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### Division 1  General Requirements

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PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be done under this Contract shall be completed in a workmanlike manner, to the satisfaction of the Architect/Engineer, of the Work as shown, documented, and set forth in the Contract Documents. If these documents or job conditions make it impossible to produce first class work or to warranty the work or its performance, or should discrepancies appear among the Contract Documents, request interpretation, correction or clarification from the Architect/Engineer prior to beginning construction. If the Contractor fails to make such request, work must be performed in a satisfactory manner and no request for added cost extension of time will be considered. Should conflict occur in or between Drawings and Specifications, Contractor is deemed to have estimated on the more expensive way of doing work unless the Contractor shall have asked for and obtained written decision before submission of Bid as to which method or materials will be required.

B. Contractor represents full understanding the nature and extent of the Work, all factors and conditions affecting or which may be affected by it and characteristics of its various parts and elements and their fitting together and functioning.

1.02 BID PACKAGE PURPOSE AND REQUIREMENTS

A. Bid Package 01: for WDEP Item 1 Steam Turbine Generator complete with controls, accessories, fire suppression system, turbine enclosure, steam surface condenser, and Item 2 WDEP Cooling Tower.

1. To bid, award, and furnish steam turbine generator with controls, fire suppression system and turbine enclosure, condenser, and cooling tower.

B. Bid Package 02: Phase 1 Distribution Package

1. To bid, award, and construct the distribution piping, to the Kittredge area, the area west of C4C and 18th street.

C. Bid Package 03: EDEP Site, Footing and Foundation

1. To bid, award, and construct the building retaining walls, concrete foundations (including caissons), grade beams, ground level 1 floor slabs...

D. Bid Package 04: Balance of EDEP

1. To bid, award, and furnish plant equipment, construct the EDEP building including, but not limited to, Concrete structure, MEP sitework, landscaping and tenant finishes.

E. Bid Package 05: Phase 2 Distribution

1. Balance of distribution, including the area from EDEP to C4C, the area from C4C to Wardenburg.
F. Bid Package 06 – WDEP

1. Installation of the steam turbine generator, condenser, cooling tower, chillers and all associated piping, wiring, and controls.

1.03 SITE CONDITIONS

A. Site Investigation: The Contractor acknowledges satisfaction as to the nature and location of the Work, Soils Report, the general and local conditions, particularly those bearing upon availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, power, and uncertainties of weather, or similar physical conditions at the site, the conformation and conditions of the ground, the character or equipment and facilities needed preliminary to and during work, and all other matters that can in any way affect the work or the cost thereof under this contract.

1.04 PROJECT DESCRIPTION

A. Briefly and without force and effect upon the Contract Documents, the Work of the Contract can be summarized as follows:

B. Project Identification: The University of Colorado at Boulder’s Campus Utility System, consisting of new East District Energy Plant (EDEP), upgrade of the West District Energy Plant (WDEP) located at 100 S 18th Street, and installation of interconnecting distribution piping between the two plants and to other zones. The new EDEP facility is to be constructed on a site of approximately 7.5 acres located NW of the Coors Event Center, 980 Regent Drive in Boulder, Colorado.

C. Approximate Gross Floor Area: The EDEP Building is approximately 52,000 gross square feet.

1. Stories: Four (4) stories.
2. Occupancy: III
3. Construction Type: IIA
5. Foundations: Concrete Grade Beam with Concrete Caissons.
7. Walls: Stone Veneer on Metal Studs or Concrete Wall dependent upon location.
8. Roof: Clay Tile on Metal Decking or Single-Ply EPDM dependent upon location.

D. West District Energy Plant (WDEP): The WDEP work consists of the replacement of three absorption chillers with new electric driven chillers. New Chilled water pumps will be installed to replace the existing chilled water pumps. The existing back pressure steam turbine will be replaced with a new extraction condensing steam turbine. A new cooling tower with pumps will be associated with the steam turbine and condenser system. New electrical gear will be installed to provide power for the new motor driven equipment.

E. Distribution System: New distribution steam, condensate and chilled water piping will be installed to connect the new equipment into the existing distribution system and to connect the two plants into the existing system.
1.05 WORK COVERED BY CONTRACT DOCUMENTS

A. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents, reasonable inferable from them and reasonably foreseeable, using the means, methods and procedures necessary to produce the intended results. In the event of question or ambiguity, request clarification from the Architect/Engineer.

1. Work not particularly detailed, noted, or specified, shall be the same as similar parts that are detailed, noted or specified.

2. In the event of inconsistencies among the Contract Documents, the Architect/Engineer shall interpret them when asked to do so by the Owner or Contractor. The Architect/Engineer shall not be responsible for the results of such interpretations made by others.

3. The general character of detail work is shown on the Contract Drawings, but subsequent clarifications may be made by additional layouts or large scale or full size details.

4. When the Architect/Engineer furnishes miscellaneous large scale and full size details, to further clarify the Work, such details shall be considered a part of the Contract.

5. Drawing and diagrams for mechanical and electrical work shall be considered as diagrammatic only, not to be used for any structural guidance or physical layout. In case of conflict, and unless otherwise noted, the Architect/Engineer’s Drawings showing locations for mechanical and electrical items such as sprinkler heads; supply, return or exhaust grilles; electrical fixtures, and similar appurtenances shall take precedence.

6. Unless specifically noted to the contrary, it is the intention of the Drawings and Specifications that all Work, equipment, casework, mechanical, electrical and similar devices of whatever nature, be completely installed, hooked-up, made operational and made functional for the purposes such are intended, and that all costs therefore be included in the Contractor’s Proposal.

B. Titles and headings to Divisions, Sections, and Paragraphs in these Specifications are introduced for convenience and shall not be taken as a correct or complete segregation of the several units of materials and labor. No responsibility, direct or implied, is assumed by the Architect/Engineer or Owner for omissions or duplications by the Contractor or Subcontractors, due to real or alleged error in arrangement of matter in the Contract Documents.

C. Items listed under “WORK INCLUDED” or “RELATED WORK” for each Section of the Specifications are not necessarily all inclusive but listed for convenience. The Contractor shall be responsible for the complete work as shown or indicated by the Contract Documents.

D. Drawings contain General Notes on the Title Sheet which also describe requirements for the use of the documents as well as requirements for performing this work.
1.06 SPECIAL REQUIREMENTS

A. Owner-Furnished and Installed Equipment:

1. The Owner may furnish certain items as listed on the Responsibility List. Contractor will be responsible for coordinating work to accommodate these items including, but not limited to, physical space fit, utility connections and rough-in, power wiring and electrical characteristics.

2. Contractor will schedule the latest times when information, especially physical dimension, piping, electrical rough-ins, for such items is required and so notify the Owner in writing.

B. Owner-Furnished, Contractor-Installed Equipment:

1. The Owner will furnish certain items delivered to the jobsite as listed on the Responsibility List. Contractor will receive, unload, move, set in position, anchor and connect such items and put them into operating condition.

2. Contractor will be responsible for coordinating work to accommodate these items including, but not limited to, physical space fit, utility connections and rough-in, power wiring and electrical characteristics.

3. Contractor will schedule the latest times when information for such items is required and so notify the Owner in writing. The Contractor will cooperate with the Owner in scheduling the delivery of these items and be responsible for accommodating their storage and protection in the building and their replacement or repair due to damage as a result of Contractor’s operations.

1.07 OCCUPANCY

A. Occupancy for Equipment Installation: Owner or separate contractors will be afforded access to spaces in the building in order to install equipment in such areas provided those areas or appropriate portion thereof are enclosed, roofed, and ready to receive such equipment. The Contractor shall cooperate with such installers or contractors to the fullest extent possible without delaying overall completion schedule.

1.08 ADVERTISING

A. Contractor and Subcontractors, dealers, suppliers, manufacturers or agents shall not use their dealing with the Owner in any promotion, advertising, selling campaign, or other similar endeavor without obtaining their express written permission.

PART 2 - MATERIALS  (Not Applicable)

PART 3 - EXECUTION

3.01 CONTRACTOR’S DUTIES

A. Except as otherwise specified, furnish the following to the full extent required by the Contract.

1. Labor, superintendence, and products.
2. Construction equipment, tools, machinery, and materials.
3. Utilities required for construction and related activities.
4. Other facilities and services necessary to properly execute and complete the work, including security for Worksite and storage and protection of all materials awaiting incorporation into the Work.

END OF SECTION 00 11 10A
SECTION 00 11 10B – SUMMARY OF WORK (PART B)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:
   2. Contractors.
   3. Job conditions.
   4. Protection of work and adjacent property.
   5. Access to site.
   6. Owner-furnished products.
   7. Coordination with occupants.
   8. Construction and sequence scheduling.

B. Related Section: Division 1 Section "Temporary Facilities and Controls" for limitations and
   procedures governing temporary use of Owner's facilities.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. Work covered: Work under this contract includes all materials, equipment and labor
   necessary to complete the work indicated on the drawings, described in specifications,
   addenda or reasonably inferred.

1.04 CONTRACTORS

A. Work will be executed under one prime construction contract between the Owner and the
   CMGC.

1. Except as indicated otherwise, all work under this contract will be under the direction
   of the CMGC.

a. Materials Testing will be performed by, who will provide material testing for the
   contractor. is contracted by the University of Colorado at Boulder.

1.05 JOB CONDITIONS

A. Areas of the building immediately adjacent to areas under construction will be occupied by
   the public during the work of this project. Conduct the work of this project in a manner that
   will minimize disruption of the Owner's occupancy of adjacent areas.

B. Do not interrupt building access and use, except as permitted by the Owner.
C. Provide seven (7) working days notice to the Owner of construction activities which will severely impact the occupancy and use of adjacent areas.

D. Provide temporary barriers and/or partitions as required to protect the occupants of the building and the general public from injury due to the work of this project; and/or to protect adjacent areas of the building from the spread of dust and dirt caused by the work or this project.

1. Remove temporary barriers and partitions upon completion of the Project. Temporary partitions shall be constructed of 1/2 inch plywood on the construction face nominal 2" X 4" wood studs and 1/2 inch gypsum wallboard on the public occupied face.

E. Do not interrupt power, lighting, plumbing, telephone and HVAC services to occupied areas without Owner's approval. Such interruptions must be scheduled at least seven (7) work days in advance and have Owner's approval.

1.06 PROTECTION OF WORK AND ADJACENT PROPERTY

A. Buildings and property adjacent to work included in this project may be subject to damage due to construction operations.

1. Prior to the start of the work included in this Contract engage the services of a photographer to record the existing condition of adjacent structures and property. Contractor shall provide one set of 3" X 5" prints or a set on disk to the Owner and retain negatives and one set of prints for their records. Sufficient photos with adequate detail to thoroughly document the conditions surrounding the work shall be provided.

B. At the completion of the project, Contractor shall restore existing buildings, landscaping, parking facilities and property to same condition as prior to the start of the work.

C. In addition to the requirements of the General Conditions of the Contract for Construction, the Contractor shall:

1. Notify, in writing, the Owner of University or private property which interferes with the work and arrange with them for disposition of such property.
2. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into excavation. Provide temporary protection around openings through and at floors, roofs, and other openings.
3. Provide and maintain proper shoring and bracing for existing underground utilities, sewers, etc., encountered during excavation work, to protect them from collapse or other type of damage until such time as they are to be removed, incorporated into the work of this project, or can be properly back-filled upon completion of new work.
4. Weather Protection: Provide protection against rain, snow, wind, ice, storms, or heat so as to maintain work, materials, apparatus, and fixtures free from injury or damage. At the end of each day's work, cover new work likely to be damaged.
5. Provide and maintain adequate protection of the work from damage due to freezing, especially freezing earth and soils. Risk of proceeding with the work on or with freezing or frozen materials will be the sole responsibility of the Contractor.
6. Water Protection: Provide protection from damage at all times from rain water, ground water, backing up of drains or sewers, and other water. Provide pumps and
equipment enclosures to provide this protection. Contractor will maintain free of obstructions and debris, all designated corridors and emergency exits, handicap access ramps and sidewalks to building. Provide temporary directional handicapped signage for routing to the nearest accessible facilities.

1.07 CONTRACTOR'S ACCESS PARKING AND STAGING AREAS

A. Work included in this project will need to be performed within the limitations of available access at the site. The University shall limit the area available for staging and parking due to the additional number of construction projects planned during the execution of this contract. Contractor shall adjust the means and methods of construction to allow for the restrictions surrounding the site parking on campus except for some one-hour zones on city streets and a few metered spaces is under control and authority of the Parking and Transportation Services (PTS) of the University. All University parking is by permit only.

1. Types of parking and staging are defined as follows:

a. General Staging Areas are approved areas adjacent to the site when available or in University designated group staging yards. General Staging Areas may be used for any purpose, including employee parking, on a space available basis, but must be coordinated through the UCB Project Manager and PTS. Vehicles may not park outside of general staging areas except in areas coordinated and approved by PTS. See attached site map “General Staging”.

   (1) Restricted Staging Areas are approved areas near the site for the construction dumpster, off-loading of equipment, contractor's work trailer, and materials that are soon to be incorporated into the work. No vehicles shall park in a restricted staging area for more than 20 minutes between the hours of 8:00 a.m. and 5:00 p.m. weekdays.

b. Contractor Employee Parking are areas for workers needing parking on campus. Coordinate through UCB Project Manager and PTS.

c. Prohibited Parking areas, are areas designated in the Contract Documents as No Parking areas. The contractor shall not allow any parking in areas so designated under any circumstance.

B. The restrictions in this Section are in addition to any other restrictions or rules provided by PTS.

1. Fees shall be assessed for the use of any PTS facility for staging and construction activities.

C. The designated staging area for this project shall be – see attached site map.

D. Vehicles parked on sidewalks or in landscape areas outside the designated staging areas cause damage to University property. The contractor shall reimburse the University $25.00 per vehicle per occurrence for vehicles parked outside the designated staging areas. This amount shall be in addition to any fines which might be levied by PTS.
1.08 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.

B. Owner-Furnished Products: Owner-furnished products and materials includes, but not limited to, free heat exchanger.

1.09 OCCUPANCY REQUIREMENTS

A. Owner may occupy designated areas for the purpose of storage of furnishings and equipment and installation of equipment.

B. Execute Certificate of Substantial Completion for each designated portion of work prior to Owner occupancy. Contractor shall allow:

1. Access for Owner personnel.
2. Use of parking facilities.
3. Operation of HVAC and electrical systems.

C. On occupancy, Owner will provide, for occupied areas:

1. Operation of HVAC and electrical systems.

1.10 CONSTRUCTION AND SEQUENCE SCHEDULE

A. Sequence of construction operations shall be as follows:

1. The sequence concept is to: upon completion, occupy the building.
2. Utilizing this concept break down the Schedule into broad scope categories augmented by “Owner Action” and “Contractor action” columns that indicate coordination tasks which define the various phases of the work intent of the categorization is to generally summarize the nature and extent of work to be performed without in any way limiting specific requirements of the Contract Documents.
3. Some overlapping between the several construction operations will occur, and where possible, permission may be granted to start certain portions of the work before the previous operations were completed in their entirety. Such detail scheduling shall be done as the work progresses, provided that the Owner’s access to surrounding buildings remain uninterrupted, but in all cases must receive Owner approval, it may not be possible to complete certain mechanical and electrical services in connection with making the work complete and ready for occupancy, temporary services as directed and as approved shall be installed to permit occupancy by the Owner at the earliest possible date.
4. The construction sequence schedule and related drawings are intended to aid the Contractor in bidding and in the preparation of a specific construction schedule. Deviations of sequence may be made upon approval of the Owner and the Architect/Engineer. The preparation of a specific construction schedule remains the responsibility of the Contractor.
PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 00 11 10B
SECTION 00 26 00 - SUBSTITUTIONS PRIOR TO BIDDING

PART 1 - GENERAL

1.01 DEFINITION

A. Acceptable Manufacturers and Products: See Section 01 61 00.

B. Section includes administrative and procedural requirements for handling requests for substitutions made prior to bid.

C. Product proposed by Contractor which does not meet requirements of Contract Documents, whether in product characteristics, performance, quality, manufacturer, or brand name is considered a substitution.

D. In case of non-availability of materials contact Architect/Engineer for review and action.

E. For bidding purposes, base all bids on materials, equipment, and procedures specified, or approved by Addenda.

1.02 SUBSTITUTION PRIOR TO BIDDING REQUEST

A. Submit complete data substantiating compliance of proposed substitution with Contract Documents.

B. For products and systems:

1. Product identification, including manufacturer’s name and literature marked to indicate specific model, type, size, and options to be considered:

   a. Product description.
   b. Performance and test data.
   c. Reference standards.
   d. Difference in power demand, air quantities, etc.
   e. Dimensional differences from specified unit.

2. Samples:

   a. Architect/Engineer reserves right to retain sample until physical units are installed on project for comparison purposes.
   b. Requester pay all costs of furnishing and return of samples.
   c. Architect/Engineer is not responsible for loss of or damage to samples.

3. Name and address of at least five similar projects that proposed product has been in use on for at least four years, and name and phone number of owner’s and Architect/Engineer’s or engineer’s representative, which Owner or Architect/Engineer can contact to discuss product, installation, and field performance data.
C. Environmental Criteria: Provide the following additional information where environmental requirements are specified and when they apply to proposed substitutions, or where Contractor is proposing alternative products or systems which due to environmental aspects will improve project.

1. VOC Content: Comply with specified requirements for VOCs and indicate VOC content. Owner, in consultation with Architect/Engineer reserve right to reject proposed substitutions where data for VOCs is not provided or where emissions of individual VOCs are higher than for specified materials.

2. Recycled Content: Indicate recycled content for specified product and proposed substitution.

3. Local/Regional: Indicate final point of manufacture for specified product and proposed substitution.

4. Energy Efficiency: Indicate energy efficiency for specified equipment and proposed substitution.

5. Life-Cycle Cost: Include life cycle cost savings by product, system or assembly recommended if applicable.

D. For construction methods:

1. Detailed description of proposed method.

2. Illustrate with drawings.

E. Itemized comparison of proposed substitute to specified item; indicate variations.

F. Effect and changes required on other trades, subcontractors or contracts.

G. Data related to change in construction time.

H. Cost of proposed substitution in comparison with product, system or method specified.

I. Availability of maintenance and repair services, and sources of repair or replacement items.

J. Warranty comparison with specified product or system.

1.03 PRODUCT SELECTION – GENERAL

A. Certain types of products are described in Project Manual by means of trade names, catalog numbers or manufacturer’s names, or both. This is not intended to exclude other products from consideration which may be capable of accomplishing purpose indicated.

