "AIR DISTRIBUTION."

3.02 COMMISSIONING

A. Test functions, operations, and control sequences and protective features. Adjust to assure operation is in accordance with specification.
B. Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.03 CLEANING AND ADJUSTING

A. Cleaning: Upon completion of installation, inspect units and associated components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
B. Adjusting: Make control and other adjustments for optimum heating performance and efficiency. Adjust heat distribution features, including shutters, dampers, and relays to provide optimum heating performance and system efficiency.

END OF SECTION 23 81 43

SECTION 26 00 10
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes requirements for electrical installations:
   1. Submittals.
   2. Rough-ins.
   3. Record documents.
   4. Electrical installations.
   5. Maintenance manuals.
   6. Cutting and patching.

1.03 WORK INCLUDES

A. The work to be performed under this Division shall include all labor, materials, equipment, transportation, and facilities necessary to provide a complete and satisfactory system ready to use. Wherever the words "the Contractor" or "this Contractor" appear in this Division, they refer to the Contractor for the work specified in that Section. This Contractor shall examine all Drawings and all Sections of the Specifications and shall be responsible for ascertaining to what extent other Drawings and Sections affect the work herein specified.

B. Unless noted on the drawings otherwise, work shall also include:
   1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
   2. All fees and direct expenses involved in any inspection required for the project.
   3. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
   4. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
   5. All lights, guards, and signs as required by safety regulations applicable to the work.
   6. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.

C. The work shall include revisions, modifications, and rework of existing work as required for installation of new work, and as required for connections of new work to existing systems, and as required for connections of existing work to new systems.

1.04 CODES, REGULATIONS, AND STANDARDS

A. All work must be performed in accordance with the requirements of local, county, state and national codes and regulations including the requirements of the following:
   1. National Electrical Code, Latest Edition
   2. Occupational Safety and Health Act. of 1970.
   3. Life Safety Code, N.F.P.A. No. 101.
   4. NFPA 17/17A, 72, 72E, 54, and 96.
   5. For work not specifically listed above, use standards and codes of the National Fire Protection Association.

1.05 ABBREVIATIONS

A. All equipment, apparatus and systems shall be rated, tested, fabricated and/or installed in accordance with the applicable industry standard mentioned. The following list will serve to clarify abbreviations that appear in other sections of this specification:
   1. AABC — Associated Air Balance Council
   2. ADC — Air Diffusion Council
   3. ANSI — American National Standards Institute
   4. ASE — Association of Safety Engineers

5.	ASTM	American Society for Testing and Materials
6.	EPA	Environmental Protection Agency
7.	IEEE	Institute of Electrical and Electronics Engineers
8.	NEMA	National Electrical Manufacturers Association
9.	NFPA	National Fire Protection Association
10.	NSC	National Safety Council
11.	UL	Underwriters Laboratories

1.06 SUBMITTALS

A. See also Division 01 Section "SUBMITTALS" for requirements for submittals, shop drawings and product data.
B. Before beginning the fabrication of any material or the installation of any equipment, a complete schedule of the materials and equipment proposed for installation shall be submitted to the Engineer for approval. This schedule shall include manufacturers' names, catalog data, diagrams, drawings and other descriptive data as required or requested by the Engineer.
C. Submit all items listed within each section under "SUBMITTALS".
D. Refer to general conditions of the specifications for format and number of copies required.

1.07 SUBSTITUTION OF EQUIPMENT

A. All proposed substitutions for specified products on this project (except as listed above) require approval in advance of bidding. Approval will not be granted after award of contract. Substitutions must be submitted for review five (5) working days prior to the bid date to be considered.
B. In the event of Engineer's approval of a substitution of equipment, the requestive entity will be notified by telephonic message or FAX by the Engineer (or authorized representative), and/or by the issuance of an amendment to the contract documents incorporating the equipment by name and model number.

1.08 CONTRACT DRAWINGS

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

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver equipment in time to maintain approved construction schedule.
B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
C. Store in safe, dry location. Protect from dust, moisture, weather and extreme temperatures.
D. Follow manufacturer's recommendation for transportation, handling and storage.

1.10 GUARANTEES AND WARRANTIES

A. Submit to the Owner, two copies of all warranties and guarantees specified in the General Conditions, Supplementary Conditions, the individual sections of the specifications, or as provided by the various subcontractors and material suppliers. All such documents shall show the name and location of the project and the name of the purchaser.
B. This Contractor shall provide to the Owner a non-prorated guarantee of all materials and workmanship for a period of not less than one year from the date of the Owner's final certificate.
C. Exclusions: lamps furnished by the Contractor shall be guaranteed for their rated life, not to exceed one year from the date of final acceptance. Lamps failing to meet the rated life shall be replaced by the Contractor. Replacement lamps shall be furnished to the Owner and installation of the replacement lamps shall be by the Owner.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ROUGH-IN

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

3.02 ELECTRICAL INSTALLATIONS

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

3.03 DEFECTIVE WORK AND MATERIAL

A. All materials or work found to be defective or not in strict conformity with the drawings or different from requirements of the drawings and specifications or defaced or injured through negligence of Contractor or his employees, or through action of fire or weather will be rejected and shall be immediately removed from premises by Contractor and satisfactory materials and work substituted without delay.

3.04 COOPERATION AND COORDINATION

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

3.05 CUTTING AND PATCHING

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

END OF SECTION 26 00 10

SECTION 26 00 20
CONTRACT CLOSEOUT & COMMISSIONING

PART 1 - GENERAL

NOT APPLICABLE

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

1.01 MAINTENANCE MANUAL AND OPERATING INSTRUCTIONS

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

1.02 PROJECT RECORD AND CLOSEOUT DOCUMENTS

A. See Division 01 Section 01 78 00 "CLOSEOUT SUBMITTALS" for red lining of all documents during construction to reflect "as-built" conditions.

2.01 WIRES & CABLES FIELD QUALITY CONTROL

A. Inspect wiring for physical damage and proper connection.
B. Torque test conductor terminations to manufacturer's recommended values.
C. Perform continuity test on all power and branch circuit conductors. Verify proper phasing.

3.01 ELECTRICAL EQUIPMENT IDENTIFICATION PLATES

A. Provide plates for all equipment consisting of machine engraved laminated plastic. Plate field shall be black with white core.
   1. Size of plate shall be commensurate with lettering thereon.
   2. Lettering for major items of equipment, such as a disconnect or panelboard, shall be 1/2" in height. Lettering for smaller items, such as light or timer switches shall be 1/4" in height.
   3. Wording on plate shall contain the following information as appropriate and approved by the Engineer.
      a. Equipment served, such as RTU-1.
      b. Originating or controlled circuit number, such as AL 1, 3, & 5.
      c. Voltage.
      d. Maximum fuse size (if applicable).

4.01 ELECTRICAL EQUIPMENT INSTALLATION (26 24 00)

A. Provide engraved plastic nameplates for each switch in main panel, for each panelboard, and for each safety switch. Indicate type of load and maximum fuse size. Provide schedule of nameplates with submittals.

5.01 SECONDARY GROUNDING FIELD QUALITY CONTROL

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 10 ohms. When resistance exceeds 10 ohms drive and bond an additional ground rod, one rod length away. Ground resistance test shall be made a minimum of 48 hours after rainfall.

6.01 LIGHT FIXTURES (26 50 00)

A. Remove all dirt, paint, and foreign matter from fixture lenses and frames between substantial completion and final acceptance of the building.

7.01 CONTINUITY TESTS

A. Test branch circuits and control circuits to determine continuity of wiring and connections.

7.02 VOLTAGE TESTS

A. Make and record voltage tests and recorded at the following listed points. Conduct tests under normal load conditions.
   1. Service entrance at main panelboard.

7.03 TESTING PHASE RELATIONSHIP

A. Examine connections to equipment for proper phase relationships. Verify proper motor rotation.

7.04 TESTING CORRECTION OF DEFECTS

A. When tests disclose any unsatisfactory workmanship or equipment furnished under this Contract, correct defects and retest. Repeat tests until satisfactory results are obtained.
B. When any wiring or equipment is damaged by tests, repair or replace such wiring or equipment. Test repaired items to ensure satisfactory operation.

END OF SECTION 26 00 20

SECTION 26 05 19
WIRES & CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide wiring and cables including, but not limited to, feeders, branch circuit power, and lighting.
B. Provide electrical connections to all equipment unless noted otherwise.

1.03 SUBMITTALS

A. No submittals required when using specified materials. Otherwise, Division 26 Section 26 00 10 "SUBMITTALS" and "SUBSTITUTION OF EQUIPMENT".

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Wire, cable and installation thereof shall be in accord with the NEC and standards specified.
   2. All materials shall be new, without blemish or defect, and UL listed or labeled.
   3. Test power and signal wire and cable according to Section 26 00 20 - "Contract Close-Out and Commissioning".

1.05 REFERENCES

A. Specified references, or cited portions thereof, govern the work.
B. National Electrical Manufacturers Association (NEMA):
   1. WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   2. WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   3. WC 7 - Cross-Linked-Thermosetting-Polyethylene-Insulated. Wire and Cable for the Transmission and Distribution of Electrical Energy.
C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code 1993 Edition.
D. Underwriters Laboratories, Inc. (UL): Listed and labeled materials.
E. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.06 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.
B. Store materials on site in clean, dry storage area.
C. Handle all materials carefully to preclude damage. Material with damaged insulation shall not be acceptable for use.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Building Wire
   1. Anaconda Wire & Cable Co.
   2. Phelps Dodge Cable & Wire Co.
   3. Crescent.
   4. Pirelli.
   5. General Cable Corp.
   6. Sigma Corra-Clad (MC Cable).
   7. General Electric Co.
   8. Triangle.
   9. Okonite.

B. Joints and Splices - Indent Type Pressure Connector for #8 AWG and Smaller
   1. Buchanan.
   2. Ideal.
   3. Burndy.
   4. Thomas & Betts.

C. Joints and Splices - Insulated Spring Compression Connectors for #10 Awg and Smaller
   1. Buchanan, Bcap.
   2. T & B, Piggy.
   3. Ideal, Wing nut.
   4. 3M, Scotchlok.
   5. ITT Holub, Free Spring.

D. Joints and Splices - Mechanical Compression or Bolted Type Connector for #6 Awg or Larger
   1. AMP, Inc.
   2. Ideal Industries.
   3. Anderson.
   4. ITT Weaver.
   5. Blackburn.
   6. O.Z./Gedney Co.
   7. Burndy Corp.
   8. T & B.
   9. General Electric Co.
   10. 3M Co.

2.02 BUILDING WIRE

A. Thermoplastic insulated building wire: NEMA WC 5, UL-83 ICEA S-61-402 or S-66-524.

B. Color code conductor insulation for #8 AWG or smaller. Standard colors:

	120/240V 1 phase
1. Phase A	Black
2. Phase B	Red
3. Neutral	White
4. Ground	Green

C. Provide 1" wide taped, colored bands at panelboards, cabinets, and boxes for sizes larger than #8 AWG.

2.03 JOINTS & SPLICES

A. Make terminations, taps and splices with an indent type pressure connector with insulating cover for #8 AWG and smaller.

B. Instead of indent type connectors, insulated spring compression connectors may be used for #10 AWG and smaller.

C. Use mechanical compression or bolted type connector for #6 AWG or larger. Cover connector with insulating tape or heat shrinkable insulation equivalent to 150% conductor insulation.

PART 3 - EXECUTION

3.01 BASIC WIRING

A. All power wiring shall be installed in a raceway.

B. Use no wire smaller than #12 AWG for power and lighting circuits.

C. Use no smaller than #14 AWG for control wiring for fused control circuits.

D. Multiwire branch circuits will only be permitted for general use receptacle circuits and individual branch

circuits. All other circuits shall have individual neutrals (where a neutral is required).

E. Splice only in accessible junction or outlet boxes. Do not splice in panelboard cabinets and gutters.
F. Neatly train and lace wiring inside boxes, equipment and panelboards.
G. Make conductor lengths for parallel circuits equal.

3.02 WIRING IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling #4 AWG and larger wires.
B. Install wire in raceway after interior of building has been physically protected from weather, all plumbing, heating and ventilating work likely to injure conductors completed, conduit system is complete and interior of raceway cleaned.

3.03 CONNECTIONS AND TERMINATIONS

A. Identify each conductor in panelboards, junction or pull boxes, or troughs with a permanent pressure sensitive label with suitable numbers or letters for easy recognition. Identify control wiring at each end and in junction boxes with numeric wire number corresponding to control wiring diagram. See Section 26 05 53 - "ELECTRICAL IDENTIFICATION", for identification requirements.
B. Thoroughly clean wire before installing lugs and connectors.
C. Make splices, taps and terminations to carry full ampacity of conductors without perceptable temperature rise.
D. Terminate spare conductors with electrical tape and roll up in box.

3.04 FIELD QUALITY CONTROL

A. See Section 26 00 20 - "Contract Close-out & Commissioning".

3.05 BUILDING WIRE INSTALLATION CABLE

A. All wiring shall be in conduit, except that MC-Cable may be substituted only as follows:
   1. MC-Cable (maximum cable length of 10'-0") may be installed only for branch circuit wiring to light fixtures in lay-in grid ceilings.
   2. MC-Cable (maximum cable lenghts shown on Detail 2/E2) shall be installed inside the front checkout counters.
B. Feeders and branch circuits: Copper, stranded conductor, 600 volt insulation THHN/THWN. (Exception: Wire sizes #10 AWG and smaller shall be solid.)
C. Control circuits: Copper, solid or stranded conductor, 600 volt insulation, THHN/THWN.

END OF SECTION 26 05 19

SECTION 26 05 26
SECONDARY GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide power system grounding for service.

B. Provide equipment grounding.

1.03 RELATED WORK

A. Section 26 05 33 - "RACEWAYS".

B. Section 26 00 20 – "CONTRACT CLOSE-OUT AND COMMISSIONING".

C. Section 26 05 19 - "WIRES AND CABLES".

1.04 SUBMITTALS

A. Test data. Comply with Division 26 Section 26 00 10 "SUBMITTALS".

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with 1993 National Electric Code.
   2. Comply with Public Authorities having jurisdiction.

1.06 SYSTEM DESCRIPTION

A. Ground electrical service neutral at service entrance equipment to the electrode system.
B. Ground raceways and electrical equipment.
C. Bond together system neutrals, service entrance enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

1.07 REFERENCES

A. Specified references, or cited portions thereof, govern the work.
B. National Fire Protection Association (NFPA): NFPA 70 - 93 National Electrical Code (NEC) 1993 Edition.
C. Underwriters Laboratories, Inc. (UL): All products UL listed and labeled.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ground rods: steel, copper-encased, 3/4 in. O.D., minimum length 10 ft
B. Connections: bronze clamps.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide a system ground and equipment grounding provisions as shown on plans, and as specified in this section. Comply with NEC Article 250.
B. Main service grounding electrode shall consist of all of the following:
   1. A concrete encased conductor at the footing as detailed on drawing.
   2. Metal cold water pipes where the underground portion of the main water pipe is at least 10 feet long. Install a flexible copper bonding jumper around the water meter.
   3. All connections to the grounding electrode shall be of the exothermic type.
C. Equipment grounding provisions shall consist of the following:
   1. Exposed, noncurrent-carrying metal parts of fixed equipment likely to become energized, including the following, shall be grounded (bonded):
      a. Electrical distribution and control equipment enclosures, frames, cabinets, and cutout boxes.
      b. Metal raceways and boxes.
      c. Wiring devices.
      d. Motor frames and enclosures.
   2. Cord and plug connected equipment, except for double insulated appliances and other exceptions allowed by the National Electrical Code, shall be grounded.
D. Equipment grounding conductors shall comply with the following requirements:
   1. An equipment grounding conductor shall be installed in all branch circuit and feeder raceways.
   2. Ground wires shall be run inside the same raceways as the circuit conductors and shall have green insulation of the same type as the circuit conductors. Ground wires shall be bonded to all boxes and equipment enclosures through which they pass and at each end of metal raceways by means of grounding bushings.

3.02 FIELD QUALITY CONTROL

A. See Section 26 00 20- "Contract Close-out & Commissioning.

END OF SECTION 26 05 26

SECTION 26 05 33
RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide raceways for all conductors, including, but not limited to, that required for service, feeders, branch circuit power, and lighting.
B. Provide power raceways to connecting point for all equipment. Make final electrical connections unless noted otherwise.
C. Provide identification of all raceways.

1.03 SUBMITTALS

A. No submittals required when using specified materials. Otherwise, comply with Division 26 Section 26 00 10 "SUBMITTALS".

1.04 QUALITY ASSURANCE

A. Provide all new materials, without blemish or defect, in accord with standards specified and UL listed or labeled.

1.05 SYSTEM DESCRIPTION

A. Raceways Include:
1. Rigid Metal conduit and fittings.
2. Rigid non metallic conduit and fittings.
3. Intermediate metal conduit and fittings.
4. Liquidtight flexible metallic tubing and fittings.
5. Flexible metallic conduit and fittings.
6. Electrical metallic tubing and fittings.
6. Liquidtight Flexible conduit and fittings.

1.06 REFERENCES

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
B. American National Standards Institute (ANSI):
   1. C80.1 - Rigid Steel Conduit, Zinc coated.
   2. C80.3 - Electrical Metallic Tubing, Zinc coated.
   3. C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.
C. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA): FB 1 - Fittings and Supports for Conduit.
D. National Electrical Manufacturers Association (NEMA):
   1. NEMA TC-3 - PVC Fittings for use with Rigid PVC Conduit and Tubing.

1.07 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturers to prevent damage during shipment. Damaged materials will not be acceptable for use.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Raceways
   1. Allied Tube and Conduit.
   2. Republic Steel.
   3. Anaconda.
   4. Robintech.
   5. B-line.
   6. Steelduct Conduit Products
   7. Carlon.
   8. Square D.
   9. Certain-Teed Corp.
   10. Triangle.
   11. Electri-Flex
   12. Walker.
   13. ETP.
   14. Wheatland Tube.
   15. International Metal Hose.
   16. Wiremold.
   17. Jones & Laughlin Steel.
   18. Youngstown Steel.

B. Fittings
   1. Carlon.
   2. O.Z./Gedney.
   3. Crouse-Hinds.
   4. RACO.
   5. Killark.
   6. Steel City.

C. Conduit Sealing
   1. Chase Technology-CTC, PR-855.
   2. T & B - Flamesafe.
   3. Dow Corning - Silicone RTV foam 3-6548.
   4. 3M - Fire Barrier.
   5. Nelson - Flameseal.

D. Conduit Supporting Devices
   1. Minerallac.
   2. Crouse-Hinds.
   3. Midwest Electric.
   4. T & B.

2.02 RACEWAYS

A. Conduit:
   1. Steel Rigid Metal: Comply with ANSI C80.1, FS-WW-C-581 and UL-6.
   2. Intermediate Metal: Comply with ANSI C80.1, FS-WW-C-581 and UL-6.
   3. Steel Flexible Metal: Comply with FS-WW-C-566 and UL-1.
   4. Steel Liquidtight Flexible: Comply with FS-WW-C-566 and UL-1.
   5. Rigid Nonmetallic: Comply with NEMA TC-2, PVC, Schedule 40.

B. Tubing:
   1. Steel Electrical Metallic (EMT): Comply with ANSI C80.3, FS-WW-C-563 and UL 797.

C. Surface metallic raceway:
   1. Comply with UL E4376 and E41751.

2.03 FITTINGS

A. Rigid and IMC Conduit fittings and conduit bodies:
   1. Comply with ANSI C80.4, ANSI/NEMA FB 1, threaded type.
   2. Locknuts; steel or malleable iron.
   3. Bushings; insulating or insulated throat type.
   4. Couplings; threaded or gland compression malleable iron type. Set screw or indenter type not acceptable.
   5. UL listed hazardous location fittings (with sealing compound).

B. Electrical Metallic Tubing fittings and conduit bodies:
   1. Couplings and Connectors; steel compression type. Set screw type not acceptable. Comply with ANSI/ NEMA FB 1.

C. Flexible conduit fittings and conduit bodies:
   1. Connectors; malleable iron, threadless, squeeze clamp type for nonjacketed conduit.
   2. Connectors; steel or malleable iron compression type with insulated throat and "O" ring assembly for

liquidtight conduit.
3. Comply with ANSI/NEMA FB 1.

D. Nonmetallic conduit fittings and conduit bodies:
1. Comply with NEMA TC 3.

2.04 CONDUIT SEALING

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

B. Water Seal:
1. Seal penetrations of perimeter walls or floors below grade to prevent entry of water. Use materials compatible with wall or floor construction and reviewed by Engineer's Representative. Use premanufactured fittings.
2. Seal penetrations of roof with flashings compatible with roof design and reviewed by Roofing System Manufacturer and Engineer's Representative.

C. Hazardous Location Seal:
1. Install conduit sealing fitting on conduits entering the hazardous location. Fill fittings with sealing compound.
2. Install conduit sealing fittings on conduits entering devices within the hazardous location.

2.05 RACEWAY SUPPORTING DEVICES

A. Suspended conduits less than 1 inch.
1. For exposed construction, provide strap type hangers supported from beam clamps or threaded rods.
2. For conduits suspended above ceilings, anchor to building structural steel. When span exceeds NEC limits, provide channel steel between framing members. Tie wiring of conduit to air ducts, or other piping not permitted. Plumber's perforated strap not permitted.

B. Suspended Conduit 1 inch or larger.
1. Provide threaded rod with "U" type hangers for single conduit.
2. Provide trapeze hanger assemblies with Unistrut P-1000, Husky HP-200 or Kindorf B-901 and threaded rod for two or more conduits. Anchor conduits to hanger assembly with split pipe clamps.
3. Anchor threaded rod to inserts in concrete or beam clamp on steel structure.

C. Surface Mounted Conduit:
1. Provide one-hole galvanized steel straps for conduits one inch or less manufactured by Appleton, Steel City or RACO. Provide clampbacks on exterior walls below grade or in wet areas.
2. For conduit larger than one inch and all exterior surfaces, use malleable iron pipe straps.
3. For multiple conduits, provide channel anchored to wall with conduit attached to channel with split pipe clamps.

D. Anchoring:
3. Hollow Masonry: Toggle bolts or spider type expansion anchors.
4. Solid Masonry: Lead expansion anchors or preset anchors.
5. Concrete: Self-drilling anchor or powder driven studs.
6. Metal: Machine screws, bolts or welded studs.
7. Wood: Wood screws.

PART 3 - EXECUTION

3.01 INTERFERENCES

A. Coordinate work with other trades so that interference between piping, equipment, structural and electrical work will be avoided.
B. When interference develops, Engineer's Representative will decide which equipment will be relocated; regardless of which apparatus was installed first.

3.02 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. In general, conduit shall be concealed within walls, ceilings, and floors. Conduit in spaces such as equipment rooms may be exposed.
B. Size conduit for conductor type installed; 1/2 in. minimum size unless noted otherwise.
C. Arrange conduit to maintain headroom and present a neat appearance.
D. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
E. Maintain minimum 6 in. clearance between conduit and uninsulated piping. Maintain 12 in. clearance between conduit and heat sources such as flues, and heating appliances.
F. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
H. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.
I. **DO NOT SUPPORT ANY CONDUITS, BOXES OR ANY OTHER ELECTRICAL WORK DIRECTLY FROM UNDERSIDE OF ROOF DECK WITHOUT WRITTEN CONSENT OF ENGINEER'S REPRESENTATIVE.**

3.03 CONDUIT INSTALLATION

A. All conduit in finished spaces shall be concealed unless otherwise noted.
B. Cut conduit square using a saw or pipecutter; de-burr cut ends.
C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
D. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
E. Install no more than the equivalent of four 90-degree bends between boxes. (Two 90-degree bends for telephone conduits, data conduits, and sound system conduit).
F. Use conduit bodies to make sharp changes in direction, as around beams.
G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 in. size.
H. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
I. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
J. Provide No. 12 AWG insulated conductor or nylon pull string in empty conduit, except sleeves and nipples.
K. Provide UL listed expansion-deflection joints where conduit crosses building expansion or seismic joints.
L. Where conduit penetrates fire-rated walls and floors, provide mechanical fire-stop fittings with UL listed fire rating equal to wall or floor rating, or, at contractor's option, seal opening around conduit in accord with paragraph 2.04.
M. Route conduit through roof openings for piping and ductwork where possible. Provide flashing making waterproof joints where conduits pass through roof or roofing membrane.
N. Maximum Size Conduit in floor slabs: 3/4 in. Do not route conduits to cross each other in slabs. Run larger conduits below floor slabs or above ceilings.
O. Thermally seal conduit where conduits leave heated area and enter unheated area. See 2.04.
P. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be

inserted into fitting. Let joint cure for 20 minutes minimum.

3.04 CONDUIT INSTALLATION SCHEDULE

A. Underground Installations: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit.
B. Installations In or Under Concrete Slab: Schedule 40 PVC conduit.
C. In Slab Above Grade: Schedule 40 PVC conduit.
D. Exposed Outdoor Locations: Rigid steel conduit. Intermediate metal conduit.
E. Interior Locations Above Floor Slabs: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
F. Where nonmetallic conduit is used in or below slab or underground, continue the conduit runs above slab or grade using: IMC or rigid steel conduit.
G. Connections to ballasted lighting fixtures, appliances, and equipment with motors or compressors: Flexible Metallic Conduit. Liquidtight flexible conduit in exterior locations in wet locations, and in grease laden areas such as food service areas. Provide green insulated equipment grounding conductor.
H. Hazardous Locations: Intermediate metal conduit. Rigid steel conduit.
I. Interior exposed locations in finished spaces: surface metallic raceway system.
J. Provide a green insulated equipment grounding conductor in all feeder and branch circuit raceways. Size conductor according to NEC Section 250-95.

END OF SECTION 26 05 33

SECTION 26 05 34
BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide all boxes for the work.
B. Provide coordination of boxes requiring access with General work.
C. General Construction Trades provide access panels for boxes hidden by building construction.

1.03 SUBMITTALS

A. No submittals required when using specified materials. Otherwise, comply with General Conditions and Applicable Supplementary Conditions, Division 01, Section 26 00 10 "SUBMITTALS" and Division 26 Section 26 00 10 "SUBMITTALS".

1.04 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Comply with NFPA.
   2. Provide materials listed/labeled by UL.
   2. National Electric Code.

1.05 SYSTEM DESCRIPTION

A. Boxes include:
   1. Wall and ceiling outlet boxes.
   2. Pull and junction boxes.

1.06 REFERENCES

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
B. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA OS-1-Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports).
C. National Electrical Manufacturers Association (NEMA): NEMA 250 - Enclosures for Electrical Equipment.
D. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code latest Edition.
E. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.07 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials not acceptable for use.
B. Store materials on site in clean, dry storage area.
C. Handle all materials carefully to preclude damage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Boxes (other than Floor Boxes)

1. Appleton Electric Co.
2. Pyle-National
3. Crouse-Hinds Co.
4. RACO
5. General Electric Co.
6. Square D.
7. Hoffman Co.
8. Steel City
9. Hubbell.
10. Thomas & Betts Co.
11. Killark Electric Mfg. Co.
12. Walker.
13. O.Z./Gedney Co.
14. Quazite.

2.02 PULL BOXES AND JUNCTION BOXES

A Comply with 1996 NEC - 370, UL 50 and ANSI/NEMOS 1; galvanized steel.
B. Flush mounted pull boxes: Overlapping cover with flush head retaining screws, prime-coated.
C. Surface mounted boxes: Screw-on or hinged cover. Provide silicon bronze standard retaining screws.
D. Finished Areas: Boxes of 14 gauge steel minimum, galvanized or prime coated.
E. Boxes greater than 144 square inch: Make of 1-1/2 in. X 1-1/2 in. X 1/4 in. galvanized angle covered with 10 gauge galvanized sheet steel riveted or bolted with hinged cover of 11 gage galvanized steel.
F. Boxes larger than 12 inches in any dimension: hinged enclosure.
G. Exterior Below Grade: Non-metallic, sand-gravel polymer base fiberglass reinforced.

2.03 OUTLET BOXES

A. Hot dipped galvanized, 1.25 oz. per sq. ft., sherardized or cadmium plated. Conform to UL 514.
B. Interior boxes: Sheet steel with conduit knockouts, attached lugs for locating. ANSI/NEMA OS 1.
C. Exterior boxes or exposed interior in wet/damp locations: Cast aluminum, deep type, corrosion proof fasteners, watertight, gasketed, threaded hubs.
D. For suspended or surface mounted fixtures:
   1. 4-inch octagonal or square according to devices used. Minimum 1-1/2 in. deep. Furnished with fixture studs. Installed with 3/4 in. minimum depth plaster rings on suspended ceilings. 4 in. octagonal or square for all exposed conduit work with fixture extension pan or deep fixture canopy to enclose the box.
   2. Fixtures listed for thru-way wiring may be used as such without an outlet box.
E. For recessed fixtures:
   1. 4 in. octagonal or square. Minimum 1-1/2 in deep. Complete with blank cover.
   2. .Fixtures listed for thru-way wiring may be used as such without an outlet box.
F. Switch and Receptacle Boxes:
   1. Wall: 4 in. square for up to two devices. Single gang with 18 cubic inch minimum capacity for one device. Solid gang boxes for two devices. Complete with 1 in. minimum depth tile ring where used in exposed tile, paneled walls. Complete with 1 in. minimum depth plaster ring where used In plastered walls. Install with 1/2 in. raised galvanized device covers conduit work. Provide concrete-tight masonry boxes in poured concrete or CMU walls.

2.04 CONDUIT BODIES

A. Galvanized cast metal of type, shape and size to fit location.
B. Constructed with threaded conduit ends, removable cover, corrosion resistant screws.

PART 3 - EXECUTION

3.01 COORDINATION

A. Provide boxes as shown and for splices, taps, wire pulling, equipment connections and code compliance.
B. Locations shown are approximate unless dimensioned. Verify location of boxes and outlets prior to rough-in.
C. Locate boxes to allow access. When inaccessible, provide access doors.
D. Locate boxes to maintain headroom and present a neat appearance.

3.02 INSTALLATION

A. Provide knockout closures to cap unused knockout holes where blanks have been removed.

B. Support all boxes independently of conduit except for cast boxes connected to two rigid conduits both supported within 12 inches of box.
C. Outlet Boxes:
   1. Flush mount outlet boxes in areas other than mechanical rooms, electrical rooms, and above removable ceilings.
   2. Do not install boxes back-to-back in same wall. Provide at least 6 in. separation where possible.
   3. Use multiple gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate different voltage systems.
   4. For boxes mounted in exterior walls, make sure insulation is behind outlet boxes. Do not damage insulation.
   5. For outlets mounted above counters, benches, or backsplashes, coordinate location and mounting heights with units. Where boxes are mounted on sidewalls at counters and lavatories, hold boxes to front of counter or lavatory for handicapped accessibility.
   6. Adjust outlet mounting height to agree with specified location for equipment served.
   7. Position outlets to locate luminaires as shown on reflected ceiling drawings.
   8. Position outlets and junction boxes in inaccessible ceilings areas within 6 in. of luminaire; accessible through luminaire ceiling opening.
   9. Provide recessed boxes in finished areas; secure to interior wall and partition studs, allow for surface finish thickness. Use stamped steel stud hangers in hollow stud wall, and adjustable steel channel fasteners for flush ceiling boxes.
   10. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
   11. Provide cast boxes for exterior locations & wet locations.
D. Pull and Junction Boxes:
   1. Locate above accessible ceilings or in unfinished areas.
   2. Support independent of conduit.
E. Provide covers for all boxes.

END OF SECTION 26 05 34

SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide identification of manual and automatic operable equipment:
   1. Safety Switches.
   2. Panelboards & Switchboards.
   3. Starters.
   4. Control panels, relay panels, and special junction boxes.
   5. Contactors, relays and time switches.
   6. Manual starters and interval timers.

B. Provide identification of all passive equipment:
   1. Terminal Cabinets.

C. Provide identification of conduit system including boxes.

D. Provide identification of wiring system.

1.03 QUALITY ASSURANCE

A. Comply with:
   1. ANSI A 13.1, Identification of Piping Systems.
   2. Local Rules & Regulations.
   3. National Electric Code. (NEC)

1.04 REFERENCES

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.

B. American National Standards Institute (ANSI): ANSI A13.1 - Identification of Piping Systems.

C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC) 1993 Edition.

D. Underwriters Laboratories, Inc. (UL): All products UL listed and labeled.

E. Manufacturers' Catalogs: Specification manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.05 SUBMITTALS

A. See Division 26 Section 26 00 10 "SUBMITTALS".

PART 2 - PRODUCTS

2.01 EQUIPMENT IDENTIFICATION PLATES

A. See Section 26 00 20 - "Contract Close-out & Commissioning".

2.02 CONDUIT SYSTEM IDENTIFICATION

A. See Section 26 00 20 - "Contract Close-out & Commissioning".

2.03 UNDERGROUND-TYPE PLASTIC LINE MARKERS

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

2.04 WIRING SYSTEM IDENTIFICATION

A. Wire Insulation Color: See Section 26 05 19 - "WIRES AND CABLES".
B. Code all wire and cable larger than color coded sizes available from manufacturer by application of electrical plastic tape in colors specified. Apply tape in uniform manner circling wire or cable. Apply tape in all boxes and cabinets. Half-lap tape for length of cable as required by Local Authorities or NEC. Tape shall be 3M, Plymouth or Permacel.
C. Maintain consistent coding throughout installation to ensure proper phase identification.
D. See Section 26 00 20 - "Contract Close-out & Commissioning".

2.05 MISCELLANEOUS IDENTIFICATION

A. Complete all panel directories completely typewritten. Each circuit shall be identified by location and type of load. Example: Lighting - Office.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Affix Equipment Identification Plates to equipment with stainless steel self tapping screws. Do not use adhesive.

3.02 UNDERGROUND PIPING IDENTIFICATION

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

END OF SECTION 26 05 53

SECTION 26 24 00
ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide:
   1. Panelboards.
   2. Contactors.
   2. Safety Switches.
   4. Fuses.

1.03 SUBMITTALS

A. No submittals required when using specified equipment or owner provided equipment, otherwise submit information as follows:
B. Division 01 Section "SUBMITTALS" – Shop drawings, product data, installation drawings; also see Division 26 Section 26 00 10 "SUBMITTALS".
C. Division 01 Section "PROJECT RECORD AND CLOSEOUT DOCUMENTS" – Complete record of "as-built" drawings and specifications for all components.
D. Panelboard submittals shall include overall dimensions, wiring gutter dimensions, location of the main, branches and neutral.
E. Safety switches.
F. Contractors.
G. Time clocks.
H. Lighting controllers.

1.04 QUALITY ASSURANCE

A. Regulatory requirements:
   1. Panelboards:
      a. UL Standard 67.
      a. Fed. Spec. W-P-115A Type 1, Class 1.
      b. NEMA Standards PBI-1977.
   2. Safety Switches:
      a. UL Std. 98.
      b. NEMA Std. KS1-1975.
   3. Contactors:
      a. UL Std. 508.
      b. NEMA Std. 1CSZ-Z11B.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in time to maintain approved construction schedule.
B. Store in safe, dry location. Protect from dust, moisture, weather and extreme temperatures.
C. Follow manufacturer's recommendation for transportation, handling and storage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Electrical Equipment
   1. Cutler-Hammer.
   2. Siemens-ITE.
   3. GE.
   4. Square D.
B. Fuses
   1. Bussman.