B. Other types of products may be considered acceptable to Owner and Architect/Engineer in place of those specified.

C. Listing of a manufacturer implies acceptance of them only as supplier of a product which complies with specified item.

1. Refer to Section 01 61 00 for definition of “Base” and “Optional” manufacturers.
D. No substitution permitted after execution of contract, unless allowed by Contract Documents.

E. Conditional bids and voluntary alternates will not be considered unless allowed by Instructions to Bidders.

1.04 SUBSTITUTION REQUESTS

A. Only written requests with complete data for evaluation will be considered.

1. Request must be received at least 15 calendar days prior to bid date.
2. Requests received late will not be considered.
3. Submit evaluation data with attached form to Architect/Engineer.

B. In making request for substitution, supplier and Contractor represent:

1. They have personally investigated proposed product, system or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform intended function;
2. The proposed substitution is in full compliance with applicable code;
3. They will provide same warranty for substitute item as for product, system or method specified;
4. If the substitution is a finish product, complies color wise and pattern wise with base specified items;
5. They will coordinate installation of accepted substitution into Work, to include building modifications if necessary, and be responsible for such modifications as may be required for Work to be complete and functional in all respects;
6. They certify cost data presented is complete and includes all related costs, excluding Architect/Engineer's review and redesign cost;
7. They waive all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution;
8. They will pay additional costs to other trades, subcontractors or contracts caused by substitution;
9. They will pay all Architect/Engineer's review and redesign cost, special inspections, and other costs caused by substitutions or revisions made necessary by the acts or omissions of Contractor, due to product submittal or product not being ordered in a timely manner, due to ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor or Contractor;
10. They acknowledge acceptance of these provisions.

C. Supplier shall sign the Substitution Request in space provided on form acknowledging acceptance of terms.

D. Contractor shall sign the substitution request in space provided on form acknowledging it’s acceptance of terms.

1.05 APPROVAL OF SUBSTITUTION REQUEST

A. No verbal or written approvals other than by Addenda will be valid. Addenda listing approved substitutions will be published prior to Bid date.
1.06 REJECTION OF SUBSTITUTION REQUESTS

A. Substitutions may not be considered if:

1. Submitted after stipulated date or time period.
2. Not submitted in accord with this Section.
3. Acceptance will require substantial revision of Contract Documents, building or system.
4. Substitution request does not indicate specific item for which request is submitted.
5. Substitution Request form is not properly executed and signed.
6. Insufficient information submitted.
7. Substitution color or pattern wise does not comply with base specified item.
8. Substitution does not appear to comply with requirements of specifications for base item or is incompatible with the contract documents and will not produce the indicated results, or is incompatible with other portions of the work, or has not been coordinated with other portions of the work.
9. Substitution adversely affects Contractor’s construction schedule
10. Substitution does not provide the specified warranty.
11. Owner or Architect/Engineer does not want to consider.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 00 26 00
SUBSTITUTION REQUEST

PROJECT: ___________________________________________  PROJECT NO. ______

TO: Office of Engineer:
LUTZ, Daily & Brain, LLC
6400 Glenwood, suite 200
Overland Park, KS 66202
Attention: Ed Barton, Engineering Project Manager

SPECIFIED PRODUCT:
Substitution request for:
Specification Section No.:
Article(s) / paragraph(s):

REASON FOR SUBSTITUTION REQUEST:
☐ Fails to comply with building code requirements  ☐ Not available
☐ Unavailable to meet Project schedule  ☐ Reduce Project construction time
☐ No qualified installer for specified item  ☐ Project cost savings
☐ Supplier refuses to warrant item or installation  ☐ Unsuitable for application
☐ Supplier, Subcontractor, or Contractor convenience  ☐ Constructability issue
☐ Other:

Explanation in Detail: ☐ See attached: ________________________________

SUPPORTING DATA:
Attach product description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with the requirements of Division 1 Section 01 25 13, “SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT”.

Sample is included: Yes ☐  No ☐
Sample will be sent, if requested: Yes ☐  No ☐
Maintenance service available: Yes ☐  No ☐
If yes, location: ____________________________________________
Spare parts source: __________________________________________

PRODUCT SYSTEM COMPARISON:
Provide a one-to-one comparison of proposed substitution with ALL specified attributes and qualities of specified item(s).

<table>
<thead>
<tr>
<th>SPECIFIED PRODUCT</th>
<th>PROPOSED SUBSTITUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer:</td>
<td></td>
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<tr>
<td>Name/brand:</td>
<td></td>
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<tr>
<td>Catalog No.:</td>
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<tr>
<td>Unit Cost:</td>
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<tr>
<td>Attributes / Qualities:</td>
<td></td>
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<tr>
<td>Variations / warrante / etc.:</td>
<td></td>
</tr>
</tbody>
</table>
SECTION 00 31 33 - SUBSURFACE DRILLING AND SAMPLING INFORMATION

PART 1 - GENERAL

1.01 SOILS REPORT
   A. Soils Report (a.k.a. Geotechnical Report) has been prepared for Owner. Report was prepared to assist in design process. Copies are available upon request.
   B. No representation or warranty is made by Architect, Engineer, Owner or any other party regarding completeness, accuracy, adequacy, or contents of report or of the subsurface investigation upon which report is based.

1.02 AVAILABILITY
   A. Copies of report may be obtained from the Owner upon request.

1. Office of the Owner:
   University of Colorado Boulder
   Planning, Design and Construction
   1540 30th Street, 3rd Floor, 453 UCB
   Boulder, CO  80309-0453
   Attention:  Katherine Dunklau,
   Facility Project Manager

1.03 BIDDER RESPONSIBILITY
   A. Bidders accept full responsibility for using soil information in preparing bids. The Owner will not entertain claims for extra cost based on allegations of lack of knowledge of the soil conditions.
   B. Bidder is responsible to obtain, at its expense, any additional information necessary to bid and perform Work.
   C. Bidders agree they will make no claim, exceeding actual cost of work, if, in performing the Work, they find actual subsurface conditions encountered do not conform to those indicated by soil borings, test excavations, and other subsurface investigations.
   D. The exploring borings were spread in order to obtain a comprehensive report of the subsoil conditions, however, different soil conditions may occur between test holes. If such conditions are found during construction, the Architect/Engineer shall be notified.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 00 31 33
SECTION 01 00 00 – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL

A. Owner: University of Colorado Boulder for Work described in the Contract Documents.

B. Contract Identification: Contract – CP144260

C. EDEP Project Site Location: University of Colorado East District Energy Plant (EDEP), Building 427, 980 Regent Drive located on the University of Colorado Boulder main campus in Boulder Colorado, 80309.

D. WDEP Project Site Location: University of Colorado West District Energy Plant (WDEP), Building 354, 1100 18th Street located on the University of Colorado Boulder main campus in Boulder Colorado, 80309.


F. Owner’s Representative: Katherine Dunklau, Project Manager – Facilities Management, 1540 30th Street, Room 328(reception), Campus Box 453 UCB, Boulder, CO 80309.


H. Commissioning Firm: Independent third-party commissioning firm hired by the Owner: STPCx LLC, I402 South White Horse Pike, Audubon, NJ 08106. Tele 865.547.8300, Fax 856.547.8302

I. Installation Contractor: Contractor or Contractors contracted under CMGC for installation of equipment specified herein.

J. Equipment Vendor: Equipment Representative, direct vendor(s) supplying equipment specified herein.

1.02 RELATED DOCUMENTS

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

1.03 CONDITIONS AND REQUIREMENTS

A. Division 1 GENERAL REQUIREMENTS shall govern work under all Divisions of the Specifications.

1.04 SPECIFICATION LANGUAGE EXPLANATION

A. Specifications are of abbreviated, simplified or streamlined type and include incomplete sentences. Omissions of words or phrases such as "the Contractor shall," "in conformity
therewith," "shall be," "as noted on the Drawings," "a," "the" are intentional. Supply omitted words or phrases by inference in same manner as they are when "NOTE" occurs on Drawings. Supply words "shall be" or "shall" by inference when colon is used within sentences or phrases. Supply words "on the Drawings" by inference when "as indicated" is used with sentences or phrases.

B. Where reference is made to specifications, societies, institutes, or associations or manufacturer's directions, they are, except as may be inconsistent herewith, and made part of specifications, to same extent as if written out in full herein. Use latest edition, at time of bidding, if a date is not given.

1.05 SUBMITTALS

A. Prepare data for use by the University of Colorado, Facilities Management personnel. Format shall be as follows:

1. Submit electronically in PDF format as one document, bookmarked according to CSI standards.
2. Title shall be "SPECIFICATIONS", and shall include:
   a. Name of project and submittal stage and date of submittal (month, day, and year).
   b. University of Colorado Project number (Include on cover and in header or footer of each page).

B. Content of Manual: An electronically-written table of contents shall be provided for each volume, arranged according to CSI standards and shall include the following:

1. Name of responsible installing principal contractor, address, and telephone number.

1.06 ABBREVIATIONS

A. Refer to Division 1 Section "REFERENCE STANDARDS" for references in Contract Documents to trade associations, technical societies, recognized authorities and other institutions, which are sometimes referred to only by corresponding abbreviations.

1.07 LAYING OUT WORK

A. The Contractor will furnish reference bench mark and maintain bench mark and all other grades, lines, and levels and dimensions as indicated in the Contract Documents. Report any errors or inconsistencies in above to the Owner before commencing work.

B. Except as delegated by subcontract or normal trade practice, the Contractor will be responsible for all lines, elevations, and measurements of work indicated.

1.08 EXAMINATION OF SITE

A. Failure to visit the site will in no way relieve any Contractor from the necessity of furnishing materials or performing work that may be required to complete work in accordance with the Contract Documents without additional cost to the Owner.
PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 00 00
SECTION 01 11 13 - SPECIFICATION SYSTEM

PART 2 - GENERAL

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section Includes:

1. Specification system format
2. Grammar (syntax) description

1.04 DESCRIPTION

A. These specifications have been derived from automated specification systems, and include minor deviations from format and traditional writing forms. Such deviations must be recognized as a normal result of this production technique, and no other meaning will be implied or permitted.

1.05 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   a. Imperative language of the technical sections is directed to the Contractor. The term "provide" used repeatedly in the text is defined to mean..."furnish and install, complete, in place and ready for operation and use unless specifically indicated otherwise."

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 1 Section GENERAL REQUIREMENTS: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 11 13
SECTION 01 22 00 – UNIT PRICES

PART 3 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Sections: Division 1 Section “QUALITY CONTROL” for general testing and inspecting requirements.

1.03 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specifications referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION

3.01 SCHEDULE OF UNIT PRICES

A. Drilled Piers, Size

1. Additional or less drilling for actual lengths in place of design lengths, per lineal foot based on total net allowance.
2. Additional or less concrete for piles in place, for actual lengths in place of design lengths, per CY calculated on nominal diameter for each pile size, actual net difference of all piles of all sizes.
3. Additional reinforcing steel, for steel for additional lengths, fabricated, tied, and placed. No Credit for under runs where steel was cut off.

END OF SECTION 01 22 00
SECTION 01 23 00 – ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section identifies each Alternate by number and describes basic changes to be incorporated into Work, only when that Alternate is made a part of Work by specific provisions in Construction Contract.

B. This Section includes only nontechnical descriptions of Alternates. Refer to specific Sections of Specifications and Drawings for technical description of Alternates.

C. Coordinate pertinent related Work, and modify surrounding Work as required to properly integrate Work under each Alternate and to provide complete construction required by Contract Documents.

1.02 DESCRIPTION

A. Work includes:

1. Indicate Alternate prices on Bid Form.
2. Alternates will be selected after bids are evaluated.
3. Selected Alternates will be made a part of Contract and final Contract Amount will be adjusted accordingly.
4. Prices for Alternates not made a part of Contract shall be good for 60 days after date of Agreement.

1.03 PROCEDURES

A. In order to enable the Owner to compare total costs where alternate materials, products, equipment, methods, or finishes might be used in the Work, Alternates have been proposed as described in the various sections of these specifications.

B. Modifications to related work: If the Owner elects to accept one or more of the proposed Alternates, make all modifications to the Work required by the furnishing and installation of the Alternate item without additional cost or other adjustments to the Contract Sum other than as noted on the Bid Form for the Alternate.

C. Method of Proposal: The Bid Form contains spaces for stating the additional costs or deduction which would result from the Owner’s acceptance of each proposed Alternate. No further adjustment will be made to the Contract Sum other than the stated amount for each Alternate, if accepted.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION

3.01  ADDITIVE ALTERNATES

A.  Additive Alternate #1: Additive Alternate #1

END OF SECTION 01 23 00
SECTION 01 25 13 - SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT

PART 1 - GENERAL

1.01 DEFINITION

A. This Section includes administrative and procedural requirements for handling substitutions requests made after execution of Contract.

B. Any product proposed by Contractor that does not meet requirements of the Contract Documents, whether in product characteristics, performance, quality, or manufacturer or brand names, is considered a substitution.

1.02 SUBSTITUTION AFTER EXECUTION OF CONTRACT

A. If a substitution request occurs after such 35-day period, substitution may be reviewed at discretion of Owner and Architect; and costs of such review and initiation of a change document shall be borne by Contractor and deducted from Contract Sum.

B. All cost including Architect/Engineer cost will be responsibility of Contractor for substitutions or revisions made necessary by the acts or omissions of Contractor, requested due to product submittal or product not being ordered in a timely manner, requested due to ease of construction progress or Work, or requests which are in interest of or for convenience of supplier, subcontractor or Contractor.

1.03 PRODUCT SELECTION – GENERAL

A. Certain types of products are described in Specifications by means of trade names, catalog numbers and/or manufacturer's names. This is not intended to exclude from consideration other products that may be capable of accomplishing purpose indicated.

B. Other types of products may be considered acceptable to Owner or Architect/Engineer in place of those specified.

C. Listing of a manufacturer implies acceptance of them only as supplier of a product that complies with specified item.

1. Refer to Division 1 Section "ACCEPTABLE MANUFACTURERS AND PRODUCTS" for definition of “Base” and “Optional” manufacturers.

D. Architect/Engineer reserves right to require substitutions comply with color and pattern of base specified items.

1.04 SUBSTITUTION REQUESTS

A. Only written requests with complete data for evaluation will be considered.

1. Submit evaluation data with attached form to Architect/Engineer.

2. Submit in timely manner to allow Architect/Engineer adequate time for evaluating, making recommendation, and for Owner approval.
B. Supplier, Subcontractor and Contractor in making substitution request, or in using an approved substitution, represent:

1. Has personally investigated proposed product, system or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform intended function;
2. Is in full compliance with applicable code;
3. Will provide same warranty for substitute item as for product, system or method specified
4. Finish product, complies with color and pattern selections/options for base specified items.
5. Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, and be responsible for such modifications as may be required for Work to be complete and functional in all respects;
6. They certify cost data presented is complete and includes all related costs, excluding Architect/Engineer's review and redesign cost;
7. They waive all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution;
8. They will pay additional costs to other trades, subcontractors or contracts caused by substitution;
9. They will pay all Architect/Engineer's review and redesign cost, special inspections, and other costs caused by substitutions or revisions made necessary by the acts or omissions of Contractor, due to product submittal or product not being ordered in a timely manner, due to ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor or Contractor;
10. Responsibility of Contractor for substitutions or revisions made necessary by the acts or omissions of Contractor, requested due to product submittal or product not being ordered in a timely manner, requested to ease construction progress or Work, or which are in interest of or requests for convenience of supplier, subcontractor or Contractor;
11. They acknowledge acceptance of these provisions.

C. Contractor sign Substitution Request in space provided on form acknowledging acceptance of terms.

1.05 SUBSTITUTION DATA

A. Submit complete data substantiating compliance of proposed substitution with Contract Documents.

1. For products and systems:
2. Product identification, including manufacturer's name.
3. Manufacturer's literature, marked to indicate specific model, type, size, and options to be considered:
   a. Product description.
   b. Performance and test data.
   c. Reference standards.
   d. Difference in power demand, air quantities, etc.
   e. Dimensional differences from specified unit.
4. Samples:
   a. Architect/Engineer reserves right to retain sample until physical units are
      installed on project for comparison purposes.
   b. Requester pay all costs of furnishing and return of samples.
   c. Owner and Architect/Engineer are not responsible for loss of or damage to
      samples.

5. Name and address of at least five similar projects that proposed product has been in
   use for at least four years, and name and phone number of owner’s and
   Architect/Engineer’s or engineer’s representative, which Owner or
   Architect/Engineer can contact to discuss; product, installation, and field
   performance data.

B. For construction methods:
C. Detailed description of proposed system or method.
D. Illustrate with drawings.
E. Itemized comparison of proposed substitute to specified item; indicate variations.
F. Warranty comparison with specified product or system.
G. Effect and changes required on other trades, subcontractors or contracts.
H. Data relating to change in construction time.
I. Complete breakdown of costs, of proposed substitution that shall include additional costs
   or saving generated by proposed substitution and shall indicate amount, if any, to be
   deducted from Contract Sum if proposed substitution is accepted.
J. Include life cycle cost savings by product, system or assembly proposed, if applicable.
K. Availability of maintenance and repair services, and sources of repair or replacement
   items.

1.06 APPROVAL OF SUBSTITUTION REQUESTS
A. For substitutions which have no cost or time impacts, no verbal or written approvals other
   than by Owner’s signed approval on attached Substitution Request form.
B. For substitutions which have cost or time impacts, no verbal or written approvals other
   than by Owner’s signed approval of a Change Order.