2.02 PANELBOARDS - LIGHTING AND APPLIANCE

A. Circuit breakers panelboards shall meet Federal Spec W-P-115A for Type 1 panels. Panelboard bussing may be tinned-aluminum. Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating, and have common trip on all multipole circuit breakers. Trip indication shall be shown by the breaker handle taking a neutral position between ON and OFF when the breaker is tripped. The ampacity of the circuit breaker shall be stamped in a location visible without removing the front of the panelboard. The minimum circuit breaker interrupting capacity shall be as indicated on plans. Circuit breakers shall be plug on type. All circuit breakers on lighting panels shall be UL labeled "SWD" and "HACR". All circuit breakers serving HID loads shall be so rated. Panelboards shall be equal to the style/type shown on schedules.
B. All terminals shall be UL listed as suitable for the type of conductor specified.
C. Main lugs shall be bolt type.
D. Panelboard bus assemblies shall be enclosed in galvanized or rust-resisting steel cabinets. Fronts shall include doors and cylinder tumbler type locks with catches and spring loaded door pulls. All doors shall be keyed alike. Door hinges shall be concealed when panel doors are closed. Fronts shall not be removable with doors locked. A circuit directory frame and card with clear plastic cover shall be locked on the inside of the front. Door and front shall be of code gauge steel with rust inhibiting primer and gray baked enamel finish.
E. Panelboards shall have solid neutral and equipment grounding bus. Panels designated for electronic equipment (Cpx) shall have 200% neutral bus.

2.03 SAFETY SWITCHES

A. All safety switches shall be the fusible type, horsepower rated, NEMA type, general duty (240V and below) unless otherwise noted on drawings. Note: Heavy duty safety switches shall be provided on all voltages greater than 240V.
B. Enclosures shall be code gauge steel with rust inhibiting primer and gray baked enamel finish. Install safety switches with NEMA 1 enclosures in dry locations and NEMA 3R enclosures in wet locations.
C. Switches shall have quick-make, quick-break operating handle and mechanism which shall be an integral part of the enclosure. Switches shall be lockable in both positions and shall have an interlock to prevent opening switch door with handle in the OFF position. This feature shall have a defeater mechanism.
D. Switch blades shall be visible in OFF position with door open. Switches shall be dead front type with arc suppressors. Lugs shall be UL listed for copper or aluminum. All current carrying parts shall be plated.
E. Switches shall have a solid neutral unless otherwise noted.
F. Switches shall have factory installed kits to prevent the use of other than UL class R fuses.

2.04 LIGHTING CONTACTORS

A. Contactors shall be electrically held and shall switch the load at the voltage required and shall have the quantity of poles required.
B. The contactor shall be continuously rated per pole for all types of ballast and tungsten lighting and resistance loads, and shall not be de-rated for use on high-inrush loads.
C. The contactor shall have double-break, silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. all power contacts shall be convertible from N.O. to N.C. or vice-versa. All contacts shall HVAC clearly visible N.O. and N.C. contact-status indicators.
D. The contactor shall be industrial-duty rated for applications to 600 volts maximum.
E. The contactor shall have NEMA type enclosure as required by installation.

2.05 FUSES

A. Circuits 601 to 6000 amperes shall be protected by current limiting time-delay fuses. Fuses shall hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriters Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class L.
B. Circuits 0 to 600 amperes shall be protected by current limiting dual-element fuses. All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F. melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds (30A, 250V Class RK1 case size shall be a minimum of 8 seconds at 500% of rated current) and be listed by Underwriters Laboratories, Inc., with an

interrupting rating of 200,000 amperes RMS symmetrical.

C. Motor circuits - All individual motor circuits with full load ampere ratings (FLA) of 480 amperes or less shall be protected by dual-element fuses. The fuses shall be UL Class RK1, or J, dual-element time-delay.
D. The ampere rating of fuses shall be as required by the load served. Field verify by inspecting the nameplate of the equipment being protected.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with equipment manufacturer's written installation instructions for all equipment.
B. Install equipment with minimum of 3'-6" working clearance measured from front of enclosure.
C. Set equipment true and plumb using a carpenter's level.
D. Support panels adequately in the same manner as described for outlet boxes for different types of construction.
E. Wiring within equipment cabinets shall be done in a neat and workmanlike manner with branch circuit conductors run along the outside edges of the wiring gutters and then horizontally into the terminals.
F. For flush mounted panelboards, stub a minimum of three 3/4" diameter raceways into the ceiling cavity space.
G. Install safety switches which serve as equipment disconnecting means so that equipment maintenance can be performed within sight of the disconnect if possible.
H. When safety switches are mounted directly to equipment in wet locations, the installation shall be watertight. Install sealing locknuts with rubber O-rings for equipment with knockouts.
I. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A.
J. Adjust operating mechanisms for free mechanical movement.
K. Touch-up scratched or marred surfaces to match original finishes.
L. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.
M. Prior to energization of equipment, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
N. Prior to energization, check equipment for electrical continuity to circuits, and for short-circuits.
O. Subsequent to wire and cable hook-ups, energize equipment and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.
P. See Section 26 00 20- "Contract Close-out & Commissioning".
Q. Fuses shall not be installed until equipment is ready to be energized.

END OF SECTION 26 24 00

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide:
   1. Switches.
   2. Device plates.
   3. Receptacles.

1.03 RELATED WORK

A. Section 26 05 19– "WIRES AND CABLES".
B. Section 26 05 34 – "BOXES".

1.04 SUBMITTALS

A. Provide product data in accordance with Division 26 Section 26 00 10 "SUBMITTALS".

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: All materials: U.L. listed or labeled.

1.06 REFERENCES

A. Specified references, or cited portions thereof, govern the work.
B. National Electrical Manufacturers Association (NEMA):
   1. WD-1 - General Purpose Wiring Devices.
   2. WD-5 - Specific Purpose Wiring Devices.
C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC) 1993 Edition.
D. Underwriters' Laboratories, Inc. (UL): All materials UL listed and labeled.
E. Federal Specification WC596F (Receptacles) and WS896E (Switches).

1.07 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.
B. Store materials on site in clean, dry storage area.
C. Handle all materials carefully to preclude damage during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Arrow-Hart.
B. Leviton.
C. Hubbell.
D. Pass & Seymour.

2.01 WALL SWITCHES

A. Specification Grade , 20A, 120-277 V., quiet type, back and side wired, toggle handle. Color - Ivory. Equal to Hubbell series as follows:
   1. Single pole - #CS-1221
   2. Double pole - #CS-1222
   3. 3-Way - #CS-1223
   4. 4-Way - #CS-1224
   5. Pilot Light Switch - #HBL-1221L

B. Narrow Switches: Equal to "Eagle" #1211-V, 20A, 227V., quiet type, back wired, toggle handle. Color – ivory. Provide Eagle #919 mounting strap and "Pass & Seymour" SNG1 cover plate.

2.02 RECEPTACLES

A. Duplex:
   1. Flush, straight blade, 3 wire grounding, construction series, heavy duty, specification grade, 20 A, 125 V., NEMA 5-20R, capable of being split wired and/or feed thru.
   2. Hubbell #CR-5362, or equal.
   3. Color: Ivory (Gray for "Designated Receptacle).

B. Ground Fault Circuit Interrupter:
   1. Commercial, specification grade feed through type capable of protecting downstream receptacles on same circuit, grounding type, UL class A-Group 1, 20 amp 125 v.
   2. Solid State ground fault sensing and signaling, 5 ma. trip level.
   3. Color: Ivory.
   4. Hubbell #GF-5362, or equal.

C. Isolated Ground:
   1. Single or duplex, 3 wire, construction series, heavy duty specification grade, 20 amp, 125V, NEMA 5-20R.
   2. Color: Orange.
   3. Hubbell CR-5352IG or equal.

C. Telephone/Communication Outlet:
   1. Provide wall box only and provide blank coverplate for locations that are not used.

2.03 DEVICE PLATES

A. Materials:
   1. Finished Spaces: .04 inch thick, type 302, satin finished stainless steel.
   2. Outdoor, Exterior: Cast metal, gasketed. Provide springloaded gasketed door for receptacles.
   3. Surface Devices in Unfinished Areas: Galvanized steel.

B. Use plates manufactured by device manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wall switches with OFF position down.
B. Install convenience receptacles with grounding pole on top when mounted vertically or with grounding pole on left when mounted horizontally.
C. Install plates on all switch, and receptacle outlets. Install blank plates on all unused boxes.
D. Install devices and plates flush and level.
E. Seal all connections on GFCI with seal coat compound and wrap with two layers tape.

END OF SECTION 26 27 26

SECTION 26 29 00
MOTOR CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide starters specified and shown on electrical drawings.

1.03 RELATED WORK

A. Section 26 05 33 - "RACEWAYS".
B. Section 26 24 00 - "ELECTRICAL EQUIPMENT".
C. Section 26 05 19 - "WIRES AND CABLES".
D. Section 26 05 53 - "ELECTRICAL IDENTIFICATION".

1.04 SUBMITTALS

A. Product data in accord with Division 26 Section 26 00 10 "SUBMITTALS".
   1. Provide catalog cut sheets showing voltage, controller size, ratings and size of switching and overcurrent protection devices, short circuit ratings, dimensions, and enclosure details.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Power & Control Wiring in accord with N.E.C.
   2. NEMA ICS-2, NEMA KS1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General Electric.
B. Siemens.
C. Square D.
D. Eaton.

2.02 MOTOR CONTROLLERS

A. Manual Motor Controller
   1. NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller with overload element, red pilot light, auxiliary contact, where noted, and push button operator.
B. Fractional Horsepower Manual Motor Controller
   1. NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
C. Motor Starting Switches
   1. NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with red pilot light where shown, and toggle operator.
D. Magnetic Motor Controllers - Non-reversing

1. NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower with 120 volt encapsulate coil, poles and size as scheduled or as indicated.
2. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
3. Wiring: Straight-through wiring with all terminals clearly marked.
4. Overload Relay: NEMA ICS; with one-piece thermal unit construction. Thermal units shall be interchangeable. Overload relay control circuit contact shall be replaceable. Thermal units shall be required for starter to operate.
5. Auxiliary contacts, pilot devices and other options as scheduled or as indicated.
6. All controller enclosures shall be as scheduled or indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.
B. Install enclosed controllers plumb with 5 ft. AFF to operating handle.
C. Install fuses in fusible switches under provisions of fuses section.
D. Select and install overload heater elements in motor controllers to match installed motor characteristics.
E. Provide engraved plastic nameplates under the provisions of Section 26 05 53 - "ELECTRICAL IDENTIFICATION".
F. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION 26 29 00

SECTION 26 50 00
LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDES

A. Provide lighting fixtures.
B. Provide required fixture supports.
C. Provide lamps.

1.03 SUBMITTALS

A. No submittals required on specified equipment or owner furnished equipment otherwise provide: Product data in accordance with Division 26 Section 26 00 10 "SUBMITTALS".

1.04 QUALITY ASSURANCE

A. Regulatory requirements.
   1. NEMA Std. Pub. Nos. SH5 and TT1 for pole construction, materials, and hardware.
   2. Building lighting fixtures:
      a. Applicable sections of NEC.
      b. ANSI 132.1
      c. UL 57, 676, 1570, 1571, and 1572.
      d. Fluorescent ballasts shall be CBM labeled.
      e. NEMA Std. Pub. Nos. FA1. LE1 and LE2.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Electronic ballasts
   1. Advance.
B. Lamps
   1. General Electric.
   2. Phillips.
   3. Osram-Sylvania

2.02 FIXTURES

A. Specified on plans.

2.03 BALLASTS

A. All ballasts shall be rated for the circuit voltage shown on plans.
B. All ballasts shall be P thermal rating. Fluorescent ballasts shall have class A sound rating.
C. Ballasts for exterior lighting fixtures shall be suitable for use at temperatures -20°F. and above.
D. Unless otherwise noted, fluorescent ballasts shall be solid state electronic type for use with T8 (Octron or equal) fluorescent lamps. Electronic ballasts shall have a total harmonic distortion of 10% or less.

2.04 LAMPS

A. Provide lamps for all light fixtures as scheduled on drawings.
B. All flourescent lamps shall contain mercury in reduced amounts allowing them to pass the EPS's "Toxic Characteristic Leaching Procedure" (TCLP) and be so labeled.

PART 3 - EXECUTION

3.01 LIGHTING FIXTURES

A. Provide all plaster frames, angles, channel, hangers and supports required to support lighting fixtures. Fixtures shall be supported independently of ceiling.
B. Exit signs in suspended ceiling areas shall be located in the center of the ceiling tile and oriented so as to provide maximum visibility to escape paths.
C. See Section 26 00 20 - "Contract Close-out & Commissioning".

END OF SECTION 26 50 00

SECTION 31 00 00

EARTHWORK

PART 1 – GENERAL

1.01 SUMMARY

A. Perform excavation, filling, compacting and grading operations both inside and outside building limits as required for below-grade improvements and to achieve grades and elevations indicated. Provide trenching and backfilling for mechanical and electrical work and utilities.
B. Provide subbase materials, drainage fill, and common fill materials for slabs, pavements, and improvements.
C. Provide suitable fill from off-site if on-site quantities are insufficient or unacceptable, and legally dispose of excess fill off-site.
D. Provide rock excavation without blasting, unless specifically authorized, in unit prices on Bid Proposal and as defined herein.

1.02 PROJECT CONDITIONS

A. If a boundary and topographical survey have been prepared for this site, refer to Section 00 31 00.
B. If a geotechnical analysis has been prepared for this site, refer to Section 00 31 00.
C. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for the convenience of Contractor. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.
D. Locate existing underground utilities in the area of work. Provide adequate means of protection during earthwork operations. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of operating authority.

1.03 TESTING AND INSPECTION

A. Contractor to employ and pay for a qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations. It is recommended, but not required, to utilize same soils testing laboratory that prepared the original geotechnical report.
B. Test and analysis of fill material will be performed in accordance with ANSI/ASTM D 698 “Standard” Proctor Density.
C. Frequency of test: One in-place compaction test should be performed for each 2,500 square feet of fill placed, per lift, with a minimum of three tests per lift.
D. Sub-grade shall be approved by testing lab before backfilling begins.

1.04 SUBMITTALS

A. Submit for approval field density test reports.
B. Submit for approval list of materials and gradations proposed for use.

1.05 QUALITY ASSURANCE

A. Compaction (Unless otherwise indicated in Geotechnical Analysis):
   1. Under structures, building slabs, steps, pavements, and walkways, 95% minimum density, ASTM D 698, at moisture content range of 1% below to 3% above optimum moisture content.
   2. Under lawns or unpaved areas, 90% minimum density, ASTM D 698, at moisture content range of 3% below to 3% above optimum moisture content.
B. Grading Tolerances Outside Building Lines:
   1. Lawns, unpaved areas, and walks, plus or minus 1-inch.
   2. Pavements, plus or minus ½-inch.
C. Grading Tolerance for Fill Under Building Slabs: Plus or minus ½-inch measured with 10-foot straightedge.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Subbase material: Material acceptable for intended use as subbase for paving specified unless noted on the drawings.
   1. Naturally or artificially graded mixture of natural or crushed gravel.
   2. Crushed limestone graded from 1" to dust.
   3. Crushed slag.
   4. Natural or crushed sand, free of silt, clay, loam, friable or soluble materials, and organic matter.
   5. Cohesive subgrade: Subgrade soils may be stabilized with hydrated lime, cement, or flyash, or chemical treatment in accordance with AASHTO standards. The quantity of additive required should be determined after the site is stripped of the loose topsoil and the subgrade soils exposed. Actual percentage required shall be determined by independent laboratory tests provided by Contractor and approved by Architect.
   6. Substitute materials may be utilized with prior approval from Architect.
B. Drainage fill: Washed gravel or crushed stone, ¼" to ¾" size; ASTM C 33, Size 67.
C. Common fill: Mineral soil substantially free from organic and unsuitable materials, and free from rock or gravel larger than 2" in diameter, 80% passing No. 40 sieve and not more than 50% passing No. 200 sieve.
D. Structural fill:
   1. Inactive silty or sandy clay, with a plasticity index less than 20 and a liquid limit less than 45, free of rocks greater than 6" in diameter.
   2. Gravel or sandy gravel free of organic and unsuitable materials and within the following gradation limits: 4" sieve, 100 percent finer by weight; 1" sieve, 60 to 100 percent; No. 4 sieve, 25 to 85 percent; No. 20 sieve, 10 to 60 percent; No. 50 sieve, 4 to 35 percent; No. 200 sieve, 0 to 5 percent.
   3. Substitute materials may be utilized with prior approval from Architect.

PART 3 – EXECUTION

3.01 EXCAVATION

A. Excavation classification: Excavation classifications shall be defined herein and includes removal and disposal of any material encountered to obtain required subgrade elevations, including pavement, obstructions visible on ground surface, underground structures and utilities indicated to be removed, boulders, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.

B. Unauthorized excavations (removal of materials beyond indicated subgrade elevations and dimensions) shall be corrected as follows:
   1. At structure:
      a. Extend the indicated bottom elevation of footing to the lower elevation.
      b. Provide concrete or lean concrete mix approved by Architect.
      c. Compacted structural fill.
   2. Elsewhere: Backfill and compact as directed.

C. Excavation for structure: Excavate for structure to elevations and dimensions shown, extending excavation a sufficient distance to permit placing and removal of concrete formwork, installation of services, other work, and for inspection. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottom to required lines and grades to provide solid base to receive concrete.
   1. Arrange for observation of completed excavation by geotechnical engineer prior to fill placement or footing construction.

D. Excavation for pavements: Cut surface under pavements to comply with cross-section, elevations and grades as indicated.

E. Excavation for trenches: Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room, and to the depth indicated or required. Trench width for piping shall be cut to provide 6" –12" of clear space between the pipe O.D. and trench wall. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations with a minimum of 4" of granular bedding below the pipe. Beyond the building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups. Where rock is encountered, carry the excavation 6" below the required elevation and backfill with a 6" layer of crushed stone or gravel prior to installing pipe. Grade bottoms of trenches as indicated, notching pipe bells to provide solid bearing for the entire body of pipe. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place backfill to level of bottom of adjacent footing. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Architect. Use care in backfilling to avoid damage or displacement of pipe system.

F. Excavation of rock: If rock, as defined below, which requires for its removal the continuous use of pneumatic tools or drilling and blasting, is encountered, Contractor shall cease all excavation and trenching work in associated area and notify Architect in accordance with General Conditions. Provide rock excavation unit price basis as set forth in Contractor's Bid Proposal defined as follows:
   1. Solid rock excavation is defined as rock in solid bed or masses in its original or stratified position including boulders and detached masses of rock, portions of which projecting into the lines of excavation and necessary to be removed exceed in any one bed, mass or boulder one (1) cubic yard, and which is not, in the opinion of the Architect, practicable to except after drilling and blasting.
   2. Trench rock excavation is defined as excavation of a continuous nature, narrow in width such as excavation for foundation walls, foundation wall footings, plumbing, heating and sewer lines, drain tile and excavation of a similar nature.
   3. Pit rock excavation is defined as excavation of an isolated nature, such as piers, footing for piers, shafts, tanks and other excavation of a similar nature.
   4. Solid rock occurring in any excavation shall be uncovered by Contractor and measured by the Architect before its removal by the Contractor. Any rock removed before Architect's inspection and measurement shall be treated as earth excavation and the Contractor shall not be entitled to additional compensation for its removal.
   5. Unless rocks comply with the requirements above, closely packed strata or flint or other rock separated by clay or earth seams shall be classed as earth excavations and the Contractor shall not be entitled to additional compensation for its removal; provided, however, that bedded deposits, unstratified masses, and other rock

deposits so firmly cemented as to present the characteristics of solid rock shall be deemed to be solid rock within the provision above when Architect so certifies.

6. Blasting: No blasting of rock will be allowed unless specifically authorized.
   a. Contractor shall comply with all local, state, and federal laws, ordinances, applicable safety code requirements and regulations relative to handling, storage, and use of explosives and the protection of life and property.
   b. The Contractor shall be responsible for all damages caused by his blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within limits of the excavation or trench.
   c. No blasting of rock will be allowed in foundation wall lines or general areas that are within twenty (20) feet of adjacent structures unless specifically authorized.
   d. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

3.02 SHORING AND BRACING

A. Sheeting, bracing and shoring shall be the responsibility of the Contractor and be designed by a professional engineer licensed in the jurisdiction of the project and built to withstand all loads that might be caused by earth movement or pressure, and shall be rigid, maintaining shape and position under all circumstances. Design and construction shall be in compliance with codes and ordinances of governing authorities having jurisdiction.

B. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, and shored, as necessary, to prevent caving or sliding; to provide protection for workmen and the work; and to provide protection for existing structures and facilities.

3.03 BACKFILL AND FILL

A. Place and compact acceptable soil material in layers to required elevations. Do not place materials on surfaces that are muddy, frozen, contain ice, or frost. Backfill excavations as promptly as work permits.

B. Place acceptable materials in layers not more than 8” loose depth for materials compacted by heavy equipment and not more than 4” loose depth for materials compacted by hand equipment to subgrades indicated as follows:
   1. Structural Fill: Use under foundations, slabs on grade in layers as indicated.
   2. Drainage Fill: Use under designated building slabs, at foundation drainage and elsewhere as indicated.
   3. Common Fill: Use under unpaved areas. Note, where post-tension type foundation systems are indicated or when recommended in Geotechnical Analysis for other foundation system types, provide 12” of high plastic index type clay soil “plug” surrounding unpaved building perimeter for a minimum of five (5) feet extension from building properly compacted to minimize infiltration of surface water for gaining access to subgrade beneath structure.
   4. Subbase Material: Use under pavement, walks, steps, piping and conduit.
   5. Pipe Embedment: Pipe embedment shall extend from the pipe bedding to 12” above the top of pipe for plastic pipe and to the centerline of the pipe for reinforced concrete pipe. Pipe embedment shall consist of gravel or sand compacted to 90% density.

3.04 PAVEMENT SUBBASE COURSE

A. Place specified subbase material in layers of indicated thickness, over subgrade surface to support pavements. Place in a single layer not to exceed 6” in thickness and in equal layers of 6” or less for thickness greater than 6”.

3.05 BUILDING SLAB DRAINAGE COURSE

A. Place drainage fill material on prepared subgrade in a single layer not to exceed 6” in thickness and in equal layers of 6” or less for thickness greater than 6”.

3.06 GRADING

A. Subgrade elevation to be 4” below finish indicated for placement of topsoil specified in Section 32 90 00. Grade areas indicated with uniform levels or slopes between finish elevations. Shape surface of areas to 0.10 ft. above or below required subgrade elevation, compacted as required. Where in-situ soil is used as subgrade, soil shall be scarified, moisture conditioned and recompacted to a depth of 6-inches unless otherwise noted.

3.07 MAINTENANCE AND DISPOSAL

A. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other de-watering systems components necessary to convey water away from excavations. Convey water removed from excavations and rainwater to collection or runoff areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.
B. Material storage: Stockpile excavated materials in such a manner not to impede construction activities, encumber adjacent property, or within drip line of trees to remain. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations.
C. Protect existing structures, planting, utilities, and conditions designated to remain.
D. Protect newly graded areas from traffic and erosion. Recompact and regrade settled, disturbed and damaged areas as necessary to restore quality, appearance, and condition of work.
E. Control erosion to prevent runoff into sewers or damage sloped or runoff areas.
F. Control dust to prevent hazards to adjacent properties and vehicles. Immediately repair or remedy damage caused by dust, including air filters in equipment and vehicles. Clean soiled surfaces.
G. Dispose of waste and unsuitable materials off-site in a legal manner.

END OF SECTION

SECTION 31 62 00

DRIVEN PILES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide driven piles for cast-in-place foundation structural support.
B. Refer to structural drawings for driven pile locations, sizes, depths and loading criteria.

1.02 SUBMITTALS

A. Submit for approval test reports and driving records.

1.03 QUALITY ASSURANCE

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

1.04 PROJECT CONDITIONS

A. A geotechnical report has been prepared for this site, (refer section 00 31 00).
B. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for the convenience of Contractor. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.
C. Locate existing underground utilities in the area of work. Provide adequate means of protection during earthwork operations. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
D. Contractor shall inspect and document conditions of adjacent construction prior to beginning driving operations. Care shall be taken to assure potential vibrations from driving and pile installation be achieved without damage to existing construction. Contractor shall be responsible for all damages caused by driven pile operations.

1.05 TESTING AND INSPECTION

A. Contractor to employ and pay for a qualified independent geotechnical testing laboratory to perform testing and inspection service during driven pile operations. It is recommended, but not required, to utilize same testing laboratory who prepare original geotechnical report. Furnish services of registered land surveyor or engineer to record actual location of piles and top of pile elevations.
B. Test and analysis of driving operations and material shall be performed in accordance with ANSI/ASTM standards and in sufficient number as recommended by qualified geotechnical testing laboratory.
C. Notify Owner 48 hours prior to driving initial pile. Do not commence pile driving without Owner's representative and testing laboratory being present.

D. Test Pile Program.
   1. Exploratory Piles:
      a. Furnish and drive five piles at permanent locations recommended by geotechnical engineer and approved by Architect. Exploratory piles shall be part of permanent foundation and meet requirements of piling specified.
      b. Drive exploratory piles prior to ordering permanent piles.
   2. Load Test:
      a. Load test one exploratory pile and test with compression as outlined by ASTM D1143. Apply load with hydraulic jack acting directly on head of pile. Furnish and install materials required for testing, with exception of hydraulic jack.
      b. Load test piles to yield point of soil in accordance with requirements of local code authorities and geotechnical engineer recommendations.
      c. Pile design loads: Refer to structural drawings.
      d. Loading:

Applied load in Tons	Time of Hold-Free of Movement
2 through 16	One hour

E. Keep accurate records showing each pile location, depth of placement, tip elevation and driving resistance.
F. Pile installation conditions shall be approved by geotechnical engineer and Owner before proceeding with subsequent work.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Timber Piles:
   1. Friction-type timber piles.
   2. Round, one-piece timbers, ASTM D 25, pressure preservative treated. Refer to structural drawings for sizes and depths.
   3. Steel plate driving shoes and steel strapping.
   4. Field applied wood preservative for cuts and penetrations in accordance with AWPA Standard M4.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Select pile driving hammer according to pile type, length, size, and weight of pile, as well as potential vibrations resulting from pile driving operations. Hammer selection to be capable of achieving desired penetration without causing damage to piles or causing excessive vibrations and damage to existing structures.
B. Provide testing and observation as outlined in TESTING AND INSPECTION paragraph.
C. Drive piles only after earthwork operations in immediate area are completed. Drive piles continuously to specified depth and resistance. Drive piles to performance required by project conditions.
D. Piles arranged in clusters to have center piles driven first.
E. Tolerance: 1” deviation for center of gravity for piles under walls. 1” in 10’ in plumb and angle.
F. Reseat piles significantly displaced by heaving.
G. Cut pile ends and apply wood preservative for cuts and penetrations in accordance with AWPA Standard M4 where required.
H. Remove and replace defective or non-conforming piles.

END OF SECTION

SECTION 31 63 00

BORED AND BELLED CONCRETE PIERS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide bored and belled piers for cast-in-place foundation structural support.

1.02 PROJECT CONDITIONS

A. A geotechnical report has been prepared for this site, (refer section 00 31 00).
B. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for the convenience of Contractor. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.
C. Locate existing underground utilities in the area of work. Provide adequate means of protection during earthwork operations. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

1.03 TESTING AND INSPECTION

A. Contractor to employ and pay for a qualified independent geotechnical testing laboratory to perform soil testing and inspection service during piering operations. It is recommended, but not required, to utilize same soils testing laboratory who prepare original geotechnical report.
B. Test and analysis of material will be performed in accordance with ANSI/ASTM standards and as recommended by qualified geotechnical testing laboratory.
C. Frequency of test: Shall be of sufficient number as recommended by geotechnical testing laboratory.
D. Pier soil conditions shall be approved by geotechnical engineer before steel and concrete placement begins.
E. Keep records showing depth to which each pier was placed and amount of material used in each pier.

1.04 SUBMITTALS

A. Submit for approval geotechnical test reports and site observations.
B. Submit for approval list of materials proposed for use.

1.05 QUALTIY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Construction Tolerances:
   1. Location, not more than L/24 of shaft diameter or 3-inches, whichever is less.

2. Shafts out of plumb, not more than 1.5% of length nor exceeding 12.5% of shaft diameter or 15%, whichever is less.
3. Concrete cut-off elevation, plus 1-inch to minus 3-inches.
4. Construction not meeting these requirements shall be rejected.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel: Conform to requirements of Section 03 30 00.
B. Concrete: Conform to requirements of Section 03 30 00.
C. Casings: Steel pipe, ASTM A 252, Grade 2 or ASTM A36.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Placement, Site Tolerances, Testing and Inspection:
   1. Placement: Refer structural drawings for location, size, reinforcing and depth of piers.
   2. Site Tolerances: Refer to QUALITY ASSURANCE this section.
   3. Testing and Inspection: Refer to TESTING AND INSPECTION this section.
B. Equipment: Drill pier holes with power auger foundation drilling rig especially designed for that purpose.
C. Placing Concrete:
   1. After pier holes have been drilled to proper depth and cutting edge of casing is seated if casings are necessary, pump all water out. Wherever water is present in pier holes, provide temporary castings and leave casings in place until concrete is poured in respective piers.
   2. Clean bottoms of pier excavations of loose material and foreign matter and receive approval of Geotechnical Engineer and Architect before allowing concrete to be placed.
   3. Block up reinforcement in concrete piers 3-inches from pier bottom and secure in place, free of contact with unformed sides. Provide steel dowels, as detailed or scheduled, in concrete piers.
   4. Place concrete in each pier hole within two hours after completion of drilling. Use tremie to place concrete and vibrate as required to fully embed reinforcing steel and eliminate voids but not so much as to separate aggregate. Pour concrete in piers up to one inch above soffit of deepest intersecting beam or column at least 24 hours before beginning to pour concrete for such beams or columns.
   5. Do not leave pier holes open overnight.
D. Casings:
   1. Casings will be required in event of excessive water or non-cohesive soils.
   2. Seat and seal casing bottom before removing water or completing drilling of hole to depth required and under-reaming.
   3. Withdraw casing in short lifts, making certain concrete is always well above bottom of casing to assure seal against water penetration or entry of loose soil.
   4. If seal is lost during withdraw of casing or if reinforcing is displaced, remove reinforcing immediately, drill out wet concrete, and re-case hole.
   5. If pier is lost entirely due to inability to remove concrete, steel, etc., cost to add additional piers, pier caps, etc., and cost to design replacement piers as well as necessary removal of portions of misplaced piers, shall be at no additional cost to Owner. Corrective work shall be as directed by Architect.
E. Casing Removal:
   1. Prior to breaking temporary casing seal, static head of plastic concrete shall be sufficiently above ground water head to prevent water and caving soils from

entering holes during casing removal. Once seals have been broken, temporary casings may be slowly removed vertically (no rotation permitted) while additional concrete is placed in casing tops.

END OF SECTION

SECTION 32 01 13

SLURRY SEALING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide slurry sealing over existing asphalt paving areas as indicated on drawings.
B. Provide striping for parking, roadway, fire lanes and handicapped markings as indicated on drawings.

1.02 SUBMITTALS

A. None required.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as noted or specified, or as accepted or directed by the Architect.
   1. ASTM C 131-89, "Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine".
   2. ASTM D 242-85, " Specifications for Mineral Filler for Bituminous Paving Mixtures".
   3. ASTM D 977-86, "Specifications for Emulsified Asphalt".
   4. ASTM D 2397-85, "Specifications for Cationic Emulsified Asphalt".
   5. Paint handicap spaces to conform to ADA, ANSI A117.1 and local code requirements.

1.04 PROJECT CONDITIONS

A. Weather limitations:
   1. Apply slurry sealant when ambient temperature is above 50° F, and when temperature has not been below 35° F for 12 hours immediately prior to application. Do not apply when existing paving is wet or contains an excess of moisture.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Design Requirements
   1. This specification shall meet requirements of International Slurry Seal Association, Type I.
B. Asphalt Emulsion
   1. Conform to requirements of ASTM D 977 or ASTM 2397.
   2. Minimum percent of emulsion to aggregate shall be 18 percent.
C. Aggregate
   1. Mineral aggregate consisting of natural or manufactured sand, slag, or combination thereof.
      a. Smooth textured sand of less than 1.25% water absorption shall not exceed 50% of total combined aggregate.

b. Material shall be clean and free from organic matter and other deleterious substances and show loss of not more than 35 when tested in accordance with ASTM C 131.
c. Mineral fillers shall meet requirements of ASTM D 242, and following gradation requirements:

1).	Sieve Size	% Passing by Weight
(a).	#4	100
(b).	#8	90 to 100
(c).	16	65 to 90
(d).	30	40 to 60
(e).	50	25 to 42
(f).	100	15 to 30
(g).	200	10 to 20

D. Water – Potable and free from harmful soluble salts.
E. Lane and Parking Area Marking Paint: Colors as indicated on drawings. Alkyd-resin type, ready-mixed, AASHTO M 248, Type I.

PART 3 – EXECUTION

3.01 PREPARATION

A. Immediately prior to applying slurry, clean surface of loose material, silt spots, vegetation, oil spots, and other objectionable material. Power brooms, power blowers, air compressors, water flushing equipment, and hand brooms shall be suitable for cleaning existing pavement.
B. Apply tack coat of one part emulsion, 3 parts water at rate of 0.05 to 0.10 gallons per sq. yd.

3.02 APPLICATION

A. Equipment, tools, and machines used in performance of work of this Section shall be maintained in satisfactory working order during performance of work of this Section.
   1. Slurry mixing machine shall be continuous flow mixing unit capable of delivering accurately predetermined proportion of aggregate, water, and asphalt emulsion to mixing chamber and to discharge thoroughly mixed production on continuous basis.
   2. Attach to mixer mechanical type squeegee distributor equipped with flexible material in contact with surface to prevent loss of slurry from distributor.
B. Surface may be pre-wetted by fogging ahead of slurry box providing no water is accumulated in front of slurry box.
C. Maintain adequate amounts of slurry in spreader to insure complete coverage. No lumping, balling, unmixed aggregate, or streaking due to oversize aggregate shall be permitted.
D. Use approved squeegees to spread slurry in areas not accessible to slurry mixer.
E. Apply at rate of 6 to 10 lbs. per sq. yd. based on dry aggregate weight.
F. Roll with 6 to 8 ton pneumatic tired roller with minimum contact pressure of 40 psi after emulsion has broken.
G. No unsightly joints or other visual imperfections are permitted on finished product.
H. Traffic and Lane Markings:
   1. Cleaning: Sweep and clean surface to eliminate loose material and dust.
   2. Striping: Use lane-marking paint, factory-mixed, quick-drying, and non-bleeding; yellow, blue, red, or white color as indicated on drawings or selected by Architect.

   3. Site Tolerances:
      a. General: Make lines parallel, evenly spaced, and with sharply defined edges.

b. Line Widths:
   1). Plus or minus ¼-inch variance on straight segments.
   2). Plus or minus ½-inch variance on curved alignments.
4. Do not apply traffic and lane marking paint until layout and placement has been verified by Architect.
5. Do not apply until slurry sealant has cured 72 hours minimum.
6. Apply paint with mechanical equipment to produce uniform 4" wide straight edges. Apply in 2 coats at manufacturer's recommended rates. Colors as indicated on drawings.

3.03 PROTECTION & CLEANING

A. Allow treated areas to cure 24 hours minimum before opening to traffic.
B. Remove drips, overspray, improper markings, and paint material tracked by traffic by sand blasting, wire brushing, or other method approved by Architect prior to performance.