1.07 REJECTION OF SUBSTITUTION REQUESTS
A. Substitutions may not be considered if:
   1. Submitted after stipulated date or time period.
   2. Not submitted in accord with this Section.
PART 2 - PRODUCTS  (Not Applicable)

PART 3 - EXECUTION  (Not Applicable)

END OF SECTION 01 25 13
SECTION 01 26 13 - REQUESTS FOR INFORMATION (RFIs)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 SUMMARY
   A. Section specifies administrative and procedural requirements for handling and processing Requests for Information (RFI).
   B. RFI is intended for requesting clarifications and interpretations of Contract Documents due to apparent inconsistencies, errors or omissions in Contract Documents, and due to unanticipated existing conditions.
   C. RFI is not intended for requesting substitutions; Contractor’s proposed changes, resolution of nonconforming work or for general questions not related to Contract Documents.
   D. RFI process is intended to be a cooperative effort between the Architect/Engineer and the Contractor to expedite responses to RFIs and maintain progress of Work without utilizing other lengthy procedures.
   E. Any other proposed method of processing RFI’s other than indicated within this Section, such as project collaboration systems, shall be evaluated by Architect/Engineer for potential impact on the Architect/Engineer’s services.

1. If the Architect/Engineer agrees to utilize another proposed method, the Architect/Engineer will be reimbursed for any special training, usage fees, extra time required to implement, maintain, utilize and administer such a system.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 REQUESTS FOR INFORMATION
   A. Review of Contract Documents and Field Conditions:
      1. Contract Documents are complementary; therefore, before starting each portion of Work, carefully study and compare various Drawings, Specifications and any other Contract Documents, coordination drawings, shop drawings, prior correspondence or documentation relative to that portion of Work, as well as information furnished by the Owner.
2. Contractor and Subcontractors shall evaluate and take field measurements of any existing conditions related to that portion of Work and shall observe any conditions at site affecting Work.

3. These obligations are for purpose of facilitating and coordinating construction and are not for purpose of discovering errors, omissions, or inconsistencies in Contract Documents.

4. Contractor and subcontractors acknowledge that all documents pertaining to Work has been examined, have examined character of site and any existing conditions, and are satisfied with nature of Work, and all other matters which can in any way affect Work.

5. In event of inconsistency between portions of Contract Documents or within Contract Documents; provide better quality or greater quantity of Work, and comply with more stringent requirement, either or both in accordance with Architect's interpretation.

6. Any errors, inconsistencies or omissions discovered in Contract Documents shall be reported promptly to Architect/Engineer as a properly prepared and timely RFI.

7. Contractor and Subcontractors are not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, but the Contractor shall promptly report to Architect/Engineer any nonconformity discovered by or made known to Contractor as an RFI.

8. If Contractor or Subcontractor fail to give such notice, and knowingly proceeds with Work affected by errors or omissions in Contract Documents, Contractor shall correct any such errors, inconsistencies, or omissions at no additional cost.

B. Contractor’s and Subcontractor’s Responsibilities:

1. When interpretation, clarification or explanation of portion of Construction Documents is needed by Contractor, Subcontractor, Vendor or Supplier, the request shall be processed through Contractor.

   a. Review request for completeness, quality, proper referencing to drawing or specification section and reason submitted.

   b. If request is not acceptable it shall be sent back to submitter with comments regarding reason for being returned.

   c. Make every attempt to validate, resolve or respond to RFI by thoroughly researching and reviewing Contract Documents and field conditions.

   d. Respond to RFI accordingly if review of RFI discloses a response or is related to coordination of construction or other issue not related to Contract Documents.

   e. If unable to respond to request, it shall be restated in a clear, concise, correct, complete, and comprehensible manner (and rewritten if necessary), with additional information included if necessary, and only then submitted to the Architect/Engineer for response.

2. Request for interpretation, clarification or explanation of Contract Documents shall be submitted to Architect/Engineer through Contractor.

   a. List specific Contract Documents researched when seeking information being requested.
b. Reference all applicable Contract Drawings by sheet number, section, detail, room number, door number, etc., Specifications by section and paragraph number, and reference any other relevant documents.

c. The field titled "Regarding" on RFI form must be clear for future reference in reports or correspondence.

d. Clearly state request and provide Contract Document references and any additional information needed so request can be fully understood, including sketches, photos or other reference material.

e. Fully assess issues, suggest any reasonable solutions and include various factors, including potential costs, schedule impacts, if any, and recommendations which will aid in determining a solution or response. If a reasonable solution cannot be suggested, a statement to that effect should be so stated.

f. Indicate reason request is being submitted.

g. Any critical RFI’s requiring a rapid response shall clearly indicate such with an explanation as to why RFI is critical.

h. Priority for responses shall be indicated when multiple RFI’s are submitted within short period of time.

i. The RFI shall indicate schedule or cost impact, if any. Contractor shall be required to submit cost or schedule impact within seven days of receipt of the RFI response.

3. Copies of responses to RFIs shall be distributed to all parties affected.

4. An RFI response shall not be considered a notice to proceed with a change that may revise Contract Sum or Contract Time, unless authorized by Owner in writing.

5. If response to RFI is determined incomplete, it shall be resubmitted with reason response is unacceptable and any necessary additional information within 5 days of time of receipt of response to RFI.

6. If determined or believed that additional cost or time is involved because of clarifications, interpretations, or instructions issued by Architect/Engineer in response to an RFI, resubmit RFI within 5 working days of receipt of response with reason and alternate solution or suggestion for performing work at no additional cost. If no other solution is possible or desirable, submit Claim in accordance with the Contract Documents within 15 calendar days of receipt of response to the RFI.

C. RFI Submittal Format: Request for information shall be submitted to Architect/Engineer on RFI form provided at end of this section, or form provided by Architect/Engineer in electronic text file format, or in similar format acceptable to Architect/Engineer.

1. RFIs shall be assigned unique numbers in sequential order (1, 2, 3, 4, etc.).

2. A resubmitted RFI or a previously answered RFI requiring revising or further clarification shall be submitted using original RFI number proceeded by “.1” to indicate revision one of RFI (i.e.: RFI No. 34.1 for revision 1 to RFI No. 34).

3. RFI form shall be electronically filled out and emailed to Architect/Engineer’s designated representative in text file format. Attachments shall be in electronic text or PDF file format. Photo attachments may be in JPG format.

D. Architect/Engineer’s Response to Request for Information (RFI):

1. Clarifications, interpretations and decisions of Architect/Engineer in response to RFI will be consistent with intent of and reasonably inferable from Contract Documents,
and will be in writing, and if determined to be necessary by Architect/Engineer, will be provided in form of drawings and other attachments or both.

2. When making such interpretations and initial decisions, Architect/Engineer will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

3. Architect/Engineer’s decisions on matters related to aesthetic effects will be final if consistent with intent expressed in Contract Documents.

4. Architect/Engineer will not undertake to settle differences between Contractor, Subcontractors, trades suppliers, fabricator or manufacturer, or act as arbiter as to which Subcontractor, trade, supplier or manufacturer is to furnish or install various items indicated or required.

5. Architect/Engineer shall provide responses to RFI’s with reasonable promptness, but will endeavor to respond within seven (7) days from date of receipt.

   a. If multiple RFI’s are submitted on same day or within a five (5) day period, review time may be extended by mutual agreement of parties
   b. Architect/Engineer will provide a written response to RFI if Architect/Engineer believes response only involves an interpretation, clarification, supplemental information or orders a minor change in Work not involving an adjustment in Contract Sum or extension of Contract Time, and is not inconsistent with intent of Contract Documents, and shall be binding.
   c. If Architect/Engineer believes response may result in a change to Contract Sum or Contract Time, response will indicate that a change document will be issued for the response, and appropriate change document will be issued indicating changes to Contract Documents.
   d. Architect/Engineer will provide any additional or supplemental drawings, specifications or other information as Architect/Engineer may deem necessary to facilitate response.

6. The Architect/Engineer may return RFIs without response for the following reasons:

   a. Unclear or incomplete.
   b. Detailed information not provided.
   c. Is related to construction means, methods or techniques.
   d. Is related to health or safety measures.
   e. Is due to Contractor’s lack of adequate coordination.
   f. Is considered a “Substitution Request.”
   g. Is due to non-conformance.
   h. Response is required by another party.

E. If requested information is available from careful study and comparison of Contract Documents, field conditions, other Owner-provided information, coordination drawings, or prior Project correspondence or documentation, Architect/Engineer may invoice Owner as a change in services for costs involved in Architect/Engineer’s review, analysis, responding and processing of such RFI.

1. The Contractor shall reimburse the Owner for such costs.

END OF SECTION 01 26 13
SECTION 01 30 00 – ADMINISTRATION AND SUPERVISION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SURVEYS, LAYOUTS, AND LEVELS

A. General: Working from lines and levels established by the existing building, and as shown in relation to the work, establish and maintain bench marks and other dependable markers to set the lines and levels for the work of construction as needed to properly locate every element of the work of the entire project. Calculate and measure required dimensions as shown (within recognized tolerances if not otherwise indicated); do not scale the drawings to determine dimensions. Continuously advise tradesmen performing the work of the marked lines and levels provided for use in the layout of work.

1.03 PROJECT RECORD DOCUMENTS

A. See Division 1 Section PROJECT RECORD DOCUMENTS

2. Specifications.
3. Addenda.
4. Reviewed Shop Drawings.
5. Change Orders.
6. Other Modifications to Contract.
7. Field Test Records.
8. As-Built Drawings.

B. Maintain documents in clean, dry, legible condition and do not use record documents for construction purposes. Make documents available at all times for inspection by the Consultant and Owner.

C. Label each document "Project Record" in 1 inch or larger printed letters.

D. Record drawing information in colored pencil with different colors for the various systems and defined by color legend.

E. Record drawings and specifications shall include the following:

1. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure. Location of concealed valves, dampers, controls, balancing devices, junction boxes, clean-outs, and other items requiring access or maintenance.
2. Field changes of dimension and detail, changes made by Change Order or Field Order and details not on original contract drawings.
3. Fire protection and alarm systems shop drawings.
4. Location of all Utility lines, installed or discovered referenced to three dimensions and to the campus GIS system.

F. Submit all record drawings to the Consultant at the completion of the project.

1.04 CLEANING

A. Cleaning and Protection Work: At the time each unit of work or element of the construction is completed (substantially) in each area of the Project, clean the unit or element to a condition suitable for occupancy and use (as intended), and restore minor or superficial damage. Replace units and elements which are damaged beyond successful restoration. Clean and restore adjoining surfaces and other work which was soiled or damaged (superficially) during the installation; replace other work damaged beyond successful restoration. Where the performance of subsequent work could possibly result in damage to the complete unit or element, provide protective covering or other provisions to minimize possible damage. Repeat cleaning and protection operations during remainder of construction period, wherever work might otherwise be damaged by sustained soiling or exposure.

B. During Construction: Oversee cleaning and ensure that building, grounds, and public properties are maintained free from accumulation of waste materials and rubbish. At reasonable intervals during daily progress of work, cleanup site and access and dispose of waste materials, rubbish, and debris. Vacuum clean interior building areas when ready and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.

1.05 PROJECT SIGN

A. Erect no project sign or job-site sign of any kind, except warning signs as specified in Division 1 Section “TEMPORARY FACILITIES AND CONTROLS”, without written authorization of the Owner.

1. Refer to Division 1 Section “PROJECT IDENTIFICATION SIGN” for additional requirements.

1.06 COORDINATION

A. The Contractor shall be responsible for coordinating all the work of the project. The Contractor shall coordinate the efforts of all subcontractor(s) and the deliveries of suppliers so that the work progresses in an orderly fashion without delay towards timely completion of a complete project in accordance with the drawings and specifications.

B. The Contractor shall note that concurrent with work of this Contract, other contractors, suppliers, and the Owner's facilities and maintenance personnel may be working in relatively close proximity. The Contractor will be solely responsible for coordinating work of this Contract with that of other contractors and will make no claims for failure to do so.
1.07 METHODS OF CONSTRUCTION

A. The procedure and method of construction is the prerogative and the responsibility of the Contractor. If professional assistance is required to safely implement method of construction, the Contractor shall, employ professional help.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 30 00
SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. General Contractor is responsible for all of the work of this Contract:

1. Assign and subcontract portions of the work as required to assure that all work is constructed in compliance with these documents.
2. Coordinate the work of the several subcontractors for the project.
3. Coordinate work of this contract with work by separate contracts.

B. Coordinate work of this contract with work by separate Sub-contractors Contractor shall:

1. Coordinate work of employees and subcontractors.
2. Expedite work to assure compliance with schedules.
3. Coordinate work with that of other subcontractors and work by separate contractor.
4. Comply with orders and instructions of Owner.

C. Related Sections: All Division 1 Sections.

1.03 CONSTRUCTION ORGANIZATION AND START-UP

A. Establish on-site lines of authority and communications:

1. Attend pre-construction meeting with subcontractors upon commencement of the project.
2. Establish procedures for intra-project communications:
   a. Submittals.
   b. Reports and records.
   c. Recommendations.
   d. Coordination Drawings.
   e. Schedules.
   f. Resolution of conflicts.

3. Interpret Contract Documents:
   a. Consult with Architect/Engineer to obtain interpretation.
   b. Assist in resolution of questions or conflicts which may arise.
   c. Transmit written interpretations to subcontractors, and to other concerned parties.
4. Assist in Obtaining Permits and Approvals:
   a. Obtain building permits and special permits required for work or for temporary facilities.
   b. Verify that subcontractors have obtained inspections for work and for temporary facilities.

5. Control the Use of Site:
   a. Supervise field engineering and site layout.
   b. Allocate space for each subcontractor's use for field offices, sheds, work and storage areas.
   c. Establish access, traffic and parking allocations and regulations.
   d. Monitor use of site during construction.

1.04 CONTRACTOR DUTIES

A. Construction Schedules:
   1. Coordinate schedules with several subcontractors.
   2. Monitor schedules as work progresses:
      a. Identify potential variances between schedules and probable completion dates for each phase.
      b. Recommend adjustments in schedule to meet required completion dates.
      c. Adjust schedules of subcontractors as required.
      d. Document changes in schedule.
   3. Observe work of each subcontractor to monitor compliance with schedule:
      a. Verify that labor and equipment are adequate for the work and the schedule.
      b. Verify that product procurement schedules are adequate.
      c. Verify that product deliveries are adequate to maintain schedule.

B. Process Shop Drawings, Product Data and Samples:
   1. Review for compliance with Contract Documents:
      a. Field dimensions and clearance dimensions.
      b. Relation to available space.
      c. Relation to other trades, equipment and systems.
      d. Submit to Architect/Engineer.

C. Monitor the use of temporary utilities.
   1. Verify that adequate services are provided and maintained.

D. Inspection and Testing:
   1. Inspection work to assure performance in accord with requirements of Contract Documents.
2. Administer special testing and inspections of suspected work.
3. Reject work which does not comply with requirements of Contract Documents.
4. Coordinate testing laboratory services
   a. Verify that required laboratory persons are present.
   b. Verify that tests are made in accordance with specified standards.
   c. Review test reports for compliance with specified criteria.
   d. Recommend and administer required testing.

E. Monitor Contractor's Periodic Cleaning:
   1. Enforce compliance with specifications.
   2. Resolve any conflicts.

F. Coordinate Changes:
   1. Recommend necessary or desirable changes.
   2. Assist owner in negotiating change orders.
   3. Promptly notify all subcontractors of pending changes.

G. Maintain Reports and Records at Job Site available to Architect/Engineer and Subcontractors:
   1. Log progress of work of each subcontractor.
   2. Records:
      a. Contracts.
      b. Purchase orders.
      c. Materials and equipment records.
      d. Applicable handbooks, codes and standards.
   3. Obtain information from subcontractors and maintain file of Project Record Documents.
   4. Assemble documentation for handling of claims and disputes.

H. Coordinate work of this Contract and requirements of this section with work by Separate Contract including, but not limited to,
   1. Removal of asbestos containing materials by separate contract.

1.05 CONTRACT CLOSEOUT

A. Coordinate Equipment Start-up:
   1. Provide seven days notification prior to start-up of each item.
   2. Ensure that each piece of equipment or system is ready for operation.
   3. Execute start-up under supervision of responsible persons in accordance with manufacturer's instructions.
   4. Perform required testing and balancing.
   5. Record dates of start of operation of systems and equipment. Submit written report that equipment or system has been properly installed and is functioning correctly.
6. Provide written notice of beginning of warranty period for equipment put into service.

B. Demonstration and Instructions:
   1. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to Substantial Completion.
   2. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, seasonal operation, and shutdown of each item of equipment.

C. At completion of work of each Section, conduct an inspection to assure that:
   1. Specified cleaning has been accomplished.
   2. Temporary facilities have been removed from site.

D. At Completion:
   1. Conduct an inspection to list work to be completed or corrected.
   2. Supervise correction and completion of work as established in Certificate of Completion.

E. When a portion of the Project is occupied prior to final completion, coordinate established responsibilities of each subcontractor.

F. Final Completion:
   1. When each Subcontractor determines that work is finally complete, conduct an inspection to verify completion of work.
   2. Assist Owner and Architect/Engineer in inspection.

G. Administer Contract Closeout:
   1. Receive and review Subcontractor's final submittals.
   2. Transmit to Architect/Engineer with recommendation for action.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Carefully coordinate the interface between Divisions 21, 22, and 23 (Mechanical) and Divisions 26, 27, and 28 (Electrical) before submitting any equipment for review or commencing installations.