END OF SECTION

SECTION 32 11 26

HOT-MIXED ASPHALT PAVING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide hot-mixed asphalt paving over prepared subbase where indicated:
   1. Parking areas.
   2. Driveways (Excluding drive aprons specified as concrete construction).
B. Provide striping for parking, roadway, fire lanes and handicapped markings as indicated on drawings.

1.02 SUBMITTALS

A. Submit for approval product data, test reports, certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Comply with State highway or transportation department standard specifications, latest edition, and with local governing regulations if more stringent than specified requirements.

1.04 LAYER DESIGN THICKNESS AND TOLERANCES

A. Provide prepared subgrade, granular base, bituminous base course and bituminous surface course as indicated on the Site Details Sheet. Subgrade shall meet the requirements of Section 31 00 00-Earthwork.
B. Construction Tolerances: Test finished surface of each course for smoothness using 10 foot straightedge, applied parallel with, and at right angles to centerline of paved area. Surfaces will not be accepted if exceeding the following tolerances and smoothness:
   1. Base Course Thickness: Within ½-inch.
   2. Surface Course Thickness: Within ¼-inch.
   3. Base Course Surface Smoothness: Within ¼-inch.
   4. Surface Course Surface Smoothness: Within 3/16-inch. No ponding acceptable.
   5. Crowned Surfaces: Within ¼ inch from template.

1.05 PROJECT CONDITIONS

A. Weather limitations:
   1. Apply prime and tack coats when ambient temperature is above 50° F, and when temperature has not been below 35° F for 12 hours immediately prior to application. Do not apply when base is wet, frozen or contains an excess of moisture.
   2. Base course mixtures shall not be placed when either the temperature of the surface on which the mixture is to be placed is below 40° F, on any wet or frozen

surface, or when weather conditions prevent the proper handling and finishing of the mixture.

3. Surface course mixtures shall not be placed when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 50° F, on any wet or frozen surface, or when weather conditions prevent the proper handling or finishing of the mixture.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Use locally available materials and gradations, which exhibit a satisfactory record of previous installations.
B. Base Course Aggregate: Sound, angular crushed stone, crushed gravel, or crushed slag, sand, stone or slag screenings.
C. Surface Course Aggregate: Crushed stone, crushed gravel, crushed slag, and sharp-edged natural sand.
D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.
E. Asphalt Cement: Comply with ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.
F. Prime Coat: Cut-back asphalt type; ASTM D 2027 MC-30, MD-70, or MC-250.
G. Tack Coat: Emulsified asphalt, ASTM D 977.
H. Herbicide Treatment: Commercial chemical for weed control registered by Environmental Protection Agency and acceptable to authorities having jurisdiction.
I. Lane and Parking Area Marking Paint, Colors as indicated on drawings: Alkyd-resin type, ready-mixed, AASHTO M 248, Type I.

2.02 ASPHALT-AGGREGATE MIXTURE

A. Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with ASTM D 3515, complying with local DOT and DPW regulations.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before applying prime coat. Proof roll prepared subbase surface to check for unstable areas and areas requiring additional compaction. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.
B. Prime Coat: Apply at the rate of 0.2 to 0.5 gallons per square yard over compacted subgrade. Apply material to penetrate seal, but not flood, surface. Cure and dry as long as necessary to obtain penetration and evaporation of volatiles.
C. Tack Coat: Apply to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.05 to 0.15 gallons per square yard of surface. Allow to dry until at proper condition to receive paving. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

3.02 APPLICATION

A. Placing Mix: Place asphalt concrete mix on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 275° F. Place inaccessible and small

areas by hand. Place each course to required grade, cross-section, and compacted thickness. Beginning of work means acceptance of subbase.

1. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Architect. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.
2. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

B. Rolling: Begin rolling when mixture will bear roller weight without excessive displacement. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
   1. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
   2. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
   3. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

C. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh hot asphalt concrete. Compact by rolling to maximum density and smoothness.

D. Protection: After final rolling, do not permit vehicular traffic on pavement until pavement has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

E. Traffic and Lane Markings:
   1. Cleaning: Sweep and clean surface to eliminate loose material and dust.
   2. Striping: Use lane-marking paint, factory-mixed, quick-drying, and non-bleeding; yellow or white color as indicated or selected by Architect.
   3. Do not apply traffic and lane marking paint until layout and placement has been verified by Architect.
   4. Apply paint with mechanical equipment to produce uniform 4" wide straight edges. Apply in 2 coats at manufacturer's recommended rates. Colors as indicated on drawings.

END OF SECTION

SECTION 32 30 00

SITE IMPROVEMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide the following site improvements where indicated on drawings:
   1. Bollards
   2. Fencing
   3. Dock bumpers
   4. Site Signage (Fire lane)
   5. Site signage (Handicapped accessible parking)
   6. Precast concrete parking bumper blocks
   7. Precast concrete downspout splash blocks

1.02 SUBMITTALS

A. None required for this section unless otherwise indicated.

1.03 QUALITY ASSURANCE

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

PART 2 – PRODUCTS

2.01 MATERIALS

A. Provide units specifically designed for exterior exposure and intended use:
   1. Bollards: Concrete-filled steel bollards.
      a. Concrete construction shall comply with Section 03 30 00.
      b. Steel construction shall comply with Section 05 50 00.
      c. Painting shall comply with Section 09 90 00.
   2. Site Signage: Handicapped accessible parking.
      a. Steel construction and fasteners shall comply with Section 05 50 00.
      b. Painting shall comply with Section 09 90 00.
      c. Signs: Type and model as shown on plans.
         1). Manufacturer: Best, Grimco, Seton or approved equal.
         2). Comply with ANSI, ADA, and local governing code.
            (a). Lettering, symbols, color, quantity, and mounting heights.
   3. Precast Concrete Parking Bumper Blocks:
      a. Concrete construction shall comply with Section 03 30 00.
         1). Concrete: 4000 psi, Type A.
         2). Reinforcement: (2) #4's continuous minimum.
      b. Steel construction shall comply with Section 05 50 00.
         1). Anchor with (2) #4 dowels per block.
      c. Size: length 6' –0", height 5", width: 9", with edges rounded with faces chamfered.
   4. Precast Concrete Downspout Splash Blocks
      a. Normal weight concrete construction.

b. Manufacturers standard precast size with channel design.
c. Slope for positive drainage away from building.

5. Fencing: CCA treated wood type with steel frame and accessories.
   a. Steel construction and fasterers shall comply with Section 05 50 00.
   b. Wood construction shall comply with Section 06 10 00.
   c. Accessories: Refer to drawings for model number.
      1). Gate hardware:
         (a). Manufacturer: Stanley or approved equal.
      2). Fencing Hardware:
         (a). Manufacturer: Simpson Strong Tie or approved equal.
6. Dock Bumpers and Steel Edge Angles: Type and model where shown on plans.
   a. Steel construction and fasteners shall comply with Section 05 50 00.
   b. Manufacturer: Durable Corporation or approved equal.
7. Site Signage: Fire lane. Type and model where shown on plans.
   a. Steel construction and fasteners shall comply with Section 05 50 00.
   b. Painting shall comply with Section 09 90 00.
   c. Signs: Type and model as shown on plans.
      1). Manufacturer: Best, Grimco, Seton or approved equal.
      2). Comply with ANSI, ADA, and local governing code.
         (a). Lettering, symbols, color, quantity, and mounting heights.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Restore damaged finishes and test for proper function. Clean and protect work from damage.

END OF SECTION

SECTION 03 32 23

CONCRETE SEGMENTAL RETAINING WALL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Provide concrete masonry unit segmental retaining wall system, complete.
   1. Work includes preparing foundation soil, furnishing and installing leveling pad, unit drainage fill and backfill to the lines and grades shown on the construction drawings.

   2. Work includes furnishing and installing geogrid soil reinforcement of the type, size, location, and lengths designated on the construction drawings.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Shop Drawings (Required for retaining walls exceeding 36” in height):
   1. Submit for approval shop drawings of retaining wall system design, including wall elevation views, geosynthetic reinforcement layout, pertinent details, and drainage provisions. The shop drawings shall be signed by a registered professional engineer licensed in the state of project location.

   2. Design Calculations: Engineering design calculations prepared in accordance with the NCMA Design Manual For Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, Section 5.8 (whichever is applicable). Analysis of global stability must be addressed and incorporated into the shop drawings.

C. Submit for approval samples, product data, warranty, test reports, maintenance data.
   1. Samples: Furnish one unit in the color and face pattern specified, if requested. Furnish 12 inch square or larger piece of the geosynthetic reinforcement specified.

   2. Test Reports: Submit a test report documenting strength of specific modular concrete unit and geogrid reinforcement connection. The maximum design tensile load of the geogrid shall be equal to the laboratory tested ultimate strength of geogrid/facing unit connection at a maximum normal force limited by the "Hinge Height" of the structure divided by a safety factor of 1.5. The connection strength evaluation shall be performed in accordance with NCMA test method SRWU-1.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Deliver, handle, store, and install materials in accordance with manufacturer's instructions. Use experienced installers certified by manufacturer and meeting governing regulation licensing requirements.
   1. Remove damaged or otherwise unsuitable material, when so determined, from the site.
   2. Exposed faces of concrete wall units shall be free of chips, cracks, stains, and other imperfections detracting from their appearance, when viewed from a distance of 10 feet.
   3. Prevent mud, wet cement, adhesives and similar materials which may harm appearance of units, from coming in contact with system components.

B. Comply with requirements of the following related Sections:
   1. Section 31 00 00 Earthwork for compaction, sampling, testing and quality control standards.

2. Section 03 30 00 Cast-In-Place Concrete for concrete mix design, sampling, testing and quality control standards.

C. Standards: Comply with the following.
1. ASTM C-1372 Specification for Segmental Retaining Wall Units
2. ASTM D-422 Particle Size Analysis
3. ASTM D-698 Laboratory Compaction Characteristics of Soil -Standard Effort
4. ASTM D-4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils
5. ASTM D-4595 Tensile Properties of Geotextiles - Wide Width Strip
6. ASTM D-5262 Unconfined Tension Creep Behavior of Geosynthetics
7. ASTM D-3034 Polyvinyl Chloride Pipe (PVC)
8. ASTM D-1248 Corrugated Plastic Pipe

D. Testing:
1. If a geotechnical analysis has been prepared for this site, (refer section 00 31 00). Follow geotechnical analysis recommendations.
2. Contractor to employ and pay for a qualified independent geotechnical testing laboratory to perform soil testing and inspection services during earthwork and retaining wall construction. It is recommended, but not required, to utilize same soils testing laboratory who prepared original geotechnical report.
3. Testing and inspection shall comply with Section 31 00 00 Earthwork. As a minimum, quality assurance testing shall include foundation soil inspection, soil and backfill testing, verification of design parameters, and observation of construction for general compliance with design drawings and specifications.

PART 2 – PRODUCTS

2.01MODULAR CONCRETE MASONRY UNIT RETAINING WALL UNITS

A. Manufacturers: Anchor Wall, Keystone Block, Stonewall Select, or approved equal. Modular concrete materials shall conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units

B. Modular concrete units shall conform to the following architectural requirements:
1. Color(s): To be selected by Architect from manufacturer’s standard samples.
2. Finish: Exposed vertical surfaces sculptured split face. Concealed and horizontal faces smooth unless otherwise indicated.
3. Unit Size: 6" (H) x 16" (W) x 12" (D) minimum in angular tri-planer configuration with an integral concrete shear connection flange/locator
4. Bond configuration - running with bonds nominally located at midpoint vertically adjacent units, in both straight and curved alignments.
5. Exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused lighting.

C. Modular concrete units shall conform to the following structural and geometric requirements measured in accordance with appropriate references:
1. Compressive strength = 3000 psi minimum;
2. Absorption = 8 % maximum (6% in northern states) for standard weight aggregates;
3. Dimensional tolerances = ± 1/8" from nominal unit dimensions not including rough split face, ±1/16" unit height - top and bottom planes;
4. Unit weight - 100 lbs/unit minimum for standard weight aggregates;
5. Inter-unit shear strength - 1500 plf minimum at 2 psi normal pressure;
6. Geogrid/unit peak connection strength -1000 plf minimum at 2 psi normal force.

D. Modular concrete units shall conform to the following constructability requirements:

1. Vertical setback = 1/8"± per course (near vertical) or 1"+ per course per the design; alignment and grid positioning mechanism - fiberglass pins, two per unit minimum; maximum horizontal gap between erected units shall be - 1/2 inch.

2.02 SHEAR CONNECTORS

A. Shear connectors shall be 1/2 inch diameter thermoset isopthalic polyester resin-pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units. Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10 degrees F to + 100 degrees F.

B. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

2.03 BASE LEVELING PAD MATERIAL

A. Material shall consist of a compacted crushed stone base or non-reinforced concrete as shown on the construction drawings.
   1. Aggregate Base: Crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

Sieve Size	Percent Passing
1 inch	100
No. 4	35 to 70
No. 40	10 to 35
No. 200	3 to 10

      Base Thickness: 6 inches (minimum compacted thickness).
   2. Concrete Base: Nonreinforced lean concrete base.
      a. Compressive Strength: 500 psi (maximum).
      b. Base Thickness: At least 2 inches, but not more than 3 inches.

2.04 UNIT DRAINAGE FILL

A. Drainage Aggregate: Clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	75 to 100
No. 4	0 to 60
No. 40	0 to 50
No. 200	0 to 5

B. One cubic foot, minimum, of drainage fill shall be used for each square foot of wall face. Drainage fill shall be placed within cores of, between, and behind units to meet this requirement.

2.05 REINFORCED BACKFILL

A. Backfill (Comply with geotechnical engineer's recommendations and Section 31 00 00 - Earthwork): Soil free of organics and debris and consisting of either GP, GW, SP, SW, or SM type, classified in accordance with ASTM D2487 and the USCS classification system.
   1. Soils classified as SC and CL are considered suitable soils for segmental retaining walls with a total height of less than 15 feet unless the Plasticity Index (PI) is 20 or more.
   2. Maximum particle size for backfill is 2 inches.
   3. Unsuitable soils are organic soils and those soils classified as CH, OH, MH, OL, or PT

B. The maximum aggregate size shall be limited to 3/4 inch unless field tests have been performed to evaluate potential strength reductions to the geogrid design due to damage during construction.

C. Material can be site excavated soils where the above requirements can be met. Unsuitable soils for backfill (high plastic clays or organic soils) shall not be used in the backfill or in the reinforced soil mass.

2.06 GEOGRID SOILD REINFORCEMENT

A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high density polyethylene. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 Meg/m and a carboxyl end group values less than 30. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking, and stripping.

B. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the "Hinge Height" divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with NCMA SRWU-1 Test Method for Determining Connection Strength of SRW.

2.07 ACCESSORIES

A. Drainage Pipe: If required, the drainage pipe shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D-3034 or corrugated HDPE pipe manufactured in accordance with ASTM D-1248. The pipe may be covered with a geotextile filter fabric to function as a filter.

B. Construction Adhesive: Exterior grade adhesive as recommended by the retaining wall unit manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION & PREPARATION

A. Examine the areas and conditions under which the retaining wall system is to be erected, and notify the Architect/Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Excavation support, if required, is the responsibility of the Contractor, including the stability of the excavation and it's influence on adjacent properties and structures.

3.02 EXCAVATION

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Owner's representative shall inspect the excavation and approve prior to placement of leveling material or fill soils. Proof roll foundation area as directed to determine if remedial work is required.

B. Over-excavation and replacement of unsuitable foundation soils and replacement with approved compacted fill will be compensated as agreed upon with the Owner. Over-excavation not approved by Architect/Engineer will not be paid for by the Owner.

Replacement of these soils with compacted fill and/or wall system components will be required at the Contractor's expense. Use care in excavating to prevent disturbance of the base beyond the lines shown.

3.03 BASE COURSE PREPARATION

A. Place base materials to the depths and widths shown on the Drawings, upon undisturbed soils, or foundation soils prepared in accordance with related sections.

B. Extend the leveling pad laterally at least 6 inches in front and behind the lowermost concrete retaining wall unit.

C. Provide aggregate base compacted to 6 inches thick (minimum).

D. The Contractor may at their option, provide a concrete leveling pad as specified in lieu of the aggregate base.

E. Where a reinforced footing is required by local code official, place footing below frost depth.

F. Compact aggregate base material to provide a level, hard surface on which to place the first course of units.

G. Prepare base materials to ensure complete contact with retaining wall units. Gaps are not allowed.

3.04 MODULAR UNIT INSTALLATION

A. First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated.

B. Place the front of units side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations.

C. Install shear/connecting devices per manufacturer's recommendations.

D. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.

E. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses.

3.05 STRUCTURAL GEOGRID INSTALLATION

A. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.

B. Geogrid reinforcement shall be placed at the strengths, lengths, and elevations shown on the construction design drawings or as directed by the Engineer.

C. The geogrid shall be laid horizontally on compacted backfill and attached to the modular wall units. Place the next course of modular concrete units over the geogrid. The geogrid shall be pulled taut, and anchored prior to backfill placement on the geogrid.

D. Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between

shorter pieces of geogrid or gaps between adjacent pieces of geogrid are not permitted.

3.06 BACKFILL PLACEMENT

A. Installation of backfill shall be per geotechnical engineer’s recommendations.

B. Place reinforced backfill, spread and compact in a manner that will minimize slack in the reinforcement.

C. Place fill within the reinforced zone and compact in lifts not exceeding 6 to 8 inches (loose thickness) where hand-operated compaction equipment is used, and not exceeding 12 inches (loose thickness) where heavy, self-propelled compaction equipment is used.

D. Only lightweight hand-operated compaction equipment is allowed within 4 feet of the back of the retaining wall units. If the specified compaction cannot be achieved within 4 feet of the back of the retaining wall units, replace the reinforced soil in this zone with drainage aggregate material.

E. Unless otherwise specified by project geotechnical engineer, provided the following minimum compaction requirements for fill placed in the reinforced zone.
   1. Walls Less Than 15 Feet High: Compact to 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)] for the entire wall height
   2. Walls 15 Feet High BUT NOT MORE THAN 30 Feet High: Change compaction requirements to 98 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)] for depths below 15 feet.
   3. Walls Over 30 Feet High: Change compaction requirements to 100 percent of the soil's standard Proctor maximum dry density (ASTM D698) for depths below 30 feet.
   4. Increase compaction requirements for retaining walls with slope heights at the back of the reinforced soil zone greater than 5 feet above the top of wall. Verify compaction requirements with Project geotechnical engineer.
   5. Utility Trench Backfill: Compact utility trench backfill in or below the reinforced soil zone to 98 percent of the soil's standard Proctor maximum dry density (ASTM D698), or as recommended by the Project geotechnical engineer. If the height from the utility to finish grade is higher than 30 feet, increase compaction to 100 percent of the standard Proctor density. Utilities must be properly designed (by others) to withstand all forces from the retaining wall units, reinforced soil mass, and surcharge loads, if any.
   6. Moisture Content: Within 2 percentage points of the optimum moisture content for all wall heights.

F. At the end of each day's operation, slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.

G. The General Contractor is responsible for ensuring that the finished site drainage is directed away from the retaining wall system. In addition, the General Contractor is responsible for ensuring that surface water runoff from adjacent construction areas is not allowed to enter the retaining wall area of the construction site.

3.07 CAP UNIT INSTALLATION

A. Apply adhesive to the top surface of the unit below and place the cap unit into desired position.

B. Cut cap units as necessary to obtain the proper fit.

C. Backfill and compact to top of cap unit .

3.08 SITE CONSTRUCTION TOLERANCES

A. Vertical Alignment: Plus or minus 1-1/2 inches over any 10-foot distance, with a maximum differential of 3 inches over the length of the wall.

B. Horizontal Location Control From Grading Plan:

1. Straight Lines: Plus or minus 1-1/2 inches over any 10-foot distance.
2. Corner and Radius Locations: Plus or minus 12 inches.
3. Curves and Serpentine Radii: Plus or minus 2 feet.

C. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter of the concrete retaining wall units.

D. Bulging: Plus or minus 1-1/4 inches over any 10-foot distance

3.09 ADJUSTING AND CLEANING

A. Replace damaged units with new units as the work progresses. Remove debris caused by wall construction and leave adjacent areas clean.

END OF SECTION

SECTION 32 80 00

IRRIGATION SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide irrigation system pipe, fittings, valves, sprinklers, backflow prevention, and automatic controls.
B. System design shown on drawings is schematic and approximate. Actual placement may vary slightly as required to achieve full, even coverage without spraying onto buildings, sidewalks, fences, etc.

1.02 SUBMITTALS

A. Submit for approval shop drawings, product data, warranty, test reports, maintenance data. Provide seal, signature, and date of authenticity of landscape architect or licensed irrigator in state of project location when required by local or state regulations.
B. Provide reduced copy of record drawings to half-size, color key circuits and sprinkler zones, and laminate both sides with 5 mil. thick or heavier plastic and mounted adjacent to controller.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Deliver, handle, store, and install materials in accordance with manufacturer's instructions.
B. Use experienced irrigators and installers certified by manufacturer and meeting governing regulation licensing requirements. Submit Certificates of State Registration when requested.
C. Water Conservation: Comply with governing codes and regulations.
D. Precipitation Rate: 0.35 minimum per hour for every hour that the system is in operation or as required for local precipitation zone recommendations, whichever is less.
E. Water Coverage:
    1. Turf Areas: As indicated on Drawings.
    2. Other Planting Areas: 100 percent.
F. Testing: Hydrostatic test at 50 psi and 50 gpm.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Rock-Free Soil:
    1. Backfill soil around PVC pipe.
    2. Soil having rocks no larger than ¼-inch in any direction.
B. Gravel:
    1. For use around drains.
    2. ½-inch to ¾-inch maximum round, water worn, washed rock.
C. Sand: Natural or crushed free of silt clay, loam, mica, friable or soluble materials, and organic matter.

D. Topsoil: Existing in place material. Remove rocks, roots, sticks, clods, debris, and other foreign matter over 1-1/2 inches longest dimension encountered during trenching.

2.02 COMPONENTS

A. Manufacturer: Rain Bird, Toro, or approved equal. System components shall be of single manufacturer. Conform to requirements shown on drawings for system type and model numbers.
B. Pipe, Pipe Fittings, and Connections:
    1. Pipe shall be continuous and permanently marked with Manufacturer's name, size, schedule, type, and working pressure.
    2. Pipe sizes shown on drawings are minimum. Larger sizes may be substituted without additional cost to Owner.
    3. Pipe:
        a. Pressure lines: ASTM D2241 schedule 40 PVC or ASTM D2239 160 psi polyethylene pipe.
        b. Lateral lines: Polyethylene flexible pipe ASTM D2239 rated at 100 psi or ASTM D2240 Class 200 PVC.
    4. Fittings:
        a. PVC ASTM D2241 schedule 40; schedule 80 PVC for threaded nipples.
    5. Sleeves:
        a. Under parking area and driveway paving: PVC plastic, ASTM D 1785, Schedule 40 pipe; ASTM D 2466, Schedule 40, PVC plastic socket-type pipefitting; solvent-cemented joints.
        b. All other: Class 200 PVC pipe.
        c. Sleeve diameter shall be double the nominal size of the irrigation pipe enclosed.
        d. Extend sleeves 18-inches minimum beyond walk or pavement edge.
C. Sprinkler heads:
    1. Conform to requirements shown on drawings as to type, size, and radius of throw, pressure, and discharge.
    2. Each type of head shall be product of single Manufacturer.
D. Sprinkler Risers:
    1. Rotor pop-up sprinkler or quick coupling valves shall have an adjustable riser assembly (three ell swing joint assembly) unless otherwise noted on drawings. Swing joint fittings shall be schedule 40 PVC plastic and nipples schedule 80 (gray) PVC unless otherwise designated on drawings.
        a. Horizontal nipple parallel to side of lateral line shall be 12" long minimum. All other nipples on swing joint riser shall be a length required for proper installation of sprinkler head.
    2. Stationary spray pop-up sprinkler heads, shrub spray heads, bubbler heads, and stationary spray sprinkler heads shall have risers made up of one of the following ways:
        a. 4-inch flex-riser #FR-100 connected directly to lateral tee with an appropriately sized schedule 40 PVC threaded ell and schedule 80 (gray) nipple.
        b. Three (3) schedule 40 street ells connected to lateral tee to form an adjustable riser or pop-up riser as detailed.
        c. Risers for sprinkler heads shall be 14-inch long minimum and 24-inch maximum.
            1). Rainbird swing pipe with spiral barb fittings and street ell as detailed.
            2). Toro "Funny Pipe".
        d. Equal as approved by Architect prior to bidding.
E. Automatic Sprinkler Control:
    1. Automatic Controller:
        a. Manufacturer: Rainbird "E" series or approved equal.

1). Indoor mounted with plug in 120 amp power, no battery required.
2). Three programs: Automatic, semi-automatic, and manual operation with timer.
3). Size station capacity to accommodate system indicated on drawings.

b. Accessories:
1). Rain sensor installed per Manufacturer's recommendations and at location indicated on drawings.
2). Rain freeze installed per Manufacturer's recommendations and at location indicated on drawings.

2. Control valves shall be of a size and type indicated on drawings.
3. Control wire shall be UF-UL listed, color-coded copper conductor direct burial size #14 minimum.
4. Waterproof
a. Manufacturers: DBY by 3M, SSC by Imperial, Gel Cap by Spears, or approved equal.
5. Run one extra control wire from panel continuously from valve throughout system similar to common wire for use if a wire fails. Wire shall be different color than all other wires, shall not be green, and shall be marked in control box as an extra wire.

F. Valves:
1. Electric valves shall be of a size and type indicated on drawings.
2. Quick coupling valve:
a. Brass one piece with locking top.
b. Provide one key with hose swivel.

G. Valve Accessories:
1. Valve Boxes:
a. Rectangular heavy duty.
b. Lock top or snap top lids.
c. Sizes large enough for easy removal or maintenance of valves.
d. Use extensions as required.
e. Manufacturers: Ametek, Brooks, or approved equal.

H. Backflow Preventors:
1. Continuous pressure-type vacuum breakers:
a. Manufacturers: Watts, Zurn, Febco, or approved equal. Size and model number indicated on drawings.
b. Locate riser portion of unit within planting bed or location to protect and conceal. Mount lowest point of unit discharge 12-inches minimum above grade.

I. Other Components:
1. Recommended by Manufacturer and subject to Architect's review and acceptance.
2. Provide components necessary to complete and make system operational.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Trenching & Backfilling:
1. Pulling of polyethylene pipe is permitted. Pulling of PVC pipe is not permitted.
2. Over-excavate trenches 2-inches and bring back to indicated depth by filling with fine, rock-free soil or sand.
3. Cover pipe, both top and sides, with 2-inches of rock-free soil or sand. In no case shall there be less than 2-inches of rock-free soil or sand surrounding pipe.
4. Perform balance of fill and compaction as specified in Section 31 00 00.

B. Sleeving:
1. Sleeve water lines and control wires under walks and paving.

2. Use one water pipe maximum per sleeve. Sleeve control wiring in separate sleeve.
3. Position sleeves with respect to buildings and other obstructions so pipe can be easily removed.
4. Over excavate and provide 4-inches compacted granular backfill on top, sides, and full depth of trench when beneath pavement or traffic areas.

C. Grades & Draining:
1. In areas where freezing may occur, grade piping so system can be completely drained.
   a. Slope pipe to drain to control valve box where possible.
   b. Where this is not possible, slope pipe to a minimum number of low points. At these low points, install:
      1). ¾-inch brass ball valve for manual drain.
      2). 2-inch Class 200 PVC pipe over top of manual drain and cut at finished grade.
      3). Provide rubber valve cap marker.
      4). Provide one cu. ft. gravel sump at outlet of each manual or automatic drain.
      5). Do not use automatic drain valves.
   c. Slope pipes under parking areas or driveways to drain outside these areas.
   d. Provide and install quick coupling valve or valves in location for easy blowout of entire system.

D. Pipe:
1. Install pipe in a manner to provide for expansion, contraction and as recommended by Manufacturer.
2. Unless otherwise indicated on drawings, install main lines with minimum cover of 18-inches below finished grade. Install lateral lines with minimum of 12-inches of cover below finished grade.
3. Install pipe and wires under driveways or parking areas in specified sleeves 18-inches minimum below finish grade unless otherwise indicated on drawings.
4. Locate no sprinkler head closer than 12-inches from building foundation. Heads immediately adjacent to walks or curbs shall be 1-inch minimum below top of walk or curb and have 1-inch minimum horizontal clearance between walk or curb.
5. Clean interior of all pipes, fittings, and joints prior to installation. Exclude entry of foreign material.
6. If pipe is larger than 2-inches, install concrete thrust blocks wherever change of direction occurs on PVC main pressure lines, unless otherwise indicated on drawings.

E. Control Valves & Controller
1. Install controller, control wires, and valves in accordance with Manufacturer's recommendations and according to electrical code.
2. Install valves in heavy-duty plastic boxes located flush with finish grade. Do not install more than two (2) valves in single box. Place 6-inches minimum of gravel below valve for drainage and maintain 4-inches between bottom of valve and top of gravel.
3. Install ¾-inch brass ball valve in valve box on downstream side of automatic valves if lateral line slopes toward valve box.
4. Tape control wiring to side of main line every 10 feet. Where control wire leaves main or lateral line, enclose in class 200 PVC conduit. Use waterproof wire and connectors at splices and locate all splices within valve boxes. Use white or gray color wire for common wire and other colors for all other wire. Each common wire may serve only one (1) controller.
5. Tie a 24-inch loop in all wiring at change of direction 30° or greater; untie after all connections have been made.
6. Sleeve below all hard surface elements with class 200 PVC twice the diameter of the wire bundled within.

F. Sprinkler Heads
   1. Prior to installation of sprinkler heads, open control valves and use full head of water to flush out system.
   2. Set sprinkler heads and quick-coupling valves perpendicular to finish grade.
   3. Maintain a 12-inch minimum distance from all property lines.

G. Site Test, Adjustment & Instruction
   1. Test pressure lines at line pressure and make certain there are no leaks before backfilling.
   2. Adjust heads to proper grade when turf is sufficiently established, such lowering or raising of heads shall be a part of the original contract with no additional cost to Owner.
   3. Adjust heads for proper distribution and trim so spray does not fall on building or adjacent property.
   4. Adjust water timing of valves to provide proper amounts of water to all plants.
   5. Instruct Owner's personnel in proper operation and maintenance procedures.

H. Protection & Cleaning
   1. Protect existing landscaping from damage. Repair and repave cut paving to match paving in original condition.
   2. Restore damaged components and test for proper operation. Clean out system and protect work from damage.

END OF SECTION

SECTION 32 90 00

LANDSCAPING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide landscape work where indicated on drawings:
   1. Trees, shrubs, plants, and ground cover.
   2. Finish grading and lawns.
   3. Topsoil and soil amendments.
   4. Initial maintenance of landscape materials.
   5. Pruning and relocation of existing plant materials.
   6. Reconditioning existing lawns.
   7. Slope protection, riprap stone, and erosion control matting.
B. Plant totals shown on plant list are for convenience of Contractor only and are not guaranteed. Verify amounts shown on drawings. All planting indicated on drawings are required unless otherwise noted.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.
B. Submit signed Landscape Turn Over form (ORL-S) prior to turnover to Owner for watering and maintenance.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Balled and Burlapped Plants and Trees: Graded to American Standard for Nursery Stock, ANSI Z60.1.
C. Testing: Laboratory testing for suitable soil amendments and fertilizer for plants provided.
D. Planting Season: Plant or install materials during normal planting seasons for each type of landscape material utilized. Correlate planting with specific maintenance periods to provide maintenance from date of substantial completion.

1.04 WARRANTY

A. Warrant trees and shrubs for a period of one (1) year after date of Substantial Completion, against defects including death and unsatisfactory growth and except for defects resulting from neglect by Owner, abuse by others, or natural phenomena. Replace unsatisfactory plant material at end of warranty period at no additional expense to the Owner. One replacement is required.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Plants
   1. Conform to requirements of plant list on drawings and to "Horticultural Standards" of American Association of Nurserymen as to kind, size, age, etc.

2. Nomenclature: Plant names used in plant list conform to 'Standard Plant Names" by American Joint Committee on Horticulture Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear a tag showing the genus, species, and variety of at least 10% of each species delivered to site.
3. Quality:
    a. Plants shall be sound, healthy, vigorous, free of plant disease, insect, pests or their eggs, noxious weeds, and have healthy, normal root systems. Container stock shall be well established and free of excessive root-bound conditions.
    b. Do not prune plants or top of trees prior to delivery.
    c. Plant materials shall be subject to approval by Architect as to size, health, quality, and character.
    d. Bare root trees are not acceptable.
    e. Provide plant material from a licensed nursery.
4. Measurements:
    a. Measure height and spread of specimen plant materials with branches in their normal position as indicated on drawings or plant list.
    b. Measurement should be average of plant, not greatest diameter.
    c. Plants properly trimmed and transplanted should measure same in every direction.
    d. Measure caliper of trees 6-inches above surface of ground.
    e. Where caliper or other dimensions of plant materials are omitted from plant list, plant materials shall be normal stock for type listed.
    f. Plant materials larger than those specified may be supplied with approval of Architect if:
        1). Compliance in all other respects.
        2). No additional cost to Owner.
        3. Size of roots or balls are increased proportionately.
5. Shape and Form:
    a. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in plant list.
    b. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3 height.

B. Lawns: (Hydroseed), fresh, clean, new crop seed mixture by approved method composed of Falcon Tall Fescue (75%) and Rebel Rye (25%) or Crossfire (25%) and degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp. Mixture shall be free from weeds or other foreign matter toxic to seed germination. Seed purity shall be 95% with a minimum 80% germination.
C. Lawns: (Sod), strongly rooted, 2 years old, ASPA approved, consisting of Falcon Tall Fescue (75%) and Rebel Rye (25%) or Crossfire (25%) cut with minimum ½-inch and maximum 1-inch topsoil base or approved equal.
D. Topsoil: From site stockpile or additional fertile, friable topsoil from local source. Material shall be reasonably free of subsoil, clay, lumps, brush, reproductive parts of noxious weeds, and other litter, and free of roots, stumps, sticks, and stones larger than 2" in any dimensions.
E. Planting Soil Mixture: Provide mixture in ratio of 3 parts topsoil, 1 part peat moss and 1 part sand. Add amendments as required.
F. Soil Amendments:
    1. Fertilizer, ten pounds of 13-13-13, non-burning fertilizer per 1000 square foot composed of not less than 50% organic slow acting guaranteed analysis fertilizer or approved equal.
    2. Rotted composted manure.
    3. Planting Tablets: 21 gram Agriform (20-10-5) or approved equal.
    4. Lime, peat moss, and other amendments as required for planting soil mixture.
G. Pre-Emergent Herbicide: Elanco XL, Ronstar, Surflan, or approved equal, complying with regulatory agency requirements.

H. Landscape Materials:
   1. Gravel: Water-worn creek gravel, 5/8" diameter, 3" deep, unless otherwise indicated on drawings.
   2. Filtration Fabric: Water permeable fiberglass or polypropylene fabric, 6 mil. thickness minimum.
   3. Tree Wrapping: Standard burlap, Heavy crepe paper, Tree wrap tape.
   4. Stakes and Guys:
      a. 2" x 2" x 10" new hardwood, treated softwood, or redwood, unless otherwise indicated on drawings.
      b. 16 ga. wire with new rubber hose or strap to protect tree.
   5. Vinyl Edging: 4" wide Hortiscape or approved equal; color black.
   6. Bark or Mulch:
      a. Straw, wood cellulose fiber, ground or shredded bark.
      b. 1-1/2" to 3" pine bark wood chips.
      c. Medium or large size redwood bark.
      d. Shredded pipe bark.
      e. Shredded cedar.
      f. Aged 1 year shredded hardwood.
   7. Riprap: 6"-12" diameter rock 18" thick over filter fabric.
   8. Erosion control matting:
      a. Nylon woven geomatrix: SC150 by North American, Green or approved equal.
      b. Nonwoven polyester geotextile: Akzo or approved equal.
      c. Polyvinyl chloride non-woven mat: Greenstreak or approved equal.