B. Responsibility: Unless otherwise indicated, all motor and controls for Division 21, 22, and 23 equipment shall be furnished, set in place and wired in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Item</th>
<th>Furnished Under</th>
<th>Set in Place Under</th>
<th>Power Wiring Under</th>
<th>Control Wiring Under</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Motor</td>
<td>21/22/23</td>
<td>21/22/23</td>
<td>26</td>
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<tr>
<td>Automatically Controlled Starter/Contactors:</td>
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<tr>
<td>- Separate</td>
<td>21/22/23</td>
<td>26</td>
<td>26</td>
<td>21/22/23</td>
</tr>
<tr>
<td>- Factory-mounted &amp; wired</td>
<td>21/22/23</td>
<td>21/22/23</td>
<td>26</td>
<td>21/22/23</td>
</tr>
<tr>
<td>- In motor control centers</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Manually Controlled Starter/Contactors:</td>
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<tr>
<td>- Separate</td>
<td>21/22/23</td>
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<td>26</td>
<td>21/22/23</td>
</tr>
<tr>
<td>- Factory-mounted &amp; wired</td>
<td>21/22/23</td>
<td>21/22/23</td>
<td>26</td>
<td>21/22/23</td>
</tr>
<tr>
<td>Motor Speed Controllers</td>
<td>21/22/23</td>
<td>26</td>
<td>26</td>
<td>26</td>
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<tr>
<td>Disconnect Switches</td>
<td>26</td>
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<td>26</td>
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<tr>
<td>Contactors</td>
<td>26</td>
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</tr>
<tr>
<td>Thermal Overload Switches</td>
<td>26</td>
<td>26</td>
<td>26</td>
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<tr>
<td>Manual Operation</td>
<td>26</td>
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<tr>
<td>Switches</td>
<td>26</td>
<td>26</td>
<td>26</td>
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</tr>
<tr>
<td>Control Relays</td>
<td>21/22/23</td>
<td>21/22/23</td>
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<td>21/22/23</td>
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<tr>
<td>Control Transformers</td>
<td>21/22/23</td>
<td>21/22/23</td>
<td>26</td>
<td>21/22/23</td>
</tr>
<tr>
<td>Control Circuit Outlets</td>
<td>26</td>
<td>26</td>
<td>26</td>
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</tr>
<tr>
<td>Thermostats</td>
<td>23</td>
<td>23</td>
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<td>23</td>
</tr>
<tr>
<td>Time Switches Not in Control Panel</td>
<td>22/23</td>
<td>22/23</td>
<td>26</td>
<td>22/23</td>
</tr>
<tr>
<td>Pushbutton Stations, Pilot Lights</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Thermostats Controls: Integral with equipment or directly applied to ducts, pipes, etc.</td>
<td>23</td>
<td>23</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>Item</td>
<td>Furnished Under</td>
<td>Set in Place Under</td>
<td>Power Wiring Under</td>
<td>Control Wiring Under</td>
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<td>-----------------------------------------------</td>
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</tr>
<tr>
<td>Valve Motors, Damper Motors, Solenoid Valves, etc.</td>
<td>21/22/23</td>
<td>21/22/23</td>
<td>--</td>
<td>21/22/23</td>
</tr>
<tr>
<td>EP Valves or Switches, P.E. Switches, etc.</td>
<td>21/22/23</td>
<td>21/22/23</td>
<td>--</td>
<td>21/22/23</td>
</tr>
<tr>
<td>Control Circuit Outlets</td>
<td>26</td>
<td>26</td>
<td>26</td>
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</tr>
<tr>
<td>Fire Alarm Systems</td>
<td>26</td>
<td>26</td>
<td>26</td>
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</tr>
<tr>
<td>Fire Sprinkler Alarm</td>
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<tr>
<td>Fire stats</td>
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<td>26</td>
</tr>
<tr>
<td>Smoke Detectors Including Relays for Fan Control</td>
<td>26</td>
<td>26</td>
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<td>26</td>
</tr>
<tr>
<td>Control Air Compressor</td>
<td>23</td>
<td>23</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>Refrigerated Air Dryer</td>
<td>23</td>
<td>23</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>Equipment Interlocks</td>
<td>21/22/23</td>
<td>21/22/23</td>
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<td>21/22/23</td>
</tr>
<tr>
<td>Boiler and Water Heaters</td>
<td>22/23</td>
<td>22/23</td>
<td>26</td>
<td>22/23</td>
</tr>
</tbody>
</table>

**Notes:**

1. If furnished as part of factory-wired equipment furnished and set in place under Divisions 21, 22, and 23, wiring and connections under Divisions 26.
2. If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished under Divisions 21, 22 and 23, but they shall be set in place and connected under Division 26 except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, or other mechanical equipment, they shall be set in place under Divisions 21, 22 and 23 and connected under Division 26. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired under Divisions 21, 22 and 23.

C. Control Wiring: Consists of wiring in pilot circuits of contact or starters, sensors, controllers, and relays, and wiring for valve and damper operators.

1. Connections: Connections to all controls directly attached to ducts, piping and mechanical equipment shall be made with flexible connections.

D. Starters: Provide magnetic starters for all three phase motors and equipment complete with.

1. Control transformers.
2. 120V holding coils.
3. Integral hand-off-auto switch.
4. Auxiliary contacts required for system operation plus one (1) spare.

E. Remote Switches and Push Button Stations: Provide all remote switches and/or push button stations required for manually operated equipment (if no automatic controls have been provided) complete with pilot lights of an approved type lighted by current from load side of starter.

F. Identification: Provide identification of purpose for each switch and/or push button station furnished. Identification may be either engraved plastic sign or permanent mounting to wall below switch, or stamping on switch cover proper. All such identification signs
and/or switch covers in finished areas shall match other hardware in the immediate areas.

G. Special Requirements: Motors, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.

H. Control Voltage: Maximum allowable control voltage 120V. Fully protect control circuit conductors in accordance with National Electrical Code.

I. Related Requirements: Electric Motors: Coordinate with efficiency requirements.

J. Contractor must review all concrete embedded items (including conduit) with owner prior to placement.

PART 2 - PRODUCTS

2.01 MOTOR HORSEPOWER

A. In general, all motors 3/4 hp and above shall be 3-phase, all motors less than 3/4 hp shall be single phase.

B. Voltage and phase of motors as scheduled on the electrical drawings shall take precedence in the case of a conflict between the mechanical and electrical drawings or General Condition 2.1-A., above.

C. Work under Divisions 21, 22, and 23 includes coordinating the electrical requirements of all mechanical equipment with the requirements of the work under Division 26, before ordering the equipment:

   1. If motor horsepower is changed under the work of Divisions 21, 22, and 23, without a change in duty of the motor's driven device, coordination of additional electrical work (if any) and additional payment for the work (if any) shall be provided under the section of Divisions 21, 22, and 23 initiating the change. Increases or decreases in motor horsepower from that specified shall not be made without written approval from the Engineer.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 13
SECTION 01 31 19 – PROJECT MEETINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 REQUIREMENTS

A. The types and minimum requirements for project meetings are included but are not necessarily limited to the following categories:

1. Pre-construction meeting.
2. Progress and Coordination meetings.
3. Specially called meetings.

B. The pre-construction meeting will be scheduled within fifteen days after date of Notice to Proceed, at a central site location designated by the Owner and convenient for all parties.

1. Attendance:
   a. Owner's Representative.
   b. Consultant and sub-consultants, as applicable.
   c. Contractor's Superintendent.
   d. Major Subcontractor(s).
   e. Others as appropriate.

2. Suggested Agenda:
   a. Distribution and discussion of:
      (1) List of major subcontractors and suppliers
      (2) Projected construction schedules
      (3) Critical work sequencing
      (4) Major equipment deliveries and priorities
      (5) Project Coordination
      (6) Designation of responsible personnel
   b. Procedures and processing of:
      (1) Field decisions
      (2) Proposal requests
      (3) Submittals
      (4) Change Orders
      (5) Applications for Payment
   c. Adequacy of Distribution of Contract Documents
   d. Procedure for Maintaining Record Documents
e. Inspections
f. Storm Water Management Plan (SWMP)

C. The Contractor will Record the minutes; including significant proceedings and decisions.

D. The Contractor shall schedule and administer subcontractor and vendor pre-construction meetings throughout progress of the work. The Contractor shall:

1. Prepare agenda for meetings.
2. Distribute written notice of each meeting four days in advance of meeting date.
3. Make physical arrangements for meetings.
4. Preside at meeting.
5. Record the minutes; including significant proceedings and decisions.
6. Representatives of Contractors, Subcontractors, and Suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
7. Use of Premises:
   a. Office, work, staging, and storage areas
   b. Owner's requirements
10. Administrative Procedures and Documents as Required by Owner.

1.03 PROGRESS AND COORDINATION MEETING

A. The Contractor will schedule and administer job progress and coordination meetings at the site.

1. Attendance:
   a. Owner as needed.
   b. Consultant and sub-consultants as needed.
   c. Subcontractor as appropriate to the agenda.
   d. Suppliers as appropriate to the agenda.
   e. Others.

2. Suggested Agenda:
   a. Review of work progress since previous meeting.
   b. Field observations, problems and conflicts.
   c. Problems which impede Construction Schedule.
   d. Review of off-site fabrication and delivery schedules.
   e. Corrective measures and procedures to regain projected schedule.
   f. Revisions to Construction Schedule.
   g. Coordination of schedules.
   h. Progress and schedule during succeeding work period.
   i. Review submittal schedules and expedite as required.
   j. Maintenance of quality standards.
   k. Pending changes and substitutions.
I. Review proposed changes for:

   (1) Effect on Construction Schedule and on completion date.
   (2) Effect on other contracts of the Project.

B. The Architect/Engineer shall record and distribute the minutes of all progress meetings throughout the construction period and shall visit the site a minimum of once every week. The Architect/Engineer shall average one visit per week during construction.

   1. The Structural Engineer shall visit the site immediately prior to every major structural concrete slab pour; every major foundation wall pours; at least twice for each major segment of work (i.e., caissons, columns, steel roof joists, etc.).

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 19
SECTION 01 32 16 – CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION

A. Work Includes: The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner’s and Architect/Engineer’s information a Contractor’s construction schedule for the Work. Schedule shall not exceed time limits current under Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to entire Project to extent required by Contract Documents, and shall provide for expeditious and practicable execution of Work.

B. Coordinate Subcontractors’ schedules for entire project:

1. Secure time commitments for performing critical elements of Work from parties involved.
2. Coordinate each element on the schedule with other construction activities; include minor elements involved in sequence of Work.
3. Show each activity in proper sequence.
4. Indicate graphically the sequences necessary for completion of related portions of Work.
5. Resolve conflicts among schedules of Subcontractors.
6. Revise as required by conditions and progress of work.
7. Furnish copy of schedules for entire project to each Subcontractor.
8. Coordinate with Division 01 50 00 Section "Temporary Facilities and Controls".

1.03 SUBMITTALS

A. Project information:

1. Preliminary Construction Schedule: Provide to Owner and Architect/Engineer prior to start of Work, but not later than date set for preconstruction conference.
2. Project Schedules: Provide to Owner and Architect/Engineer within 21 calendar days of start of construction.
3. Updated Project Schedules:
   a. Provide to Owner and Architect/Engineer monthly.
   b. Provide if completion date is revised or sequence of Work is revised.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION

3.01 FORM OF SCHEDULES

A. Sheet size: Maximum 280 x 430 mm 11" x 17".

B. CPM Schedule:

1. Furnish a CPM schedule covering items of construction with, as a minimum, early/late start and early/late finish and normal float.
2. Schedule shall at a minimum correlate to the schedule of values line items.
3. Float, slack time, or contingency within the schedule (i.e. the difference between the projects early completion date and the required contract completion date), and total float within the overall schedule, is not for the exclusive use of either the Owner or the Contractor, but is jointly owned by both and is a resource available to and shared by both parties as needed to meet the contract completion date.

3.02 CONTENT OF SCHEDULES

A. Provide complete sequence of construction by activity.

1. Shop drawings, product data and samples:
   a. Submittal dates as indicated in approved Submittal Schedule.
   b. Dates reviewed copies will be required.

2. Decision dates for: Selection of finishes.
3. Product procurement and delivery dates.
4. Dates product information and delivery of Owner furnished, installed equipment and materials is needed.

B. Dates for early and late beginning, and completion of each element of construction.

C. Identify Work of separate floors, or separate phases, or other logically grouped activities.

D. Show how requirements for phased completion and partial occupancy by Owner affect sequence of Work.

E. Indicate important stages of construction for each major portion of Work, including submittal review, testing, and installation.

F. Identify punch list preparation and completion durations, agencies inspections, and Owner occupancy dates.

G. Show projected percentage of completion for each item of Work as of last day of every month.

H. Identify restraints and constraints.

I. Identify critical path and critical portions of entire schedule. There shall be only one critical path and it shall be clearly identified.
3.03 UPDATING

A. Show changes occurring since previous submission of updated schedules.

B. Indicate progress of each activity, actual verses scheduled start and completion dates, and actual verses scheduled percent complete by month.

C. Include:
   1. Major changes in scope.
   2. Activities modified since previous updating.
   3. Review projections due to changes.
   4. Other identifiable changes.

D. Provide narrative report including:
   1. Discussion of problem areas including current and anticipated delay factors and their impact.
   2. Corrective action taken or proposed and its effect.
   3. Effect of change in schedule.
   4. Description of revisions.
      a. Effect on schedule due to changes to Contract.
      b. Revisions in duration of activities.
      c. Other changes that may affect schedule.

3.04 DISTRIBUTION

A. Distribute copies of revised schedules to:
   1. Owner.
   3. Contractors/Subcontractors.
   4. Other concerned parties.

B. Instruct recipients to report inability to comply and provide detailed requirements and schedule, with suggested remedies.

3.05 University Events and Activities

A. A number of events will occur in and around the University of Colorado Boulder throughout the construction period. This Contractor will be required to limit noisy construction activities and may be required to cease work entirely. The Contractor shall include up to five (5) working days in the schedule to accommodate Owner requested work stoppage, without added cost or project time delay to the Owner.

B. The list of events for which a work stoppage could be requested is as follows:
   1. Finals – early May, and mid-December
   2. Commencements - early May, and mid-December
   3. High School Commencements - mid to end of May
4. Boulder Boulder Race – Memorial day and the day before
5. Home Football Games September thru November
6. Basketball Season – November thru March
7. Volleyball Season – August thru November
8. Orientation – Various
9. Move In – Mid August

C. Events which fall on a Saturday or Sunday shall not be counted against the allowable five
day stoppage requests.

END OF SECTION 01 32 16
SECTION 01 32 26 – PROGRESS REPORTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION

A. Work includes:

1. Compilation and submission of progress reports.
2. Taking and submission of progress photographs.
3. Project information:
   a. Progress Report: Submit copy with Application for Payment.
   b. Progress Photos: Submit digital photographs on compact disk (CD) with progress report showing current progress of Work. The photos should demonstrate the work in place and be dated with a short description of the photographed item.
   c. Contract Closeout: Provide to two compact disks (CD) of all digital progress photographs, and an index.

1.03 PROGRESS REPORTS

A. Each Subcontractor shall prepare comprehensive Daily Log and maintain it during entire project period.

B. Each Subcontractor shall submit copy of Daily Log to Contractor for compilation into monthly Progress Reports.

C. Contractor shall submit copies of Progress Reports and photos with each Application for Payment.

D. Progress report to include following:

1. Summary narrative for entire month.
2. Current total percent complete.
3. Current percent complete of major work activities.
4. Percent of work completed during past month.
5. Main work activities completed during prior month.
6. Main work activities in process and scheduled for next month, including major equipment deliveries, system tie-ins and system start-ups.
7. Overall status of project compared with project schedule.
8. Delays or potential delays, if any.
9. Sustainable Progress Reports: As specified in Division 1 Section “ENVIRONMENTAL REQUIREMENTS”.

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05-04-2012
E. Daily logs to include following data for each day of prior month.

1. Manpower, by trade.
2. Work performed, with location.
3. Weather.
4. Inspections.
5. Equipment on site.
6. Situations or circumstances which could delay work or give cause for claims for extension of time or added cost.
7. List of visitors names, to include officials, Owner’s representatives, and other authorities.

F. Progress reports to include progress photographs.

1. General:
   a. Include digital progress photographs on compact disk (CD) with progress report.
   b. Digital camera requirement: Minimum 4 megapixels resolution.
   c. Photograph format: JPEG format and file extension with 1600 by 1200 pixels, minimum.
   d. Digitally date photographs.

2. Identify photographs with project name, date, direction, and view or vantage point.
3. Photograph/file naming: Include date (YRMODY), Building or Area, Direction photo taken (N.S.E.W.), and Description of Subject.
   a. File Name Example: 070412_Area-A1_NE_AHU-6.jpeg.

4. Provide index of submitted digital photos.
5. Minimum 36 digital photos monthly until project exterior is finished, taken from different view points of interest, and related to current progress.
6. Minimum 36 digital photos monthly until project interior is finished, taken from different view points of interest, and related to current progress.
7. Contract Closeout: Provide to two compact disks (CD) of all digital progress photographs and an index.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 32 26
SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 Related Documents

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

1.02 SUMMARY:

A. This Section includes definitions, descriptions, transmittal, and review of Submittals.

B. Related Work Specified Elsewhere:

1. Project Meetings, Section 01 31 19.
2. Schedules 01 32 16
3. Progress reports 01 32 26
4. Operation and Maintenance Data 01 78 23

1.03 GENERAL INFORMATION:

A. Definitions:

1. Shop Drawings, product data, and Samples are technical Submittals prepared by Equipment Vendor, Installation Contractor, Subcontractor, manufacturer, or Supplier and submitted by CMGC to Engineer as a basis for approval of the use of Equipment and Materials proposed for incorporation in the Work or needed to describe installation, operation, maintenance, or technical properties, as specified in each Division of the Specifications.

a. Shop drawings include custom-prepared data of all types including drawings, diagrams, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.

b. Product data includes standard printed information on materials, products, and systems; not custom-prepared for this Project, other than the designation of selections from available choices.

c. Samples include both fabricated and un-fabricated physical examples of materials, products, and Work; both as complete units and as smaller portions of units of Work; either for limited visual inspection for more detailed testing and analysis. Mock-ups are a special form of Samples, which are too large to be handled in the specified manner for transmittal of Sample Submittals.

2. Informational Submittals are those technical reports, administrative Submittals, certificates, and guarantees not defined above.

a. Technical reports include laboratory reports, tests, technical procedures, technical records, and Equipment Vendor’s design analysis.

b. Administrative Submittals are those nontechnical Submittals required by the Contract Documents or deemed necessary for administrative records. These
Submittals include maintenance agreements, Bonds, project photographs, physical work records, statements of applicability, and copies of industry standards, project record data, security/protection/safety data, and similar type Submittals.

b. Certificates and guarantees are those Submittals on Equipment and materials where a written certificate or guarantee from the manufacturer or Equipment Vendor is called for in the Specifications.

3. Refer to ARTICLES 1.3 and 1.4 of this Part for detailed lists of documents and specific requirements.

B. Submittal of Documents:

1. As-constructed documents in accordance with UCB Standards shall be submitted on CD-ROM in Autodesk Revit format to the extent available along with all necessary elements necessary to generate the model. Format submitted will be approved by the Engineer. All detailed Revit specifications relevant to the model shall be provided.