PART 3 – EXECUTION

3.01 LAWN PLANTING

A. For seeded lawns, apply seed at rate of 5 pounds per 1000 square feet. Apply erosion control matting over areas where slopes exceed 1:4 or in areas of concentrated storm water flow.
B. For lawns with sod, place sod tightly, with grain in same direction, joints staggered. Apply wood pegs composed of softwood of sufficient size and length to ensure anchorage at areas where slopes exceed 1:4 and at locations of concentrated water flow.

3.02 TREES AND SHRUB PLANTING

A. Loosen subgrade and spread planting mixture to minimum depth required to meet grades and elevations indicated. Excavate pits/beds/trenches for trees and shrubs. Excavate pits and vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil on sides and bottom of excavation.
B. Prepare topsoil by mixing fertilizer with loam. Apply fertilizer at a rate of 10 pounds of actual nitrogen per 1000 sq. ft. for plant beds and 2 pounds per inch of trunk for tree pits.
C. Install soil mix to a depth of 18" in plant beds.
D. Add planting tablets in plant pit as follows:
   1. 1 gallon shrub: 1 tablet.
   2. 5 gallon shrub/tree: 3 tablets.
   3. 15 gallon tree: 4 tablets.
   4. 24 inch box tree: 6 tablets.
E. Set trees and shrubs on compacted soil mixture in center of pit. Plant immediately after removing burlap, wrapping, or container. Adjust plant position and place backfill around base and sides, and work each layer to settle backfill and eliminate voids and air pockets.

F. Water thoroughly when excavation is 2/3 full. Place final backfill and water again. Dish top of backfill for mulch application, level backfill for rock type ground cover.
G. Install vinyl edging at locations indicated. Securely anchor or stake per manufacturer's recommendations.
H. Apply specified pre-emergent herbicide to shrub and ground cover planting areas per manufacturer's recommendations.
I. Install adjacent ground covering; refer drawings for types and location.
    1. In lawn areas: Provide 2-inch deep layer of bark or mulch in a 24-inch diameter around base of tree and rake to neat finish appearance.
    2. In gravel areas: Provide layer of filter fabric installed per manufacturer's recommendation and apply 3" deep layer of gravel raked to neat finish appearance.
J. Wrap new deciduous tree trunks neat and snug by applying 6 to 10 inch wide strips spirally from ground line to second finished branches. Hold in place with suitable non-plastic cord.
K. Stake, guy, and support as required.

3.03 CLEANUP, PROTECTION, AND MAINTENANCE

A. Keep pavements clean and work area in an orderly condition. Remove excess, waste material, trash and debris.
B. Replace damaged materials and dead or unhealthy plants prior to turnover to Owner. Maintain lawn areas by mowing, watering, fertilizing and applying weed killer in accordance with manufacturer's recommendations until date of substantial completion. Maintain trees and shrubs until date of substantial completion, but in no case less than 60 days after planting.
C. Correct areas of soil settlement.
D. Instruct Owner on proper maintenance procedures.

END OF SECTION

SECTION 33 00 00
SITE PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.
   3. Supplementary Conditions.
   4. Division 01, 01 11 00 – Summary of Work.

1.02 WORK INCLUDES

A. The basic materials used in the various piping and fluid conveying systems 5'-0" outside the building to the serving utilities point of connection (POC). Unless stated otherwise the following is required:
   1. Water System
   2. Fire Hydrants and Valves (if used)
   3. Sanitary Sewer System

B. Gas service, meter and regulator (if used) will be provided by the gas utility company.

C. Unless noted on the drawings otherwise, work shall include:
   1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
   2. All fees and direct expenses involved in any inspections required for the project.
   3. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
   4. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
   5. All lights, guards, and signs as required by safety regulations applicable to the work.
   6. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.

D. The work shall include revisions, modifications, and rework of existing work as required for installation of new work, and as required for connections of new work to existing systems, and of existing work to new systems.

1.03 RELATED WORK

A. Section 20 01 00 - "GENERAL PROVISIONS".
B. Section 20 03 00 - "MATERIALS AND METHODS".
C. Section 20 04 00 - "TESTING PIPING SYSTEMS"
D. Section 20 06 00- "MECHANICAL IDENTIFICATION
E. Section 21 13 13- "WET-PIPE SPRINKLER SYSTEMS"
F. Section 22 00 00- "PLUMBING"

1.04 SUBMITTALS

A. None required unless submitting for approved equals.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with current editions of following, as applicable:
   1. National Fuel Gas Code, NFPA 54.
   2. AWWA and ASTM standards.
   3. National Fire Protection Association NFPA 24.

1.06 PROTECTION OF EXISTING UTILITIES AND CONDITIONS

A. The existing utilities and conditions as encountered or as shown on the drawings shall be protected from damage during all construction including the excavation and backfilling of trenches, and, if damaged, shall be repaired by the Contractor at his expense.

1.07 PRODUCT DELIVERY STORAGE AND HANDLING

A. Follow manufacturer's directions in delivery, storage, protection and handling of all equipment and materials.
B. Deliver and store equipment and materials to the site in original containers, suitably sheltered from the elements and mechanical injury, but readily accessible for inspection until installed.
C. Plastic pipe and materials shall be stored under cover and protected from sunlight and heat.

1.08 INTERFERENCES

A. The Contractor shall confer with other Contractors at the site to avoid interferences. In the event that interferences develop, the Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced piping, valves, etc.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Valve and Valve Boxes
   1. Meuller.
B. Hydrants and Valves
   1. Mueller.
   2. American Foundry.
   3. Clow.
   4. Waterous/Traverse City.

2.02 PIPING MATERIALS AND APPLICATIONS

A. The following applications are for only from 5'-0" outside the building to the utility point of connection (POC).
B. Underground domestic water piping:
   1. ¾" - 1 ¼", Schedule 40 PVC pipe with solvent-welded joints.
   2. 1 ½" - 3", SDR-21, PVC pipe (ASTM D2241) Class 200, Bell and Spigot with rubber gasketed joints and matching fittings. Provide concrete blocking at all tees and elbows.
   3. 4" and larger, SDR-18 PVC pipe (AWWA C-900) Class 150 Bell and Spigot with rubber gasketed joints, and matching fittings. Provide concrete blocking at all tees and elbows.
C. Underground fire protection water piping:
   1. 3" and smaller polyvinyl chloride (PVC) pipe, class 200 bell and spigot with rubber sealing ring, (SDR-21, with matching fittings). Provide concrete blocking at all tees and elbows.
   2. 4" and larger polyvinyl chloride (PVC) pipe, class 150 bell and spigot with rubber sealing ring conforming to AWWA C900. Fittings shall be ductile-iron conforming to AWWA C111/A21.11 with non-toxic rubber gaskets. Provide concrete blocking at all tees and elbows.
   3. Ductile iron pipe, 150 psi working pressure, conforming to ANSI/AWWA C-151/A21.51 with mechanical joint fittings conforming to AWWA C-111/A21.11 with gasket material that is non-toxic, durable and impervious. Provide concrete blocking at all tees and elbows.
D. Sanitary Sewer Piping:
   1. Polyvinyl chloride (PVC) sewer pipe shall conform to ASTM D3034 (SDR-35). Fittings shall also conform to ASTM D3034 (SDR-35). Connections shall be molded tees and wyes. Joints shall be rubber gasketed.
   2. Cast iron or ductile iron pipe and fittings shall conform to USASI #A-21 class 50 with mechanical or push-on joints.

2.03 VALVES AND VALVE BOXES

A. Valves shall be AWWA iron body, bronze mounted, double disc, parallel seat, non-rising stem gate valves with a working pressure of 200 psi. Valves shall be furnished with end connections as required.
B. Valve boxes shall be cast iron, two-piece, slip or screw type.
C. Valve and boxes shall be as approved by the water department.

2.04 FIRE HYDRANTS

A. Fire hydrants shall be of the compression type with break flange and shall comply to AWWA Standard C-502. Hydrants shall be tested to 300 psi with a working pressure of 150 psi.
B. Hydrants nozzle arrangement shall be one 4" pumper nozzle and two, 2-1/2" hose nozzles equipped with caps and chains. Nozzle threads shall comply with the fire department standard.
C. Hydrant inlet shall be 6" with mechanical joint or flanged connection as required. Main valve shall be 5-1/4". Hydrants shall have conventional packing.
D. Install shutoff valve ahead of each hydrant with cast iron valve box. Valves shall be UL listed, 175 psi working pressure, iron body. Bronze mounted, non-rising stem.
E. Hydrants and valves are subject to approval by the local fire department.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILLING

A. General
   1. The underground pipe lines shall be constructed of the materials specified and as shown on the drawings or as directed by the Engineer. The pipe shall be laid true to lines and grades shown on the drawings using batten boards. All pipe which has its grade or joint disturbed or is found to be defective or damaged after laying shall be taken up and relaid or replaced as directed by the Engineer without additional charge. Trenches shall be kept free from water until pipe jointing material has set and pipe shall not be laid when the trench conditions or the weather is unsuitable for such work. At all times when work is not in progress, all open ends of pipe and fitting shall be securely closed to the satisfaction of the Engineer so that no trench water, earth or foreign substances will enter the pipe or fittings.
B. Excavation
   1. Perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings. Unless otherwise indicated on the drawings, the minimum cover over the top of the water lines shall be 3'-0". All excavation materials not required for fill or backfill shall be removed from the site, or utilized as directed by the Engineer. All excavation shall be made by open cut. The banks of trenches shall be kept as nearly vertical as practicable and where required, shall be properly sheeted and braced. Trenches shall be excavated true to line and shall not be less than 12" wider nor more than 16" wider than the outside diameter of the pipe to be laid therein. The maximum width of trench specified applies to the width at or below the level of the top of the pipe. The width of the trench above that level maybe made as wide as necessary for sheeting and bracing and the proper installation of the work. The bottom of trenches shall be accurately graded and shaped so that each section of pipe for at least one-third (1/3) of its exterior circumference and for its entire length shall rest firmly on undisturbed soil, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Provide a 4" sand or crushed rock base under all underground piping. Piping shall have 12" of sand or crushed rock cover properly compacted.
   2. Where rock, clay, hardpan, or similar formation is encountered, it shall be removed and replaced with suitably selected sand or crushed rock.
   3. See the applicable section of these specifications for contract payment provisions for removal of rock.
C. Drainage and Removal of Water
   1. The Contractor shall control the grades around all excavations so as to prevent water from running into the excavated areas or tunnels. Any water which accumulates in excavations or tunnels shall be removed promptly. Grading shall be brought to meet existing adjacent grade.
D. Bracing and Shoring
   1. This Contractor shall do all shoring and bracing necessary to retain earth banks and prevent caving in and displacement of adjacent soil, furnishing all necessary timbers, cribbing, planking or sheet piling for that purpose. Proper shoring for safety of working is the exclusive responsibility of the contractor.
E. Protection of Existing Utilities
   1. All existing utilities shall be protected from damage during the entire construction including the excavation and backfilling of trenches and, if damaged, shall be repaired by the Contractor at his expense.

F. Installation of Pipe
   1. Pipe lines shall be laid to the grades and alignment indicated on the drawings or as directed by the Engineer. All pipe lines shall be laid at a constant grade as required by code.
   2. Install piping in accordance with the following standards:
      a. Ductile - iron pipe - AWWA C600.
      b. Polyvinyl chloride - per manufacturers instructions
   3. Provide anchorage for tees, bends, valves, hydrants, etc. Thrust blocks shall be concrete, 2500 psi.

G. Backfilling
   1. The trenches shall not be backfilled until all required tests are performed and until the systems, as installed, conform to the requirements of the Specifications. After the trench bottom or bedding has been prepared and the pipe installed, sand or gravel at a moisture content which will facilitate compaction, shall be carefully placed alongside the pipe in layers not exceeding 6" in depth. Care shall be taken to insure thorough compaction of the fill. Each layer shall be thoroughly compacted to 95% proctor density by tamping.
   2. The remainder of the backfill under pavements, curbs, gutters, sidewalks, and driveways shall consist of sand, gravel, or crushed rock as approved by the Engineer. Rock, broken concrete or pavement, large boulders, and frozen earth shall not be used as backfill material.
   3. The Contractor shall be responsible for backfilling all ditches, trenches or excavation covered by this contract.

H. Replacement of Pavements, Walks, Curbs, and Lawn Areas.
   1. Pavements, walks, streets, curbs, and lawn areas which are cut or damaged during construction of the sewers, gas lines, water lines, etc. shall be replaced and restored to the original conditions by this Contractor.

3.02 LINES, GRADES, AND ELEVATIONS

A. Sewer lines, grades and elevations shall be laid out with a surveyor's transit and level to offset stakes set to one side of the trench. After the trench is excavated, these lines and grades shall be transferred to a string stretched between batter boards set at 50 ft. intervals across the trench. During the pipe laying, the line shall be determined by hanging a plumb bob from the grade string. The invert of each length of pipe shall be set to the proper elevation by measuring down from the string with a grade rod.

B. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bedding shall be required for all sewer construction, except ductile iron pipe, and shall be of a minimum thickness equal to 1/4 of the outside diameter of the sewer pipe but shall not be less than four inches (4").

C. Each section shall be unobstructed, smooth, straight, true, with uniform slope and compliance with this requirement shall be demonstrated to Engineer by arranging for visual inspection by him and by shining a light from one end of the section to the other end.

3.03 SEWER INSTALLATION

A. Take great care in working on existing sewers so as not to interrupt service to any existing building without permission.

B. Where sewer pipes do not rest on natural ground but cross building excavation, the pipes in this area shall be supported on 8" concrete block or 6" poured concrete walls which are built up from undisturbed ground.

C. Where branch sewers connect to main sewer, they shall drop at 22-1/2° or 45° and connect at 22-1/2° or 45°. 90° connections will not be permitted. Flow line of two sewers shall be continuous or shall drop in direction of flow.

3.04 FIELD QUALITY CONTROL

A. Water Line Testing: Before joints are painted or covered, test underground water lines to hydrostatic pressure of at least 150 lbs. psi. Leakage shall not exceed 200 gal. per inch of pipe diameter per mile per 24 hours. Contractor shall be responsible for discovering leaks and making necessary repairs.

B. Underground sewers shall be tested in one or more sections by closing outlets; extending connections to 4'-0" above grade; filling system to top of lowest extensions. Inward (from wet trench) or outward (to dry trench), infiltration shall not exceed 200 gallons per 24 hours per mile per inch diameter of pipe.

C. Leaks shall be repaired and tests repeated until leakage or infiltration is within above limits.
D. Substitution of air testing is not permitted.

3.05 CONTINUITY OF SERVICES (UTILITY OUTAGES)

A. All existing services must be kept in continuous operation with no interruption of services (sewer, water, gas, etc.). Contractor shall install temporary services as required to maintain this continuous operation and shall remove all temporary services when work is completed. Where interruptions are absolutely mandatory, they shall be kept to an absolute minimum and coordinated with Engineer.

3.06 EQUIPMENT INSTALLATION

A. All fire hydrants, valves, valve boxes, etc. shall be installed as detailed and per manufacturer's instructions and recommendations.

END OF SECTION 33 00 00

SECTION 33 40 00

STORM DRAINAGE SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide storm drainage systems where indicated.

1.02 SUBMITTALS

A. Submit for approval shop drawings, product data, test reports for the following items where indicated:
   1. Manholes and Catch Basins
   2. Steps
   3. Frames and Covers

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ASTM A 444-89, Specification for Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process for Culverts and Underdrains.
   2. ASTM C 76-90, Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   3. ASTM D 3034-89, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   4. AASHTO M-294, 12 to 36 inch pipe, Specification for Corrugated Polyethylene Pipe.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pipe and Fittings:
   1. Corrugated Metal Pipe (CMP):
      a. Meet requirements of ASTM A 444.
      b. 16 gauge, standard round, galvanized with 2 ounces zinc per square foot sheet metal.
      c. Corrugations:
         1). 6" to 10" pipe: 1-1/2" x ¼" depth helical corrugations.
         2). 12" to 60" pipe: 2-2/3" x ½" depth helical corrugations.
      d. Banded joints.
   2. Polyvinyl Chloride (PVC) Pipe & Fittings:
      a. Meet requirements of ASTM D 3034, SDR 35.
      b. Fittings: Slip joint with elastomeric seals.
   3. Acrylonitrile-Butadiene-Styrene (ABS) Pipe and Fittings:
      a. Meet requirements of ASTM D 2751.
      b. Solvent-cemented or gasketed joints.
   4. Reinforced Concrete Pipe (RCP) and Fittings:
      a. Meet requirements of ASTM C 76, Class III.

b. Tongue and groove mastic joints.

5. Elliptical reinforced concrete pipe:
   a. Meet requirements of ASTM 507.
   b. Tongue and groove mastic joint.
6. High density Polyethylene (HDPE) pipe & fittings:
   a. Meet requirements of ASTM 3350, AASHTO M 294.
   b. Silt tight joints ASTM 477.
7. Gaskets: Compatible with pipe materials joined.

B. Manholes and Catch Basins:
   1. Precast Concrete Manholes and Catch Basins: ASTM C 478 or ASTM C 858.
      a. Materials shall be in conformance with Section 03 30 00.
      b. Cones and sections shall be substantially free of gravel pockets.
      c. Joints between precast sections shall be designed for rubber gaskets, or bituminous material.
      d. Base sections shall be placed on a well graded 6" granular bedding course firmly tamped and level extending to the limits of the excavation assuring uniform contact and support of precast element.
      e. After placement and before damp proofing, the lift holes shall be completely filled with a non-shrink grout to provide a smooth exterior surface.
   2. Cast-In-Place Concrete Manholes and Catch Basins: 4000 psi.
      a. Materials shall be in conformance with Section 03 30 00.
      b. Monolithic concrete structures shall conform to detailed shop drawings submitted to the Engineer for approval prior to beginning work and shall conform to the dimensional requirements shown on the plans.
      c. Unless otherwise specified, cast-in-place bases shall be at least 12" in thickness and shall extend at least 12" radially outside of the outside dimension of the manhole or catch basin section.
   3. Protective Coatings: All concrete manholes and catch basins, precast or cast-in-place, shall be coated as follows:
      a. Internally: Two (2) coats Koppers Bituastic 300-M, Porter's No. 7080 Maxi-Build II, or approved, coal tar epoxy. Each coat shall provide not less than 10 mils dry thickness, to result in a total dry mil thickness of 20. Follow manufacturer's recommendations.
      b. Externally: Two (2) coats Tnemec 47-461 Asphalt Base Foundation Coating, or approved equal. Application shall produce as 8 mil dry film first coat and a 5.5 mil dry film second coat. Follow manufacturer's recommendations.
      c. Test may be requested by Engineer to demonstrate mil thickness and Holiday Detector Test compliance.
   4. Steps: Type and model as shown on plans.
      a. Steel reinforcing rods with load and pullout ratings meeting OSHA Standards, and conforming to ASTM C-478 or equivalent.
      b. Polypropylene coating shall conform to ASTM 2146-68 under Type II, Grade 16906.
      c. Steel reinforcing rods shall be ½" deformed reinforcing rod, Grade 60, conforming to ASTM A-615.
   5. Frames and Covers: Type and model as shown on plans with machined horizontal bearing surfaces.
      a. Gray iron conforming to requirements of ASTM A 48.
      b. Ductile iron conforming to requirements of ASTM A 536, Grade 60-40-18, heavy-duty ductile iron with lettering.
      c. Set unit in full mortar beds or bituminous mastic beds. Mortar shall be mixed in portion of one part cement to three parts sand, by volume, based on dry materials.
      d. Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary.

6. Poured Inverts: Poured inverts shall be made to conform accurately to the flow grade and shall be brought together smoothly with well rounded junctions, satisfactory to the Engineer, and in conformance with details shown on plans.

C. Outfalls for Storm Sewerage System: Cast-in-place reinforced concrete pipe, head wall apron, tapered sides, and rip rap systems as indicated on plans.
D. Trench Drains for Storm Sewerage System: Interlocking precast polymer concrete modular units with grates, channel caps, and related accessories.
E. Identification: Metallic-core plastic underground warning tapes.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
B. Earthwork shall comply with requirements of section 31 00 00.
C. All pipe and appurtenances shall be constructed at the location and elevations indicated on the plans or as established by the Engineer.
D. Prior to the construction of any storm drainage systems, the Contractor's shall place adequate line and grade stakes and shall also set stakes and furnish grades so that all structure tops can be set to finish grade as indicated.
E. Pipe connections: Special care shall be taken to see that the openings through which pipes enter the manhole structure are completely watertight. Those materials designed on plans as RCP type piping shall be required to be installed with closure pieces, four feet in length, at every manhole or catch basin, for all pipe entering or exiting.
F. Where connections are made to existing systems, rout out old drainage lines.
G. All newly constructed systems shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at time of final inspection.
H. Test for proper operation. Protect work from damage.

END OF SECTION

SECTION 33 50 00
GAS DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. AMERICAN GAS ASSOCIATION (AGA)
      a. AGA-01 - (1989) A.G.A. Plastic Pipe Manual for Gas Service
   2. AMERICAN PETROLEUM INSTITUTE (API)
      a. API Spec 5L - (1992) Line Pipe
   3. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
      a. ASTM D 2513 - (1991a) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
      b. ASTM D 2683 - (1990) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
      c. ASTM D 3261 - (1990) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
      d. ASTM D 3350 - (1984) Polyethylene Plastics Pipe and Fittings Materials
   4. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
      a. ASME-17 - (1992; Addenda Dec 1992) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
      b. ASME B16.21 - (1992) Nonmetallic Flat Gaskets for Pipe Flanges
      c. ASME B16.40 - (1985) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
      d. ASME B31.1 - (1992) Power Piping
      e. ASME B31.8 - (1989; B31.8a, B31.8b, B31.8c, Errata Jul 6, 1990 & Feb 28, 1991) Gas Transmission and Distribution Piping Systems
   5. FEDERAL SPECIFICATIONS (FS)
      a. FS L-C-530 - (Rev C) Coating, Pipe, Thermoplastic Resin
   6. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
      a. MSS SP-25 - (1978; R 1988) Standard Marking System for Valves, Fittings, Flanges and Unions
      b. MSS SP-84 - (1990) Valves - Socket Welding and Threaded Ends
   7. MILITARY SPECIFICATIONS (MS)
      a. MS MIL-T-27730 - (Rev A) Tape, Antiseize, Polytetrafluoroethylene, with Dispenser
   8. NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)
      a. NACE RP0274 - (1974) High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
   9. STEEL STRUCTURES PAINTING COUNCIL (SSPC)
      a. SSPC SP 6 - (1991) Commercial Blast Cleaning
   10. UNDERWRITERS LABORATORIES (UL)
      a. UL-06 - (1992) Gas and Oil Equipment Directory

1.02 GENERAL REQUIREMENTS

A. Piping: Piping shall be joined by performance qualified joiners using qualified procedures in accordance with AGA-01. Manufacturer's prequalified joining procedures shall be used. All joints shall be inspected by a qualified inspector in the joining procedures being used in accordance with AGA-01. Joiners and inspectors shall be qualified at the job site by a person who has been trained and certified by the manufacturer of the pipe to train and qualify joiners and inspectors in each joining procedure to be used on the job. Training will include use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in AGA-01. The Contractor shall submit a copy of the training procedure and qualification of the trainer for approval of the Engineer. The Engineer shall be notified at least 24 hours in advance of the date to qualify

joiners and inspectors. The Contractor shall provide the Engineer a copy report of each inspector's and joiner's training and test results.

B. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Equipment shall be supported by a service organization that is, in the opinion of the Engineer, reasonably convenient to the site. Valves, flanges, and fittings shall be marked in accordance with MSS SP-25.

C. The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Engineer of any discrepancy before performing the work.

D. When shipping, delivering, and installing, pipe and components shall be handled carefully to ensure a sound, undamaged condition. Particular care shall be taken not to damage pipe coating. No pipe or material of any kind shall be placed inside another pipe or fitting after the coating has been applied, except as specified in paragraph INSTALLATION. Plastic pipe shall be handled in conformance with AGA-01.

E. Hot tapping of existing mains shall be performed by a contracting firm or utility company experienced and qualified to do such work and with at least 5 years experience in the successful performance of such work. The Contractor(s) or utility company performing hot taps and squeeze-off of existing utility lines shall accomplish the taps, plugging, and squeeze-off operations using equipment specifically designed for such purposes and approved by the Engineer prior to the performance of any such work.

1.03 SUBMITTALS

A. Follow the procedures specified in Division 01, 01 33 00 Section "SUBMITTALS."

PART 2 - PRODUCTS

2.01 PIPE, FITTINGS, AND ASSOCIATED MATERIALS

A. Polyethylene Pipe, Tubing, Fittings and Joints
   1. Polyethylene pipe, tubing, fittings and joints shall conform to ASTM D 3350 and ASTM D 2513, pipe designations PE 2406 and PE 3408, rated SDR 26 or less, as specified in ASME B31.8. Pipe sections shall be marked as required by ASTM D 2513. Butt fittings shall conform to ASTM D 3261 and socket fittings shall conform to ASTM D 2683. Fittings shall match the service rating of the pipe.

B. Identification: Provide pipe flow markings and metal tags for each valve, meter, and regulator shall be provided as required by the Engineer.

C. Insulating Joint Materials: Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrolytic action. Joints for threaded pipe shall be steel body nut type dielectric type unions with insulating gaskets. Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.

D. Gas transition fittings shall be manufactured steel fittings approved for jointing steel and polyethylene pipe. Approved transition fittings are those that conform to AGA-01 requirements for transition fittings.

E. Valves shall be suitable for shutoff or isolation service and shall conform to the following:
   1. Steel Valves (For above Grade Only on Meter Riser): Steel valves 1-1/2 inches and smaller installed aboveground shall conform to MSS SP-84, carbon steel, socket weld or threaded ends with handwheel or wrench operator.
   2. Polyethylene valves for underground installation only, shall conform to ASME B16.40. Polyethylene valves in sizes 1/2-inch to 6 inches shall be used with polyethylene distribution and service lines.

F. Protective Covering Materials: Continuously extruded polyethylene and adhesive coating system materials shall conform to FS L-C-530, Part (3).

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILLING

A. Earthwork shall be as specified in Section 31 -"EARTHWORK".

3.02 PIPE FOR GAS MAINS

A. All pipe for gas mains shall be orange or yellow colored polyethylene. Steel fittings at hot taps shall be coated with protective covering as specified. Plastic mains shall not be installed aboveground.

3.03 SERVICE LINES

A. Service lines shall be constructed of materials specified for gas mains and shall extend from a gas main to and including the point of delivery within 5 feet of the building. The point of delivery is the meter set assembly. The service lines shall be connected to the gas mains as indicated. Service line shall be provided with an isolation valve of the same size as the service line. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few joints as practicable using standard lengths of pipe. Shorter lengths shall be used only for closures. Plastic service lines shall not be installed aboveground.

3.04 PIPE, TUBING, AND FITTINGS

A. Pipe, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in pipe or tubing or fittings shall not be repaired. When defective pipe, tubing, or fittings are located in a system, the defective material shall be replaced.

3.05 PROTECTIVE COVERING FOR UNDERGROUND STEEL FITTINGS

A. Except as otherwise specified, protective coverings shall be applied mechanically in a factory or field plant especially equipped for the purpose. Fittings that cannot be coated and wrapped mechanically shall have the protective covering applied by hand, preferably at the plant that applies the covering to the pipe. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in thickness to that of the covering applied mechanically. The coatings shall consist of one of the following:
   1. Thermoplastic Resin Coating System: The coating system shall conform to FS L-C-530, Part (3). The exterior of the pipe shall be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6. Adhesive compound shall be applied to the pipe. Immediately after the adhesive is applied, a seamless tube of polyethylene shall be extruded over the adhesive to produce a bonded seamless coating. The nominal thickness of the pipe coating system shall be 10 mils (plus or minus 10 percent) of adhesive and 40 mils (plus or minus 10 percent) of polyethylene for pipes 2 through 16 inches in diameter. Joint coating field repair material shall be applied as recommended by the manufacturer and shall be one of the following:
      a. Heat shrinkable polyethylene sleeves.
      b. Polyvinyl chloride pressure-sensitive adhesive tape.
      c. High density polyethylene/bituminous rubber compound tape.
   2. The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

3.06 INSTALLATION

A. Installation of the gas distribution system, including all equipment, shall be in conformance with the manufacturer's recommendations and applicable sections of ASME B31.8 and with AGA-01. Abandoning existing gas piping shall be done in accordance with ASME B31.8. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. Cutting of plastic pipe shall be in accordance with AGA-01. Valve installation in plastic pipe shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from any other stresses which may be exerted through the valve or valve box.

B. Installing Pipe Underground: Gas mains and service lines shall be graded as indicated. Mains shall have 24-inch minimum cover, service lines shall have 18-inch minimum cover, and both mains and service lines shall be placed on firmly compacted select material for the full length. Trench shall be excavated below pipe grade,

bedded with bank sand, and compacted to provide full-length bearing. Laying the pipe on blocks to produce uniform grade will not be permitted. The pipe shall be clean inside before it is lowered into the trench and shall be kept free of water, soil, and all other foreign matter that might damage or obstruct the operation of the valves, regulators, meters, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other suitable means. Minor changes in line or gradient of pipe that can be accomplished through the natural flexibility of the pipe material without producing permanent deformation and without overstressing joints may be made when approved. Changes in line or gradient that exceed the limitations specified shall be made with fittings specified. When polyethylene piping is installed underground, foil backed magnetic tape shall be placed above the pipe to permit locating with a magnetic detector. After laying of pipe and testing, trench shall be backfilled to 12 inches over pipe with compacted bank sand. Remaining backfill is to be select soil compacted in 8-inch layers to finish grade.

C. Where "squeeze-off" of existing polyethylene piping is permitted for temporary shut off during connection of mains or branches, a "squeeze-off" tool specifically designed for the pipe size and material encountered shall be used. After squeeze-off operation is complete, a rerounding support clamp shall be applied to reduce pipe stress. Rerounding support clamp shall be constructed of 2306 polyethylene material.

3.07 PIPE JOINTS

A. Pipe joints shall be designed and installed to effectively sustain the longitudinal pullout forces caused by the contraction of piping or superimposed loads.

B. Polyethylene Pipe Jointing Procedures: Jointing procedures shall conform to AGA-01. Indiscriminate heat fusion joining of plastic pipe or fittings made from different polyethylene resins by classification or by manufacturer shall be avoided if other alternative joining procedures are available. If heat fusion joining of dissimilar polyethylenes is required, special procedures are required. The method of heat fusion joining dissimilar polyethylenes resins shall be tested in accordance with paragraph TESTING, subparagraph Destructive Tests of Plastic Pipe Joints.

1. Personnel which perform joining procedures for polyethylene pipe shall meet the following qualifications prior to commencing work:
   a. Performed joining of piping on at least one project using piping of the same type and size as to be installed under this contract.
   b. Attend a qualification training course, after contract award, conducted by the manufacture of the pipe installed under this contract. The training shall be a minimum of 8 hours and cover as a minimum the items set forth in the AGA plastic pipe manual. Equipment used for training shall be of the same manufacture as that to be utilized on this project.
2. The Contractor Quality Control representative shall attend the same training as that required for the personnel performing the joining procedure.
3. Testing: Instruments which must be available at the project site:
   a. Thermometer
   b. Anemometer
   c. Pyrometer (or temperature crayons)
4. Verification of Joining Procedure: Each morning, prior to commencing work, a joint of each size and type to be installed during that day shall be made.
   a. Three coupons from each joint shall be taken at 120 degrees apart.
   b. Each coupon shall be checked for alignment and subjected to a bend test.
   c. Coupons shall be identified and retained.
   d. Should the ambient temperature change by more than 20 degrees F or wind velocity increases by more than 10 MPH when ambient temperature is below 50 degrees F, the joining procedures to be used for the remainder of the day will be retested.
5. Recording Test Data: The following items where applicable, shall be recorded each day of installing pipe. (Complete the attached sheet titled "TEST DATA RECORD FOR P-E PIPE.")
   a. Manufacture of Equipment
   b. Operating pressures
   c. Heating iron temperatures
   d. Ambient conditions
   e. Coupon Data

f. Installer and CQC signature block

C. Connections Between Metallic and Plastic Piping: Connections shall be made only outside, underground, and with approved transition fittings.

3.08 VALVE BOXES

A. Valve boxes of cast iron not less than 3/16-inch thick shall be installed at each underground valve. Valve boxes shall be provided with locking covers that require a special wrench for removal. Wrench shall be furnished for each box. The word "gas" shall be cast in the box cover. When the valve is located in a roadway, the valve box shall be protected against movement by a suitable concrete slab at least 3 square feet. When in a sidewalk, the top of the box shall be in a concrete slab 2 feet square and set flush with the sidewalk. Boxes shall be adjustable extension type with screw or slide-type adjustments. Valve boxes shall be separately supported, not resting on the pipe, so that no traffic loads can be transmitted to the pipe.

3.09 CONNECTIONS TO EXISTING LINES

A. Connections between new work and existing gas lines, where required, shall be made in accordance with ASME B31.8 using proper fittings to suit the actual conditions. When connections are made by tapping into a gas main, the connecting fittings shall be the same size as the pipe being connected. The Contractor shall provide all materials for the connections to the existing gas lines, and shall make final connections in accordance with approved procedures. The Contractor's Connection and Abandonment Plan shall be submitted and approved prior to making any connections to existing gas lines. The Contractor shall notify, in writing, the Engineer 10 days before connections to existing lines are to be made. All above-grade valves, risers, and vault and valve box covers shall be removed. Vault and valve box voids shall be filled with suitable compacted backfill material. Deactivation of any portion of the existing system shall only be done as directed by the Engineer. Reactivation of any existing gas lines will only be done by the Government.

3.10 PRESSURE AND LEAK TESTS

A. The system of gas mains and service lines shall be tested after construction and before being placed in service using air as the test medium. The test pressure shall be 150 percent of the maximum operating pressure or 50 psig, whichever is greater. However, the maximum test pressure shall not be more than three times the design pressure of the pipe. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials. All testing of gas mains and service lines shall be done with due regard for the safety of employees and the public during the test. Suitable steps shall be taken to keep persons not working on the test operations out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling, when trenches containing the sections must be backfilled before the completion of other pipeline sections. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T(1)P(2)=T(2)P(1)$, in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Engineer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

3.11 TEST DATA RECORD FOR P-E PIPE

Project Name:_____
Address:_____
City, State, Zip:_____

1. DATE _____ TIME _____

2. FUSION EQUIPMENT

   Manufacturer _____ Model _____

   Design Pressure _____ Design Iron Temp _____

   Actual Pressure (a) _____ Actual Iron Temp (b) ____

   (a) Pressure gauge calibrated date: _____

   (b) Method of determining iron temperature: _____

3. WEATHER CONDITIONS

   Ambient Temperature _____

   Wind Velocity _____

   Weather Condition (ie - clear, dry, etc) _____

4. TEST COUPON DATA (mark and return coupons)

Bend Test	Alignment	Bead Size

5. TEST AUTHENTICATION (signature)

   Equipment Operator _____

   CQC Representative _____

   QA Representative _____

END OF SECTION 33 50 00