2. Should the Equipment Vendor not use Autodesk Revit as their design software, the Equipment Vendor shall submit all drawings in AutoCAD and PDF format. If the Equipment Vendor uses 3D Software for design, in addition to the AutoCAD and PDF drawings, the drawings shall be converted to NavisWorks and submitted in that format.

   a. Drawings shall be presented in a clear and through manner.
   b. Details shall be identified by reference to sheet, detail, schedule, or room numbers shown on the drawings.

3. Product Data:

   a. Preparation:

      (1) Clearly mark each copy to identify pertinent products or models.
      (2) Show performance characteristics and capabilities
      (3) Show dimensions and clearances required
      (4) Show wiring or piping diagrams and controls

   b. Manufacturers standard schematic drawings and diagrams

      (1) Modify drawings and diagrams to delete information that is not applicable to the work.
      (2) Supplement Standard information to provide information specifically applicable to the work

4. Samples: Offices samples shall be of sufficient and quantity to clearly illustrate:

   a. Functional characteristics of the product with integrally related attachment devices.
   b. Full range of color, texture and pattern
5. Mock-ups:
   a. Provide complete mockup of exterior to be incorporated into the work
      (1) Mock-up shall include a sample of all materials used in exterior construction, whether specified elsewhere or not in these documents, including but not limited to, masonry, stone, window systems, precast concrete, roof systems, flashing, sealants, masonry paving, paint and other readily visible materials.
      (2) Secure Owner approval of mock-ups prior to ordering and placement of materials. Modify mock-ups as directed by the Architect or Owner until acceptable.
      (3) Confirm exact mock-up(s) required by Owner prior to fabrication of mock-up(s).
   b. Remove mock-up at the conclusion of the project or when directed by the Architect.
      (1) Restore or finish site to finish condition indicated on the Drawings.

C. Quality Requirements:

1. The Contractor will be provided a copy of the design team Revit programs linked to show the as designed configuration. The Contractor will have a produce a separate Revit model linked with the design documents to show the actual materials and equipment purchased and updated to show the actual final arrangement. The Contractor shall provide the updated Revit model to the University as the record drawings for the project.

2. Submit electronically in Portable Document Format (PDF) format as one document Optical Character Recognition (OCR) searchable, bookmarked according to the Construction Specification Institute Standards (CSI).

3. Documents submitted to Engineer that do not conform to specified requirements shall be subject to rejection by Engineer, and upon request by Engineer, Equipment Vendor shall resubmit conforming documents. If conforming Submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Equipment Vendor or its Subcontractor's failure to initially satisfy the legibility quality requirements will not relieve Contractor or its Subcontractors from meeting the required schedule for Submittals.

4. Documents submitted in electronic format shall have the drawing number and revision number as a part of the file name. Each submittal of a drawing that has been changed in any way shall be assigned the next revision number. Drawings submitted for approval shall be designated with revision letters. Drawings approved for construction shall be designated with revision number 0. Subsequent drawing revisions shall be designated with revision numbers. If the Equipment Vendor has in place a different written procedure for designation for revisions, it may be submitted in writing to the Engineer for approval on this project.

D. Language and Dimensions:

1. All words and dimensional units shall be in the English language.
2. Metric dimensional unit equivalents may be stated in addition to the English units. However, English units of measurement shall prevail. Care shall be used in conversion of units to eliminate round-off errors when strings of dimensions are added together.

E. Submittal Completeness:

1. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Engineer to review the information effectively.

2. Where standard drawings are furnished which cover a number of variations of the general class of Equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the Equipment being furnished. Use hatch marks to indicate variations that do not apply to the Submittal. The use of "highlighting markers" will not be an acceptable means of annotating Submittals. Annotation shall also include proper identification of the Submittal permanently attached to the drawing.

3. Reproductions or copies of Contract Drawings or portions thereof will not be accepted as complete fabrication or Installation drawings. Equipment Vendor may use a reproduction of Contract Drawings for installation drawings to indicate information on installation or to identify detail drawing references. Whenever the drawings are revised to show this additional Equipment Vendor information, Engineer's title block shall be replaced with an Equipment Vendor's title block, and Engineer's professional seal shall be removed from the drawing. The Equipment Vendor shall revise these installation drawings for subsequent Engineer revisions to the Contract Drawings.

   a. For any given Submittal, the filename and the format shall be consistent for the initial submission and the subsequent revisions of the same. Using consistent naming convention throughout.

      (1) Nonconforming submittals are subject to rejection by the Engineer.

   b. Provide “as-constructed” submittals, record documents, equipment instruction books and operating manuals, and other documents on CD-ROM in AutoCAD format as required and approved by Owner.

4. Digital delivery media shall be accomplished using the Engineer’s File Transfer Protocol (FTP) site as defined by the Engineer in the pre design conference.

F. Responsibilities of the Contractor:

1. Review shop drawings, product data, samples and project record drawings for specification performance prior to submission.

2. Determine and Verify:

   a. Field measurements
   b. Field construction criteria
   c. Catalog numbers and similar data
   d. Conformance with specifications
3. Coordinate each submittal with requirements of the work and of the Contract Documents.
4. Notify the Architect in writing, at the time of submission, of any deviations in the submittals for requirements of the Contract Documents.
5. Begin no fabrication or work that requires submittals until return of submittals with Architect's acceptance.
6. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Architect's review of submittals.
7. Contractor shall stamp, sign or initial, and date, each submittal to show compliance with the Contract Documents prior to submittal to the Architect.

1.04 TECHNICAL SUBMITTALS:

A. Items shall include, but not be limited to, the following:

1. Manufacturer's specifications.
2. Quality control procedures employed by Equipment manufacturers.
3. Catalogs, or parts thereof, of manufactured Equipment.
4. Shop fabrication and installation drawings.
5. General outline drawings of Equipment showing overall dimensions, location of major components and weights.
7. Installation drawings as specified, showing foundation details, anchor bolt sizes and locations, baseplate sizes, location of Owner's connections; and all clearances required for installation, operation, and disassembly for maintenance.
8. Foundation loads for equipment, and support structures.
9. Bills of material and spare parts list.
10. Material lists or schedules.
12. Samples and color charts.
13. All drawings, catalogs or parts thereof, manufacturer's specifications and data, samples, instructions, and other information specified or necessary:
   a. For Engineer to determine that the Equipment and materials conform to the design concept and comply with the intent of the Project Documents.
   b. For the proper installation, operation, and maintenance of the Equipment and Materials which Engineer will review for general content but not for basic details.
   c. For Engineer to determine what supports, anchorages, structural details, connections, and services are required for the Equipment and materials, and the effects on contiguous or related structures and Equipment and materials.

B. Schedule of Submittals:

1. Prepare for Engineer's concurrence, a schedule for submission of all Submittals specified or necessary for Engineer's approval of the use of Equipment and materials proposed for incorporation in the Work or needed for proper installation, operation, or maintenance. Submit the schedule with the procurement schedule and construction/fabrication progress schedule. Schedule submission of all
Submittals to permit review, fabrication, and delivery in time so as to not cause a delay in the Work of Equipment Vendor or Subcontractors as described herein.

2. In establishing schedule for Submittals, allow 10 working days in Engineer's office for reviewing original Submittals and 5 working days in Engineer's office for reviewing resubmittals.

3. The schedule shall indicate the anticipated dates of original submission for each item and Engineer's approval thereof, and shall be based upon at least one resubmission of each item.

4. Schedule all Submittals required prior to fabrication or manufacture for submission within the time specified for each. Schedule Submittals pertaining to storage, installation and operation at the Site for Engineer's approval prior to delivery of the Equipment and materials.

5. Resubmit Submittals the number of times required for Engineer's "Submittal Approved." However, any need for resubmittals in excess of the number set forth in the accepted schedule, or any other delay in obtaining approval of Submittals, will not be grounds for extension of the Contract Times, provided Engineer completes its reviews within the times specified.

C. Transmittal of Submittals:

1. All Submittals for Equipment and Materials furnished by Equipment Vendor, including Subcontractors, Suppliers, and manufacturers shall be submitted to Engineer by CMGC.

2. Transmit all Submittals to Engineer for approval as follows:

   a. All submittals shall be identified with the following data:

      (1) University of Colorado Boulder
      (2) Contract No. CP144260
      (3) Equipment item number and description
      (4) CMGC's Name
      (5) Equipment Vendor Name
      (6) Installing Contractor's Name
      (7) Equipment Vendor's Job Reference No.

   b. Identify each Submittal by Project name and number, Contract title and number, and the Specification. The Equipment Vendor's job code and sub job code number shall appear on each Submittal.

   c. Check and include Equipment Vendor and Installation Contractor's approval for Submittals of Subcontractors, Suppliers, and manufacturers prior to transmitting them to Engineer. Equipment Vendor and Installation Contractor's approval shall constitute a representation to Owner and Engineer that Contractor has either determined or verified all quantities, dimensions, materials, catalog numbers, and similar data or Contractor assumes full responsibility for doing so, and that Equipment Vendor and Installation Contractor has coordinated each Submittal with the requirements of the Work and the Contract Documents.

   d. At the time of each submission, call to the attention of Engineer in the letter of transmittal any deviations from the requirements of the Contract Documents.

   e. Make all modifications noted or indicated by Engineer and return revised submittals until the status of Conformance has been achieved. Direct specific
attention in writing, on revised Submittals, to changes other than the modifications called for by Engineer on previous Submittals. After Submittals have been given the status of Conformance, submit for final distribution. Drawings transmitted for final distribution that have previously been given the stature of Conformance will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the Submittal and resubmit for review.

f. Following completion of the Work and prior to final payment, furnish record documents and Samples and Submittals that conform necessary changes to indicate "as-constructed" conditions, including field modifications. Submit revisions to Equipment instruction books and operating manuals as required. Submit a final Submittal list, which shall indicate the final revision status of each drawing on the list.

3. Quantity Requirements:

a. Except as otherwise specified, transmit all Submittals as follows:

   (1) Initial Submittal: One Electronic copy to the Engineer and one electronic copy to the Owner. One copy will be returned electronically by the Engineer to the CMGC and the Owner with the appropriate approval or comments.

   (2) Resubmittals: One Electronic copy to the Engineer and one electronic copy to the Owner. One copy will be returned electronically by the Engineer to the CMGC and the Owner with the appropriate approval or comments.

   (3) Submittal for final distribution: One Electronic copy to the Engineer and one electronic copy to the Owner.

   (4) As-constructed prints: P

b. Transmit Submittals of Material Samples, color charts, and similar items as follows:

   (1) Initial Submittal: One copy to Owner. The Engineer will provide the appropriate approval or comments back to the CMGC.

   (2) Resubmittals: One copy to Owner. The Engineer will provide the appropriate approval or comments back to the CMGC.

c. Transmit Submittals for Reference only – One Electronic copy to the Engineer and one electronic copy to the Owner.

d. Instruction books, operating manuals, and as constructed drawings should be sent to the Engineer and Owner prior to substantial completion.

e. Owner may copy and use for internal operations and staff training purposes any and all document Submittals required by this Contract and accepted for final distribution, whether or not such documents are copyrighted, at no additional cost to Owner.

4. Information to Manufacturer's District Office: Manufacturers and Equipment Vendors of Equipment and materials shall furnish copies of all agreements, drawings, specifications, operating instructions, correspondence, and other matters associated with this Contract to the manufacturer's district office servicing the
Owner. Insofar as practicable, all business matters relative to Equipment and materials included in this Contract shall be conducted through such local district offices.

D. Engineer's Review:

1. Engineer will review and take appropriate action on Submittals in accordance with the accepted Schedule of Submittals. Engineer’s review and approval will be only to determine if items of Equipment and Materials covered by the Submittals are compatible with the design concept and conform to information given in the Contract Documents.

2. Such review and approval will not extend to design data reflected in Submittals which is particularly within the special expertise of Equipment Vendor or Equipment Vendor's Subcontractors or Suppliers. Review and approval of a component item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval of Shop Drawings, product data, or Samples will not relieve Equipment Vendor of responsibility for any deviation from requirements of the Contract Documents unless Equipment Vendor has in writing called Engineer's attention to such deviation at the time of submission, and Engineer has given written concurrence in and approval of the specific deviation. Approval by Engineer shall not relieve Equipment Vendor from responsibility for errors or omissions in Submittals.

E. Submittal Action Stamp:

1. Engineer's review action stamp, appropriately completed, will appear on all Submittals of Equipment Vendor when returned by Engineer. Review status designations listed on Engineer's action stamp are defined as follows:

   a. Conformance: Signifies Equipment or Material represented by the Submittal conforms to the design concept and complies with the intent of the Contract Documents and is approved for incorporation in the Work. Equipment Vendor is to proceed with fabrication or procurement of the items and with related Work. Copies of the Submittal are to be transmitted for final distribution.

   b. Conformance as Noted: Signifies Equipment and Material represented by the Submittal conforms to the design concept and complies with the intent of the Contract Documents and is approved for incorporation in the Work in accordance with Engineer's notations. Equipment Vendor is to proceed with fabrication or procurement of the items and with related Work in accordance with Engineer's notations and is to submit a revised Submittal responsive to notations marked on the returned Submittal or written in the letter of transmittal.

   c. Submittal Returned for Correction: Signifies Equipment and Material represented by the Submittal does not conform to the design concept or comply with the intent of the Contract Documents and is disapproved for use in the Work. Equipment Vendor is to provide Submittals responsive to the Contract Documents.

   d. For Reference: Signifies Submittals which are for supplementary standard sheets, bulletins and similar data, all of which are useful to Engineer or Owner in design, operation, or maintenance, but which by their nature do not constitute a basis for determining that items represented thereby conform with
the design concept or comply with the intent of the Contract Documents. Engineer reviews such Submittals for general content but not for basic details.

F. Device Lists: The Equipment Vendor shall provide a device list showing all devices provided by the Equipment Vendor and vendors of the Equipment Vendor which includes the Owner’s Engineer assigned device numbers. These device numbers shall be used for identification of devices on Equipment Vendor’s drawings and as tag numbers for shipping of devices for mounting by the Equipment Vendor or by others. During the kickoff meeting, the successful Equipment Vendor will be supplied with the designations to be used for device identification and blocks of numbers will be assigned for Equipment Vendor’s use. The required format is shown in the contract documents Number

G. Connection Lists: The Equipment Vendor shall provide a connection list listing all interface terminal points for piping provided by the Equipment Vendor. This list shall indicate the identification of the terminal point, operating and design conditions for the connection and terminal preparation for the connection. A format for the required connection list will be provided to the successful bidder at the kickoff meeting.

1.05 INFORMATIONAL SUBMITTALS:

A. Informational Submittals are comprised of technical reports, administrative Submittals, and guarantees, which relate to the Work, but do not require Engineer approval prior to proceeding with the Work. Informational Submittals include but are not limited to:

1. Structural calculations.
2. Test Reports.
3. ASME pressure vessel test reports.

B. Transmittal of Informational Submittals:

1. All informational Submittals furnished by Equipment Vendors, Subcontractors, manufacturers, and Suppliers shall be submitted to Engineer by CMGC unless otherwise specified.

   a. Identify each informational Submittal by Project name and number, Contract title and number, and the Specification Section and Article number marked thereon or in the letter of transmittal. Unidentifiable Submittals will be returned for proper identification.

At the time of each submission, call to the attention of Engineer in the letter of transmittal any deviations from the requirements of the Contract Documents.

2. Quantity Requirements:

   a. Technical reports and administrative submittals, except as otherwise specified – one electronic copy to the Engineer, one electronic copy and one paper copy to the Owner.

   b. Written Certificates and Guarantees – One electronic copy and one paper copy to Engineer, one electronic copy and one paper copy to Owner.
3. Test Reports:

   a. Responsibilities of CMGC, Owner, and Engineer regarding tests and
      inspections of Equipment and Materials and completed Work are set forth
      elsewhere in these Contract Documents.
   b. The party specified responsible for testing or inspection shall in each case,
      unless otherwise specified, arrange for the testing laboratory or reporting
      agency to distribute test reports as follows:

      (1) Owner – one electronic copy and one paper copy.
      (2) Engineer - one electronic copy.
      (3) CMGC – two copies.
      (4) Manufacturer or/ or Installation Contractor – one copy.

C. Engineer's Review:

   1. Engineer will review informational Submittals for indications of Work or Material
      deficiencies.
   2. Engineer will respond to CMGC on those informational Submittals, which indicate
      Work or Material deficiency.

D. Contract Price Breakdown:

   1. In addition to the schedule of values prepared and submitted as a basis for partial
      payments, Equipment Vendor and Installation Contractor shall prepare a Contract
      Price Breakdown for Owner's accounting purposes and submit to Engineer and
      Owner prior to invoicing.
   2. The price breakdown shall include property units itemized by the Engineer.
   3. Nameplate Data: Equipment Vendor shall submit to the Engineer and Owner prior
      to final payment, complete nameplate data for all Equipment furnished under this
      Contract, including, but not limited to, machinery, motors, drives, pumps, major
      electrical power panels and transformers. Data shall include nameplate
      identification, sizing and wording as shown on nameplate.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 33 00
SECTION 01 35 13 - SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. Section Includes:

1. Renovation Work scheduling.
2. Construction sequence scheduling.

B. Related Sections: Division 1 Section "TEMPORARY FACILITIES AND CONTROLS."

1.03 SYSTEM DESCRIPTION

A. An essential condition of this Contract shall be the scheduling and conduct of all phases of construction operations in such a manner that the Owner's operations and use of the existing buildings and campus shall be uninterrupted at all times, except for such limited interruption as is required and approved by the owner.

B. Contractor shall repair all damage done to Owner's property, unknown utilities and adjoining public property as a result of Contractor's construction activities.

1.04 PROJECT/SITE CONDITIONS

A. Access and Use of Site:

1. Contractor shall use the designated site access for construction offices and material storage in such a manner that access to existing buildings and campus remain accessible at all times for use.
2. Confine operations to as limited a use of the existing building and campus as possible. A route of access to and from the work for employees shall be agreed upon and it shall be the Contractor's responsibility to see that the agreed route is maintained in order to prevent unwarranted or unnecessary traffic through the existing buildings or site.

B. Owner Notice and Approval:

1. All arrangements and scheduling in connection with the work of this Contract shall be made with and subject to the approval of the Consultant and the Owner.
2. All work under this Contract which will require interruption of service of an existing building shall be scheduled to suit the need and convenience of the Owner's operation, and arrangements shall be made with the Owner and the Architect/Engineer at least 8 working days in advance of the start of such work.
PART 3 - EXECUTION

3.01 METHOD OF PROCEDURE

A. A Method of Procedure (MOP) shall be assembled and submitted for review along with at least one MOP meeting with the Owner’s operations and Architect/Engineer to finalize the interruption of services.

END OF SECTION 01 35 13
SECTION 01 35 30 - CONSTRUCTION IAQ MANAGEMENT PLANS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out along with baseline indoor air quality testing prior to Owner occupancy.

B. Related Section: Division 1 Section "ENVIRONMENTAL REQUIREMENTS" for environmental requirements overview, including U S Green Building Council’s LEED NC v2.2 requirements.

1.03 DESCRIPTION, GENERAL

A. IAQ Management during Construction: Minimize contaminants generated during construction. Methods to include, but not limited to:

1. Practices which minimize the amount of dust generated.
2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.
3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.
4. No visible haze in the air.

B. IAQ Management Plan before Occupancy: Minimize indoor pollutant concentrations to required levels prior to Owner occupancy. Provide building flush out and/or baseline testing of targeted pollutants.

1.04 SUBMITTALS

A. Environmental Information: Comply with submittal requirements specified in Division 1 Section "Environmental Requirements" for LEED Credits EQ 3.1 and 3.2, Construction IAQ Management Plan, During Construction and Before Occupancy.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION

3.01 CONSTRUCTION IAQ MANAGEMENT DURING CONSTRUCTION

A. LEED Credit EQc3.1, Construction IAQ Management Plan, During Construction: General
IAQ Plan requirements during construction include:

1. Compliance with “SMACNA Guidelines for Occupied Buildings under Construction.”
2. Provide solid physical barriers to isolate areas of construction. Securely attach and
   seal at floor and structure above.
3. Schedule adequate time for product installation.
4. Maintain negative pressure in construction area.
5. Do not recirculate air prior to occupancy.
6. Seal return air ducts and use direct exhaust to outside.
8. Comply with manufacturer’s instructions for appropriate drying times.
9. Protect installed absorbent materials with recycled or recyclable materials.
10. Use MERV 8 filtration at all return air inlets if permanent HVAC system is used
during construction.
11. Take photos of IAQ Management strategies

B. The IAQ Plan shall meet or exceed the five SMACNA requirements and shall include the
following measures:

1. HVAC Protection.
2. Source Control.
3. Pathway Interruption.
4. Housekeeping.
5. Scheduling.

C. HVAC Protection:

1. Protect air handling and distribution equipment, and air supply and return ducting
during construction.
2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts,
   plenums, as required to prevent water, moisture, and other contaminant intrusion.
3. Apply protection immediately after installation of equipment and ducting.
4. Ducting runs that require more than a single day to install shall be protected at the
   end of each day’s Work.
5. During dust producing activities, (e.g., drywall installation and finishing), turn the
   ventilation system off, and protect HVAC supply and return openings from dust
   infiltration. Provide temporary ventilation as required.

D. Source Control:

1. Protect stored on-site or installed absorptive or porous materials such as bat
   insulation and drywall from exposure to moisture.
2. Do not use wet, damaged porous materials in the building. Materials with evidence
   of moisture damage, including stains, are not acceptable, including both stored and
   installed materials. Immediately remove them from the site and properly dispose.
3. Preconditioning:
   a. Prior to delivery to the construction site allow products that have odors and significant volatile organic compound (VOC) emissions to off-gas in dry, well ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions.
   b. Condition products, without containers and packaging, to maximize off-gassing of VOCs.
   c. Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously during the ventilation period.
   d. Do not ventilate within limits of Work unless otherwise accepted by Architect/Engineer.
   e. Comply with substitution requirements for consideration of other locations.

4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.

5. Replace moldy materials with new, undamaged materials.

6. Provide sufficient ventilation, air circulation and air changes to dissipate excess humidity when present.

E. Pathway Interruption:

1. All openings within the designated work area shall be sealed.
2. Adequate exhaust ventilation equipment shall be installed to maintain a negative pressure differential between the work area and adjacent areas of the building.
3. Units shall be exhausted to the outside of the building.

F. Housekeeping:

1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.
2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:
   a. Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is stated in these Specifications, a period of 72 hours shall be used.
   b. Ventilate areas directly to outside, do not ventilate to other enclosed spaces.
   c. If continuous ventilation is not possible via the building’s HVAC system(s), then ventilate via open windows and temporary fans that sufficiently provide no less than three air changes per hour.

3. Suppress dust with wetting agents or sweeping compounds.
4. Clean-up dust using a wet rag or damp mop.
5. Increase the cleaning frequency when dust build-up is noted.
6. Remove spills or excess applications of solvent-containing products as soon as possible.
7. Remove accumulated water and keep work areas as dry as possible.
8. Store volatile liquid containers closed when the container is inside of the building and not in use.

9. Keep volatile liquid containers closed when the container is inside of the building and not in use.

10. HEPA vacuuming and duct cleaning.
   
   a. Vacuum carpeted and soft surfaces with a high efficiency particulate arrestor (HEPA) vacuum.
   
   b. If ducts contain dust and dirt, clean them using a HEPA vacuum immediately before substantial completion and prior to using the ducts to circulate air.
   
   c. Oil film on sheet metal should be removed before shipment to site. However, ducts will be inspected to confirm that no oil film is present. Remove any oil.

11. Use nontoxic cleaning materials and procedures.
   
   a. Alternatives to toxic cleaning agents include:
      
      (1) Vinegar.
      
      (2) Citrus.
      
      (3) Borax.
      
      (4) Cornstarch.
      
      (5) Baking Soda.
   
   b. Examples of nontoxic alternatives for several cleaning methods are listed below:
      
      (1) Abrasive Cleaners: Substitute half lemon dipped in borax.
      
      (2) Ammonia Cleaners: Substitute vinegar, salt, and water mixture; or baking soda and water.
      
      (3) Disinfectants: Substitute half cup borax in a gallon of water.
      
      (4) Drain Cleaners: Substitute one forth cup baking soda and one forth cup vinegar in boiling water.
      
      (5) Upholstery Cleaners: Substitute dry cornstarch.

G. Scheduling:

1. Where odorous and/or high VOC-emitting products are applied on site, apply them before installation of porous and fibrous materials. Where this is not possible, protect porous materials with polyethylene vapor retarders.

2. Ensure that wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are properly and fully cured before installing other finish materials over them.

3. Install carpets and furnishings after all other interior finish materials have been applied and fully cured.

4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.

5. Complete interior finish material installation no less than 14 days prior to Substantial Completion to allow for building flush-out and testing prior to occupancy.
3.02 CONSTRUCTION IAQ MANAGEMENT PRIOR TO OCCUPANCY

A. LEED Credit EQc3.2, Construction IAQ Management Plan, Prior to Occupancy: General
IAQ Plan requirements prior to occupancy include completion of one of the following
approaches:

1. Whole Building Flush out: After construction ends, prior to occupancy and with all
interior finishes installed, perform a building flush-out by supplying a total volume of
14000 cu. ft. of outdoor air per sq. ft. of floor area, while maintaining an internal
temperature of at least 60 deg F and a relative humidity of no higher than
60 percent.
2. Air Quality Testing:

   a. Conduct baseline indoor air quality testing, after construction ends and prior to
      occupancy, using testing protocols consistent with the EPA’s “Compendium of
      Methods for the Determination of Air Pollutants in Indoor Air and as additionally
detailed in the USGBC’s “LEED-NC NC v2.2 Reference Guide.”
   b. Demonstrate that the contaminant maximum concentrations listed below are
      not exceeded:

      (1) Formaldehyde: 50 ppb.
      (2) Particulates (PM10): 50 micrograms/cu. m.
      (3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
      (4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
      (5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor
levels.

   c. For each sampling point where the maximum concentration limits are
      exceeded, conduct additional flush out with outside air and retest the specific
      parameter(s) exceeded to indicate the requirements are achieved. Repeat
      procedure until all requirements have been met. When retesting noncomplying
      building areas, take samples from same locations as in the first test.

d. Air sample testing shall be conducted as follows:

   (1) All measurements shall be conducted prior to occupancy but during
      normal occupied hours and with building ventilation system starting at
      the normal daily start time and operated at the minimum outside air flow
      rate for the occupied mode throughout the duration of the air testing.
   (2) Building shall have all interior finishes installed including, but not limited
to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings
      such as workstations and partitions are encouraged, but not required, to
      be in place for the testing.
   (3) Number of sampling locations will vary depending on the size of building
      and number of ventilation systems. For each portion of building served
      by a separate ventilation system, the number of sampling points shall not
      be less than one per 25,000 sq. ft. or for each contiguous floor area,
whichever is larger, and shall include areas with the least ventilation and
      greatest presumed source strength.
(4) Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

END OF SECTION 01 35 30
PART 1 - GENERAL

1.01 SUMMARY

A. This is an overview of the special environmental requirements of this project. Work includes environmental, sustainable, and “green” building practice requirements related to energy conservation and efficiency, indoor air quality, and resource efficiency. It is the goal of this project, as much as is feasible and practical, to construct a “green” building that meets the US Green Building Council's LEED™ Green Building Rating System Version as follows:

1. LEED-NC Version 2.2.
2. Rating: Gold.

B. General environmental goals for this project include:

1. Design and construction practices to obtain healthy indoor air quality (IAQ) in final Project.
2. Maximum use of durable products that contain minimal volatile organic components.
3. Maximum use of products that are easy to maintain, repair, and that can be cleaned using non-toxic substances with low volatile organic components.
4. Maximum use of recycled content in materials, products, and systems.
5. Use of wood from Forest Stewardship Council certified sustainable harvested sources.
6. Reusable and recyclable packaging.
7. Use of products with low embodied energy

C. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect/Engineer’s design and other aspects of Project that are not part of the Work of the Contract.

D. Related Sections: Divisions 1 through 33 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

E. Construction team is required to comply with sustainable building practices during construction and when considering materials for substitutions.

1.02 DEFINITIONS

A. General: Following is partial list of definitions of sustainable terms:

1. Chain-of-Custody: Tracking procedure to document status of product from point of harvest or extraction to ultimate consumer end use.
2. Chlorofluorocarbons (CFCs): Hydrocarbons used as refrigerants that deplete stratospheric ozone layer.
3. **Construction IAQ Management Plan**: Document specific to building project that outlines measures to minimize contamination in building during construction and to flush building of contaminants prior to occupancy.

4. **Construction Waste Management**: Diversion of construction, demolition, and land clearing debris from landfill disposal; redirection of recyclable material back to manufacturing process.

5. **Day lighting**: Controlled admission of natural light into space through glazing with intent of eliminating electric lighting.

6. **Ecosystem**: Basic unit of nature that includes community of organisms and their nonliving environment linked by biological, chemical, and physical process.

7. **Embodied Energy of Materials**: Energy use over life cycle of material including harvesting, mining, manufacturing, transport, installation, use, operations, recycling and disposal.

8. **Energy Conservation**: Strategies that maximize energy efficiency in order to reduce lifecycle requirements and costs.

9. **Heat Island Effect**: Effect that occurs when warmer temperatures are experienced in urban landscapes as result of solar energy retention on constructed surfaces.

10. **Hydrochlorofluoro carbons (HCFCs)**: Refrigerants that deplete stratospheric ozone layer.

11. **Hydrofluoro carbons (HFCs)**: Refrigerants that do not deplete stratospheric ozone layer but do contribute to global warming and are not environmentally benign.

12. **Impervious Surfaces**: Surfaces that promote runoff of precipitation volumes instead of infiltration into subsurface.

13. **Indoor Air Quality (IAQ)**: Nature of air that affects health and well-being of building occupants.

14. **Indoor Environmental Quality (IEQ) Strategies**: Strategies that include issues related to indoor air quality (IAQ) such as ventilation effectiveness and control of contaminants.

15. **Industrial Scrap**: By-product of industrial process that can easily be reused as feedstock.

16. **Life-Cycle Assessment (LCA)**: Informed process that considers initial capital cost in addition to ownership and maintenance costs over specified lifetime of building component, design strategy, or other measure associated with building alternatives.

17. **Light Pollution**: Waste light from building sites that produces glare, compromises astronomical research, and adversely affects environment.

18. **Local/Regional Products**: Products that are manufactured locally, within 500 miles of Project site. Manufacturing refers to final assembly of components of building product.

19. **Post-Consumer Recycled Content**: Percentage of waste material by weight available from consumer use incorporated into building material.

20. **Pre-Consumer Recycled Content**: Percentage of waste material by weight available from industrial use incorporated into building material.

21. **Rapidly Renewable Resources**: Those materials that substantially replenish themselves faster than traditional extraction demand (i.e., planted and harvested in less than 10 year cycle) and do not result in significant biodiversity loss, increase erosion, air quality impacts, and that are sustainably managed.

22. **Recycling**: Collection, reprocessing, marketing and use of materials that were diverted or recovered from solid waste stream.

23. **Reduction**: Strategy to minimize material use or to use materials more efficiently.

24. **Reuse**: Strategy to return materials to active use in same or related capacity.
26. Stormwater Runoff: Water volumes that are created during precipitation events and flow over surfaces into sewer systems or receiving waters.
27. Sustainable Forestry: Practice of managing forest resources to meet long-term forest product needs of humans while maintaining biodiversity of forested landscapes.
30. Volatile Organic Compounds (VOCs): Carbon compounds that participate in atmospheric photochemical reactions and have high enough vapor pressure to vaporize from material surfaces into indoor air at normal room temperatures (off-gassing).

1.03 SUBMITTALS

A. General: Submit additional LEED submittals required by other Specification Sections.

B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements. Identify Section number and LEED Credit on each LEED submittal.

1. LEED submittals shall include completed submittal forms as seen at the end of this section in addition to other required documentation.
   a. LEED EQ Submittal Form for Low Emitting Materials.
   b. LEED MR Submittal Form for Materials and Resources.

C. Project Materials Cost Data: Provide statement indicating total cost of materials for Project. Materials costs must exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
   1. Furniture.
   2. Plumbing.
   3. Mechanical.
   4. Electrical.
   5. Specialty items such as elevators and equipment.

D. Materials Log Book: A materials log book is required that includes Material Safety Data Sheets (MSDS) sheets and additional information on chemical content of selected materials, including Volatile Organic Compounds (VOC) in terms of grams per liter (g/L). This log book shall be maintained by contractor throughout life of project, shall be updated monthly to include any newly approved products, shall be available at all times to Architect/Engineer and Owner’s Representative, and shall be submitted at conclusion of construction as part of LEED documentation.
E. LEED Action Plans: Provide preliminary submittals within 21 days of date established for commencement of the Work indicating how the following requirements will be met:

1. LEED Credits MRc2.1 and MRc2.2, Construction Waste Management: Waste management plan complying with Division 1 Section 01 74 19 Construction Waste Management.

2. LEED Credit MRc4.1 and Credit MRc4.2, Recycled Content: List of proposed materials with recycled content. Indicate separate percentages, by weight, of pre-consumer and post-consumer recycled content per unit of product. Also include material costs, excluding cost of installation.

3. LEED Credits MRc5.1 and MRc5.2, Local/Regional Materials: List of proposed regional materials. Indicate location of manufacturing facility including name, address and distance indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs, excluding cost of installation.

4. LEED Credit MRc7, Certified Wood: List of proposed certified wood products. Provide documentation from the manufacturer certifying that wood based product is made from wood obtained from forests certified by an FSC accredited certification body to comply with the Forest Stewardship Councils "Principles and Criteria." Include cost of material and chain-of-custody certification number obtained from manufacturer. Vendor's invoices must be included with chain-of-custody certificate number listed.

5. LEED Credit EQc3.1, Construction IAQ Management Plan, During Construction: Construction indoor air quality management plan.


F. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:

1. LEED Credits MRc2.1 and MRc2.2, Construction Waste Management: Waste reduction progress reports complying with Division 1 Section "Construction Waste Management."

2. LEED Credits MRc4.1 and MRc4.2, Recycled Content: Recycled content progress reports.

3. LEED Credits MRc5.1 and MRc5.2, Local/Regional Materials: Regional materials progress reports.

4. LEED Credit MRc7, Certified Wood: Certified wood products progress reports.

G. LEED Documentation Submittals:

1. LEED Credit EAc5, Measurement and Verification: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over a period of not less than one year of post construction occupancy.

2. LEED Credit MRc4.1 and Credit MRc4.2, Recycled Content: Provide list of proposed materials with recycled content. Indicate separate percentages, by weight, of pre-consumer and post-consumer recycled content per unit of product. Also include material costs, excluding cost of installation.
3. LEED Credit MRc5.1 and Credit MRc5.2, Regional Materials: Provide list of proposed regional materials. Indicate location of manufacturing facility including name, address and distance indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs, excluding cost of installation.

4. LEED Credit MRc7, Certified Wood: Provide list of proposed certified wood products. Provide documentation from the manufacturer certifying that wood based product is made from wood obtained from forests certified by an FSC accredited certification body to comply with the Forest Stewardship Councils "Principles and Criteria." Include cost of material and chain-of-custody certification number obtained from manufacturer. Vendor's invoices must be included with chain-of-custody certificate number listed.

5. LEED Credit EQc3.1, Construction Indoor Air Quality Plan During Construction:
   a. Construction indoor-air-quality management plan.
   b. Product data for temporary filtration media.
   c. Product data for filtration media used during occupancy.
   d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.

6. LEED Credit EQc3.2, Construction Indoor Air Quality Plan Before Occupancy:
   a. Signed statement describing the building air flush out procedures including dates when flush out was begun and completed and statement that filtration media was replaced after flush out.
   b. Product data for filtration media used during flush out and during occupancy.
   c. Report from testing and inspecting agency indicating results of indoor air quality testing and documentation showing compliance with indoor air quality testing procedures and requirements.

7. LEED Credit EQc4.1, Low-Emitting Materials, Adhesives and Sealants: Provide product data and material safety data sheets (MSDS) for adhesives and sealants used inside the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.

8. LEED Credit EQc4.2, Low-Emitting Materials, Paints and Coatings: Provide product data and material safety data sheets (MSDS) for paints and coatings used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.

9. LEED Credit EQc4.3, Low-Emitting Materials, and Carpet Systems: Provide product data and material safety data sheets (MSDS) for carpeting and carpet adhesives indicating certification from the Carpet and Rug Institute Green Label Plus program for carpet and adherence with VOC limits for carpet adhesives.

10. LEED Credit EQc4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Provide product data indicating the type of binder used, and confirming the product does not contain urea-formaldehyde resin binders.

H. Environmental Project Management and Coordination: Prior to the pre-construction meeting, Contractor shall identify and assign one person on Contractor's staff to be the
Environmental Project Manager who shall be responsible for environmental issues compliance and coordination.

1. Experience: Similar responsibilities and successful performance for previous sustainable building construction project(s).

2. Responsibilities: Carefully review Contract Documents for environmental issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to environmental issues; and oversee Project Environmental Goals.
   a. Assemble and retain approved Environmental Submittals, tabulation charts and other records to document progress toward meeting environmental requirements.
   b. Provide records in secure jobsite location, available for review by Architect/Engineer or Owner.
   c. Provide Action Plans, Progress Reports and final documentation according to specified requirements and schedule.
   d. Assist Owner in preparing submission to US Green Building Council.

3. Meetings: Lead discussion of Environmental Goals at following meetings:
   a. Pre-construction meetings.
   b. Waste management conference.
   c. Pre-installation meetings.
   d. Regularly scheduled job-site meetings.
   e. Special sustainability issues meetings.

I. Environmental Issues Criteria: Comply with requirements listed in specification Sections.

1.04 ENVIRONMENTAL CONSIDERATIONS FOR DELIVERY, STORAGE, AND HANDLING

A. Packaging: Deliver materials in recyclable or in reusable packaging such as cardboard, wood, paper, or reusable blankets, which shall be reclaimed by supplier or manufacturer for recycling.

B. Minimize packaging materials to maximum extent possible while still ensuring protection of materials during delivery, storage, and handling.

1. Unacceptable Packaging Materials: Polyurethane, polyisocyanurate, polystyrene, polyethylene, and similar plastic materials such as foam plastics and shrink-fit plastics.
2. Reusable Blankets: Deliver and store materials in reusable blankets and mats reclaimed by manufacturers or suppliers for reuse where program exists or where program can be developed for such reuse.
3. Pallets: Where pallets are used, suppliers shall be responsible to ensure pallets are removed from site for reuse or for recycling.
4. Corrugated Cardboard and Paper: Where paper products are used, recycle as part of construction waste management recycling program, or return to material’s manufacturer for use by manufacturer or supplier.
5. Sealants, Paint, Primers, Adhesives, and Coating Containers: Return to supplier or manufacturer for reuse where such program is available.
1.05 PROJECT CONDITIONS

A. Provide and maintain controlled interior environment in accordance with following requirements before beginning installation of interior finish materials in order to dilute and exhaust vapors produced by solvents and other carriers from liquid materials, and particulate matter from residual manufacturing chemicals contained in solid product.

B. No smoking will be permitted in indoor Project site locations.

C. Construction Ventilation and Preconditioning, General: Comply with product emission testing procedures specified in Division 1 Section "Indoor Air Quality Protection During Construction" and additional testing requirements specified in Mechanical Specification Divisions.

1.06 CLEANING AND PROTECTION, ENVIRONMENTAL ISSUES

A. Final Cleaning, Environmental Issues:

1. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces using cleaning and maintenance products as described in Division 1 Section "Closeout Procedures".

2. Clean equipment and fixtures to sanitary condition using cleaning and maintenance products as described in Division 1 Section "Closeout Procedures".

3. Vacuum carpeted and soft surfaces with high efficiency particulate arrestor (HEPA) vacuum.

4. Duct Cleaning: Comply with requirements indicated in National Air Duct Cleaning Association (NADCA) standards in NADCA's Assessment, Cleaning and Restoration 2002 Standard and related NADCA documents, and the following:

   a. Clean ducts using HEPA vacuum immediately prior to Substantial Completion and prior to shipment to site. However, ducts shall be inspected to confirm that no oil film is present. Remove oil.

5. Replace air filters (i.e., pre and final filters) just prior to Substantial Completion with filters having a MERV 13 rating or higher.

6. Remove and properly dispose of recyclable materials using construction waste management program specified in Division 1 Section "Construction Waste Management".

B. Protection, Environmental Issues:

1. Moisture Damage: Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew on packaging and on products.

   a. Immediately remove from site and properly dispose of materials showing signs of mold and signs of mildew, including materials with moisture stains.

   b. Replace moldy and mildewed materials with new, undamaged materials.
2. Protect interior materials from water intrusion or penetration; where interior products are not intended for wet applications are exposed to moisture.
3. Protect installed products using methods that do not support growth of molds and mildews.

1.07 SEQUENCING

A. Environmental Issues:

1. On-Site Application: Where odorous and/or high VOC emitting products are applied onsite, apply prior to installation of porous and fibrous materials. Where this is not possible, protect porous materials with polyethylene vapor retarders.
2. Complete interior finish material installation no less than fourteen days prior to Substantial Completion to allow for building flush out.

PART 2 - PRODUCTS

2.01 ENVIRONMENTAL PRODUCTS, GENERAL

A. Comply with specified requirements for environmental characteristics of products, systems and assemblies. The following Articles contain product requirements of LEED Green Building Rating System Credits, as indicated.

2.02 RECYCLED CONTENT OF MATERIALS

A. LEED Credit MRc4.1 and Credit MRc4.2, Recycled Content: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of cost of materials used for Project.

1. Cost of post-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
2. Cost of pre-consumer recycled content of an item shall be determined by dividing weight of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
3. Do not include plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.
4. Recycled content of materials shall be defined according to the International Organization for Standardization document ISO 14021, “Environmental Labels and Declarations – Self Declared Environmental Claims (Type II Environmental Labeling).”

2.03 REGIONAL MATERIALS

A. LEED Credit MRc5.1 and MRc5.2, Local/Regional Materials: Provide a minimum of 20 percent of building materials (by cost) that are extracted, processed, and manufactured within a 500 mile radius of the project site. If only a fraction of a product or material is extracted, harvested, recovered, and manufactured regionally, then only that percentage (by weight) shall contribute to the regional value.
2.04 CERTIFIED WOOD

A. LEED Credit MRc7, Certified Wood: Provide a minimum of 50 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by a Forest Stewardship Council (FSC) accredited certification body to comply with FSC 1.2, “Principles and Criteria.” This calculation does not include formwork, bracing, scaffolding, sidewalk protection, guard rails, or furniture.

2.05 LOW-EMITTING MATERIALS

A. LEED Credit EQc4.1, Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D:

1. Wood Glues: 30 g/L.
2. Metal to Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Contact Adhesive: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesive: 100 g/L.
18. Structural Wood Member Adhesive: 140 g/L.
19. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
20. Top and Trim Adhesive: 250 g/L.
21. Plastic Cement Welding Compounds: 250 g/L.
22. ABS Welding Compounds: 325 g/L.
23. CPVC Welding Compounds: 490 g/L.
24. PVC Welding Compounds: 510 g/L.
25. Adhesive Primer for Plastic: 550 g/L.
26. Sheet Applied Rubber Lining Adhesive: 850 g/L.
27. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
29. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
30. Other Adhesives: 250 g/L.
31. Architectural Sealants: 250 g/L.
32. Non-membrane Roof Sealants: 300 g/L.
33. Single-Ply Roof Membrane Sealants: 450 g/L.
34. Other Sealants: 420 g/L.
35. Sealant Primers for Nonporous Substrates: 250 g/L.
36. Sealant Primers for Porous Substrates: 775 g/L.
37. Modified Bituminous Sealant Primers: 500 g/L.
38. Other Sealant Primers: 750 g/L.

B. LEED Credit EQc4.2, Low-Emitting Materials, Paints and Coatings: For interior applications use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the following chemical restrictions:

1. Flat Paints, Coatings, and Primers: VOC not more than 50 g/L.
2. Non-flat Paints, Coatings, and Primers: VOC not more than 150 g/L.
3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
6. Floor Coatings: VOC not more than 100 g/L.
7. Shellacs Clear: VOC not more than 730 g/L.
8. Shellacs, Pigmented: VOC not more than 550 g/L.
9. Stains: VOC not more than 250 g/L.
10. Aromatic Compounds: Paints and coatings not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
11. Restricted Components: Paints and coatings shall not contain any of the following:
   a. Acrolein.
   b. Acrylonitrile.
   c. Antimony.
   d. Benzene.
   e. Butyl benzyl phthalate.
   f. Cadmium.
   g. Di (2-ethylhexyl) phthalate.
   h. Di-n-butyl phthalate.
   i. Di-n-octyl phthalate.
   j. 1,2-dichlorobenzene.
   k. Diethyl phthalate.
   l. Dimethyl phthalate.
   m. Ethylbenzene.
   n. Formaldehyde.
   o. Hexavalent chromium.
   p. Isophorone.
   q. Lead.
   r. Mercury.
   s. Methyl ethyl ketone.
   t. Methyl isobutyl ketone.
   u. Methylene chloride.
   v. Naphthalene.
   w. Toluene (methylbenzene).
   x. 1,1,1-trichloroethane.
   y. Vinyl chloride.
C. LEED Credit EQc4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Do not use composite wood and agrifiber products that contain urea-formaldehyde resin binders.

PART 3 - EXECUTION

3.01 ENVIRONMENTAL ISSUES, GENERAL

A. Comply with specified requirements for environmental construction practice. The following Articles contain execution requirements of LEED Green Building Rating System Credits [Project sustainable requirements], as indicated.

3.02 SITE DISTURBANCE

A. LEED Credit SSc5.1, Reduced Site Disturbance: Comply with requirements specified for site clearing.

3.03 CONSTRUCTION WASTE MANAGEMENT

A. LEED Credit MRc2.1 and MRc2.2, Construction Waste Management: Comply with Division 1 Section "CONSTRUCTION WASTE MANAGEMENT." Achieve a minimum landfill diversion rate of 75 percent.

3.04 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. LEED Credit EQc3.1, Construction IAQ Management Plan: Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction and comply with requirements specified in Division 1 Section "CONSTRUCTION IAQ MANAGEMENT PLANS."

B. LEED Credit EQc3.2, Construction IAQ Management Plan: Comply with requirements specified in Division 1 Section "CONSTRUCTION IAQ MANAGEMENT PLANS."

END OF SECTION 01 35 36
SECTION 01 41 00 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes: General administrative requirements and procedures and related applicable codes.

1.03 APPROVAL AND RECOMMENDATION AGENCIES:

A. The University of Colorado at Boulder has jurisdiction for the interpretation and enforcement of code requirements for construction of projects.

1.04 CODES:

A. All Contractors, Equipment Vendor, Installation Contractors and the CMGC shall comply with all applicable codes, ordinances and regulations in effect at the time of bid openings.

B. Approved State Building Codes, updated July 2010.

1.05 APPROVED STATE BUILDING CODES

A. The following approved building codes and standards have been adopted by State Buildings Programs (SBP) as the minimum requirements to be applied to all state-owned buildings and physical facilities including capital construction and controlled maintenance construction projects:

1. The 2009 edition of the International Building Code (IBC) (as adopted by the Colorado State Buildings Program as follows: Chapter 1 as amended, Chapters 2-35 and Appendices C and I)
2. The 2009 edition of the International Mechanical Code (IMC); (as adopted by the Colorado State Buildings and Real Estate Programs as follows: Chapters 2-15 and Appendix A).
5. The 2009 edition of the International Plumbing Code (IPC) (as adopted by the Colorado Examining Board of Plumbers as follows: Chapter 1 Section 101.2,102, 105, 107, Chapters 2-13 and Appendices B, D, E, F and G)
6. The 2009 edition of the International Fuel Gas Code (IFGC) (as adopted by the Colorado Examining Board of Plumbers as follows: Chapter 1 Section 101, 102, 105, 107, Chapters 2-8 and Appendices A, B, and C)


8. The 2007 edition of the ASME Boiler and Pressure Vessel Code; (as adopted by the Department of Labor and Employment/Boiler Inspection Section as follows: sections I, IV, VIII-Divisions 1 and 2 and 3. X and B31.1).

9. The 2007 edition of the National Boiler Inspection Code (NBIC); (as adopted by the Department of Labor and Employment/Boiler Inspection Section).

10. The 2007 edition of the Controls and Safety Devices for Automatically Fired Boilers CSD-1; (as adopted by the Department of Labor and Employment/Boiler Inspection Section).


12. The 2007 edition of ASME A17.1 Safety Code for Elevators and Escalators (as adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

13. The 2005 edition of ASME A17.3 Safety Code for Existing Elevators and Escalators (as adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

14. The 2005 edition of ASME A18.1 Safety Standard for Platform Lifts and Stairway Chair lifts (as adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

15. The current edition of the Rules and Regulations Governing the Sanitation of Food Service Establishments; (as adopted by the Department of Public Health and Environment/Colorado State Board of Health).


B. Note: Additional codes, standards and appendices may be adopted by the state agencies and institutions in addition to the minimum codes and standards herein adopted by State Buildings Programs.

1. The 2009 edition of the IBC became effective on July 1 of 2010. Consult the state electrical and plumbing boards and the state boiler inspector and conveyance administrator and the Division of Fire Safety for adoption of current editions and amendments to their codes.

2. Projects should be designed and plans and specifications should be reviewed based upon the approved codes at the time of A/E contract execution. If an agency prefers to design to a different code such as a newer edition of a code that State Buildings Programs has not yet adopted. The agency must contact SBP for approval and then amend the A/E contract with a revised Exhibit C. Approved State Building Codes. Please note that the state plumbing and electrical boards enforce the editions of their codes that are in effect at the time of permitting not design.
3. The state’s code review agents, or the State Buildings Programs approved agency building official, shall review all documents for compliance with the codes stipulated herein. Note: The Department of Public Health and Environment, Division of Consumer Protection will review drawings for food service related projects.

4. This policy does not prohibit the application of various life safety codes as established by each agency for specific building types and funding requirements. NFPA 101 and other standards notwithstanding. Approved codes will supersede where their minimum requirements are the most restrictive in specific situations. If a conflict arises, contact State Buildings Programs for resolution.

5. It is anticipated that compliance with the federal Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG), ADMG) and Colorado Revised Statutes Section 9-5-101 will be met by compliance with the 2006 International Building Code and ICCANSI A117.1. However, each project may have unique aspects that may require individual attention to these legislated mandates.

6. The 2006 edition of the International Building Code (IBC) is to be applied to factory-built nonresidential structures as established by the Division of Housing within the Department of Local Affairs.

C. Appendices: Appendices are provided to supplement the basic provisions of the codes. Approved IBC Appendices are as follows:

1. Mandatory:
   a. IBC Appendix Chapter C - Agricultural Buildings
   b. IBC Appendix Chapter I - Patio Covers

2. Optional: Any non-mandatory appendix published in the International Building Code may be utilized at the discretion of the agency. Use of an appendix shall be indicated in the project code approach.

D. Amendments

1. International Building Code, Chapter 1 as amended

2. In case of a conflict between references applicable codes, the one having the more stringent requirements shall govern. Where governing codes indicate that the drawings or specifications do not comply with the minimum requirements of the codes, the CMGC and Installation Contractor shall be responsible for providing an installation, which will comply with code requirements. Drawings and specifications shall be followed where they are superior to code requirements.

E. Referenced Codes

1. While not adopted in entirety, portions of the following codes are referenced in the International Building Code (IBC), the International Mechanical Code (IMC), the International Energy Conservation Code (IECC) the International Plumbing Code (IPC), and the International Fuel Gas Code (IFGC). These following codes would be applied as reference standards.
   a. 2009 International Fire Code (IFC)
   b. 2009 International Existing Building Code (IEBC)
F. Referenced Standards: The IBC, IMC, IECC, IPC and IFGC ASHRAE 55, ASHRAE 62.1, and ASHRAE 90.1 standards shall be utilized to provide specific, or prescriptive, requirements on how to achieve the requirements established in the code. These standards may be unique to the code or may be derived from other established industry standards. Recognized standards may also be used to show compliance with the standard of duty established by the code.

1.02 OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

A. The Installation Contractor shall have sole responsibility for compliance on the job site to all applicable portions of the Occupational Safety and Health Act. The Installation Contractor is responsible for other regulatory requirements as they relate to occupational Health and Safety requirements. For example, NIOSH, ANSI, and MSA.

B. Protection of life, health and public welfare as it relates to the execution of the construction contract is the responsibility of the Installation Contractor. The CMGC may, at their discretion, observe, inspect, or comment on plans, procedures, or actions employed at the project as they relate to safety of life, health or public welfare. If conditions are imposed by the Owner or the CMGC which interfere with, or imply actions detrimental to safety, written notice shall be returned to the Owner and CMGC for action prior to affecting any unsafe conditions.

C. Installation Contractors shall use OSHA Lock Out/Tag Out procedures when working with energized equipment.

D. All contractors entering confined spaces owned by CU or while conducting work under contract with CU shall develop a written program and utilize procedures that, at a minimum, comply with all federal, state and local confined space standards and all applicable regulatory requirements. Contractors shall, independent of the University, monitor the space to obtain their own data to ensure a safe entry and exit. Any data generated by a contractor's confined space entry, should be provided to the Facilities Management confined Space Program Manager.

E. When contractors perform work that may involve Facilities Management controlled permit required confined spaces, Facilities Management will:

1. Inform contractors of permit required confined spaces and that entry is allowed only after compliance with the confined space entry standard. Require contractors planning to enter a confined space to provide the Facilities Management Confined Space Program Manager in charge of that space, 48-hour advance notice of such planned entry. The contractors entry will be in accordance with the current Occupational Safety and Health Administration confined space entry standard and a signed document stating such, shall be provided to the FM Confined Space Program Manager prior to entry.

F. The FM Confined Space Program Manager, following receipt of notice of contractor planned entry, will:

1. Apprise contractor of the hazards identified in the confined space and of any prior experience that is documented on the space.
2. Appraise the contractor of any precautions or procedures that CU has implemented for the protection of workers in or near the confined space.

3. Coordinate entry operations with the contractor when both Facilities Management and contractor personnel are working in or around the confined space.

4. Debrief the contractor at the end of the entry operations regarding hazards confronted or created.

1.03 HOT WORK PERMITS

A. All contractors shall be required to obtain a Hot Work Permit, three (3) working days in advance, for work that involves welding, heat treating, grinding, thawing pipe, hot riveting, soldering and brazing, power driven fasteners and similar activities involving spark, flame or heat. Compliance with the requirements of the applicable fire code, the International Building Code, and NFPA Standard 51B are mandatory and all contractors performing hot work activities shall read and understand these code requirements. To obtain a current Hot Work Permit, go to website:

http://fm.colorado.edu/firesafety/hotwork.html

B. Contractors shall read and comply with the procedures and requirements for Fire Watch, Fire Alarm Interruption and Fire Suppression Interruption as found on the following websites:

1. Fire Watch Procedures: http://fm.colorado.edu/firesafety/firewatch.html

2. Fire Alarm and Detection System Interruption/Outage: http://fm.colorado.edu/firesafety/firealarmdetectsys.html

3. Fire Suppression System Interruption/Outage: http://fm.colorado.edu/firesafety/firesuppressionsystems.html

C. No hot work shall be conducted in any campus facility without a hot work permit. Any person or firm who conducts hot work without a permit shall be fined one thousand dollars ($1000) for each occurrence and their non-permitted activities shall be stopped immediately until they obtain a hot work permit. Contractor shall be responsible for any damages caused as a result of improper hot work activities or the work stoppage.

Form location:
www.colorado.edu/facilitiesmanagement/pdc/construction/forms.html

D. Individuals or firms who obtain a permit shall fully read, understand and implement the requirements of the permit. Any person or firm who conducts hot work without the full implementation of the permit requirements shall be fined five hundred dollars ($500) the first time and one thousand dollars ($1,000) for subsequent occurrences. When the requirements of the hot work permit are not being implemented, the improper activities shall be stopped immediately until a hot work permit is obtained. Contractor shall be responsible for any damages caused as a result of improper hot work activities or the work stoppage. Any Contractor who is found to be in non-compliance a third time, will not be allowed to work on campus until further notice by Facilities Management.
E. The campus inspectors, project managers and fire marshal shall have the authority to stop improper or non-permitted hot work activities.

F. The Contractor shall notify the CU Fire Alarm Supervisor to deactivate all smoke alarms in the vicinity of the work prior to any demolition and construction work activity. Failure of the Contractor to comply with the smoke alarm deactivation requirement and cause a false alarm and arrival of the Boulder Fire Department shall be a $400 fine per occurrence.

1.04 PERMITS

A. The University will provide the building permit; all other permits including right-of-way are to be obtained by the Contractor.

B. The contractor must obtain a no fee building permit prior to starting work from Office Manager, Facilities Management at (303) 492-2904 in the Planning, Design and Construction Office, Research Laboratory No. 2, 1540 30th Street, Boulder, Colorado. Building permits are required on all projects except the following:

1. Fences not over 6 feet high & general landscape work.
2. Retaining walls which are not over 4 feet in height, unless supporting a surcharge of impounding Class I, II or IIII-A liquids.
3. Platforms, walks and driveways not more than 30 inches above grade and not over any basement or story below.
4. Painting, papering, and similar finish work that meet the requirements of Chapter 8 of UBC. (Uniform Building Code).
5. Temporary motion picture, television and theater stage sets and scenery. Review for fire-safety issues is required.

C. The contractor must post the permit(s) in a prominent location at the jobsite including all inspection reports. The contractor shall have an updated set of contract documents available at the jobsite for all inspections.

1.05 INSPECTIONS

A. The Contractor must schedule all required inspections 48 hours in advance by calling (303) 492-2922. CU or their designated inspectors will complete these inspections within 48 hours with the exception of weekends and state holidays.

B. The contractor is required to arrange for the following inspections:

1. Required inspections: General. Reinforcing steel or structural framework of any part of any building of structure shall not be covered or concealed without first obtaining the approval of the building official.
2. Lath or gypsum board inspection: To be made after lathing and gypsum board, interior and exterior, is in place, but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.
3. Final inspection: To be made after finish grading and the building is completed and ready for occupancy.
4. Special inspection: Special inspection may be required on special projects and special types of construction.
5. Re-inspections: A re-inspection fee may be assessed for each inspection or re-inspection when such portion of work for which inspection is called is not complete or when corrections called for are not made.

C. The Contractor will be responsible for all cost related to re-inspections and will be billed at a rate of $50.00 per hour for CU re-inspections and at the testing agency bill-out rate for other re-inspections.

1.06 UNIVERSITY OF COLORADO SEXUAL HARASSMENT POLICY

A. Contractors should be aware of and review the University of Colorado Boulder’s policies that prohibit discrimination and harassment on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation or veteran status. These policies are located on the web at:

http://www.cusys.edu/policies/Personnel/sexharass_07-03.html

B. Contractor personnel must adhere to these policies and conduct themselves in a manner that does not discriminate or harass as a result of interacting with an around the University of Colorado faculty, staff and students and visitors.

http://www.colorado.edu/facilitiesmanagement/pdc/construction/documents/110727SpecialcontractconditionsContractorsFINALrevised.doc

1.07 FIRE ALARM INTERRUPTION

A. The Contractor shall contact the CU Fire Alarm Systems Supervisor at 303-492-0633 prior to all interruptions or shutdowns of fire alarm systems. Interruptions or shutdowns shall be scheduled three (3) working days in advance with the CU Fire Alarm Systems Shop, CU Project Manager, and building proctor. The Contractor shall provide a fire watch as directed by the CU Fire Alarm Systems Shop during interruption or shutdown.

B. The Contractor shall be responsible for preventing nuisance alarm due to activities at their work site. Common sources of nuisance alarms are:

1. Smoke (soldering, welding, cooking, etc.)
2. Grinding.
3. Dust (drilling, sweeping, canister vacuums, sand blasting, etc.)
4. Water leaking (plumbing leaks, overflows)
5. Water sprayed on or near detectors (pressure washing or cleaning with water)
6. Popcorn or other food burning in microwaves.
7. Static electricity (covering or uncovering detectors)
8. Changing filters on air handling units (dust)
9. Steam (leaks, pressure pop-offs)
10. Broken or frozen sprinkler heads.
11. Sprinkler drain valves turned by mistake.
12. Vandalism.
C. Precautions to prevent nuisance alarms are:

1. During construction projects, treat all buildings, except totally new construction, as though they were occupied buildings with live systems.
2. Do not assume that all detectors are in plain sight. Contact University personnel for verification.
3. Maintain dust control measures per UCB Standards:
   a. Maintaining barriers.
   b. Covering air returns.
   c. Asking CU personnel to cap or disable smoke detectors (Note any capping or disabling of fire safety devices is to be done ONLY by CU personnel, not contractors)
   d. Avoiding recirculation of dust or smoke through the building air handling system.
4. Follow campus hot work procedures. Refer to specification Section 01 41 00, paragraph 1.6.
5. Do not expose fire alarm devices to water or extreme temperatures.
6. Contact Fire Systems Group for any actions that affect fire detection, alarm, and suppression systems.

1.08 STORMWATER MANAGEMENT PLAN (SWMP)

A. Stormwater Management Plan (SWMP): Prior to any construction activity disturbing one acre of land or more, an approved SWMP and a Stormwater Permit for Construction Activity application from the Colorado Department of Public Health and Environment (CDPHE) are required. The SWMP shall be prepared in accordance with the CDPHE requirements for “Contents of the Stormwater Management Plan” and the UDFCD’s Urban Storm Drainage Criteria Manual, Volume 3, “Best Management Practices” (UDFCD Drainage Criteria Manual). Stormwater quality management and erosion control measures are to be constructed and maintained in accordance with the SWMP and the UDFCD Drainage Criteria Manual.

1.09 UTILITY LOCATES

A. Contractor MUST CALL 811 (or 1-800-922-1987) for utility locates BEFORE DIGGING on any project at the University of Colorado at Boulder. This includes even small projects such as, but not limited to, planting trees or shrubs, sidewalk removal/installation, or fence post installation. Digging without calling can disrupt service to the campus or surrounding neighborhoods and potentially result in fines and repair costs.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 41 00
SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

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

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

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

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

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

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

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

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

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

1.03 INDUSTRY STANDARDS

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

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

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

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

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Name</th>
<th>Phone Numbers</th>
<th>Web Site</th>
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<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association, Inc. (The)</td>
<td>(703) 358-2960</td>
<td><a href="http://www.aluminum.org">www.aluminum.org</a></td>
</tr>
<tr>
<td>AAADM</td>
<td>American Association of Automatic Door Manufacturers</td>
<td>(216) 241-7333</td>
<td><a href="http://www.aaadm.com">www.aaadm.com</a></td>
</tr>
<tr>
<td>AABC</td>
<td>Associated Air Balance Council</td>
<td>(202) 737-0202</td>
<td><a href="http://www.aabchq.com">www.aabchq.com</a></td>
</tr>
<tr>
<td>AAMA</td>
<td>American Architectural Manufacturers Association</td>
<td>(847) 303-5664</td>
<td><a href="http://www.aamanet.org">www.aamanet.org</a></td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
<td>(202) 624-5800</td>
<td><a href="http://www.transportation.org">www.transportation.org</a></td>
</tr>
<tr>
<td>AATCC</td>
<td>American Association of Textile Chemists and Colorists</td>
<td>(919) 549-8141</td>
<td><a href="http://www.aatcc.org">www.aatcc.org</a></td>
</tr>
<tr>
<td>ABAA</td>
<td>Air Barrier Association of America</td>
<td>(866) 956-5888</td>
<td><a href="http://www.airbarrier.org">www.airbarrier.org</a></td>
</tr>
<tr>
<td>ABMA</td>
<td>American Bearing Manufacturers Association</td>
<td>(202) 367-1155</td>
<td><a href="http://www.abma-dc.org">www.abma-dc.org</a></td>
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<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
<td>(248) 848-3700</td>
<td><a href="http://www.concrete.org">www.concrete.org</a></td>
</tr>
<tr>
<td>ACPA</td>
<td>American Concrete Pipe Association</td>
<td>(972) 506-7216</td>
<td><a href="http://www.concrete-pipe.org">www.concrete-pipe.org</a></td>
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<tr>
<td>AEIC</td>
<td>Association of Edison Illuminating Companies, Inc. (The)</td>
<td>(205) 257-2530</td>
<td><a href="http://www.aeic.org">www.aeic.org</a></td>
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<tr>
<td>AF&amp;PA</td>
<td>American Forest &amp; Paper Association</td>
<td>(800) 878-8878 (202) 463-2700</td>
<td><a href="http://www.afandpa.org">www.afandpa.org</a></td>
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<tr>
<td>AGA</td>
<td>American Gas Association</td>
<td>(202) 824-7000</td>
<td><a href="http://www.aga.org">www.aga.org</a></td>
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<tr>
<td>AGC</td>
<td>Associated General Contractors of America (The)</td>
<td>(703) 548-3118</td>
<td><a href="http://www.agc.org">www.agc.org</a></td>
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<tr>
<td>AHAM</td>
<td>Association of Home Appliance Manufacturers</td>
<td>(202) 872-5955</td>
<td><a href="http://www.aham.org">www.aham.org</a></td>
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<tr>
<td>AHRI</td>
<td>Air Conditioning, Heating, and Refrigeration Institute</td>
<td>(703) 524-8800</td>
<td><a href="http://www.ahrinet.org">www.ahrinet.org</a></td>
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<tr>
<td>AI</td>
<td>Asphalt Institute</td>
<td>(859) 288-4960</td>
<td><a href="http://www.asphaltinstitute.org">www.asphaltinstitute.org</a></td>
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<tr>
<td>AIA</td>
<td>American Institute of Architects (The)</td>
<td>(800) 242-3837 (202) 626-7300</td>
<td><a href="http://www.aia.org">www.aia.org</a></td>
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<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
<td>(800) 644-2400 (312) 670-2400</td>
<td><a href="http://www.aisc.org">www.aisc.org</a></td>
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<td>AISI</td>
<td>American Iron and Steel Institute</td>
<td>(202) 452-7100</td>
<td><a href="http://www.steel.org">www.steel.org</a></td>
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<td>AITC</td>
<td>American Institute of Timber Construction</td>
<td>(303) 792-9559</td>
<td><a href="http://www.aitc-glulam.org">www.aitc-glulam.org</a></td>
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<td>Acronym</td>
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<td>ALSC</td>
<td>American Lumber Standard Committee, Incorporated</td>
<td>(301) 972-1700</td>
<td><a href="http://www.alsc.org">www.alsc.org</a></td>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
<td>(202) 293-8020</td>
<td><a href="http://www.ansi.org">www.ansi.org</a></td>
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<tr>
<td>AOSA</td>
<td>Association of Official Seed Analysts, Inc.</td>
<td>(405) 780-7372</td>
<td><a href="http://www.aosaseed.com">www.aosaseed.com</a></td>
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<tr>
<td>APA</td>
<td>Architectural Precast Association</td>
<td>(239) 454-6989</td>
<td><a href="http://www.archprecast.org">www.archprecast.org</a></td>
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<tr>
<td>APA</td>
<td>APA - The Engineered Wood Association</td>
<td>(253) 565-6600</td>
<td><a href="http://www.apawood.org">www.apawood.org</a></td>
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<tr>
<td>API</td>
<td>American Petroleum Institute</td>
<td>(202) 682-8000</td>
<td><a href="http://www.api.org">www.api.org</a></td>
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<tr>
<td>ARI</td>
<td>Air Conditioning &amp; Refrigeration Institute (Now AHRI)</td>
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<td>ARMA</td>
<td>Asphalt Roofing Manufacturers Association</td>
<td>(202) 207-0917</td>
<td><a href="http://www.asphaltroofing.org">www.asphaltroofing.org</a></td>
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<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
<td>(800) 548-2723, (703) 295-6300</td>
<td><a href="http://www.asce.org">www.asce.org</a></td>
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<tr>
<td>ASCE/SEI</td>
<td>American Society of Civil Engineers/Structural Engineering Institute (See ASCE)</td>
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<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating and Air-Conditioning Engineers</td>
<td>(800) 527-4723, (404) 636-8400</td>
<td><a href="http://www.ashrae.org">www.ashrae.org</a></td>
</tr>
<tr>
<td>ASME</td>
<td>ASME International (American Society of Mechanical Engineers International)</td>
<td>(800) 843-276 (973) 882-11703</td>
<td><a href="http://www.asme.org">www.asme.org</a></td>
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<tr>
<td>ASSE</td>
<td>American Society of Safety Engineers</td>
<td>(847) 699-2929</td>
<td><a href="http://www.asse.org">www.asse.org</a></td>
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<tr>
<td>ASSE</td>
<td>American Society of Sanitary Engineering</td>
<td>(440) 835-3040</td>
<td><a href="http://www.asse-plumbing.org">www.asse-plumbing.org</a></td>
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<tr>
<td>ATIS</td>
<td>Alliance for Telecommunications Industry Solutions</td>
<td>(202) 628-6380</td>
<td><a href="http://www.atis.org">www.atis.org</a></td>
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<tr>
<td>AWCI</td>
<td>Association of the Wall and Ceiling Industry</td>
<td>(703) 534-8300</td>
<td><a href="http://www.awci.org">www.awci.org</a></td>
</tr>
<tr>
<td>AWCMA</td>
<td>American Window Covering Manufacturers Association (Now WCMA)</td>
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<td>AWI</td>
<td>Architectural Woodwork Institute</td>
<td>(571) 323-3636</td>
<td><a href="http://www.awinet.org">www.awinet.org</a></td>
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<tr>
<td>AWPA</td>
<td>American Wood Protection Association (Formerly: American Wood Preservers' Association)</td>
<td>(205) 733-4077</td>
<td><a href="http://www.awpa.com">www.awpa.com</a></td>
</tr>
<tr>
<td>AWS</td>
<td>American Welding Society</td>
<td>(800) 443-9353, (305) 443-9353</td>
<td><a href="http://www.aws.org">www.aws.org</a></td>
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<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
<td>(800) 926-7337, (303) 794-7711</td>
<td><a href="http://www.awwa.org">www.awwa.org</a></td>
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<tr>
<td>BHMA</td>
<td>Builders Hardware Manufacturers Association</td>
<td>(212) 297-2122</td>
<td><a href="http://www.buildershardware.com">www.buildershardware.com</a></td>
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<td>BIA</td>
<td>Brick Industry Association (The)</td>
<td>(703) 620-0010</td>
<td><a href="http://www.bia.org">www.bia.org</a></td>
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<td>BICSI</td>
<td>BICSI, Inc.</td>
<td>(800) 242-7405, (813) 979-1991</td>
<td><a href="http://www.bicsi.org">www.bicsi.org</a></td>
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<td>BIFMA</td>
<td>BIFMA International (Business and Institutional Furniture Manufacturer's Association International)</td>
<td>(616) 285-3963</td>
<td><a href="http://www.bifma.com">www.bifma.com</a></td>
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<td>CCC</td>
<td>Carpet Cushion Council</td>
<td>(610) 527-3880</td>
<td><a href="http://www.carpetcushion.org">www.carpetcushion.org</a></td>
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<td>CDA</td>
<td>Copper Development Association</td>
<td>(212) 251-7200</td>
<td><a href="http://www.copper.org">www.copper.org</a></td>
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<td>CEA</td>
<td>Canadian Electricity Association</td>
<td>(613) 230-9263</td>
<td><a href="http://www.canelect.ca">www.canelect.ca</a></td>
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<td>CEA</td>
<td>Consumer Electronics Association</td>
<td>(866) 858-1555, (703) 907-7600</td>
<td><a href="http://www.ce.org">www.ce.org</a></td>
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<td>CFFA</td>
<td>Chemical Fabrics &amp; Film Association, Inc.</td>
<td>(216) 241-7333</td>
<td><a href="http://www.chemicalfabricsandfilm.com">www.chemicalfabricsandfilm.com</a></td>
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<td>CGA</td>
<td>Compressed Gas Association</td>
<td>(703) 788-2700</td>
<td><a href="http://www.cganet.com">www.cganet.com</a></td>
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<td>CIMA</td>
<td>Cellulose Insulation Manufacturers Association</td>
<td>(888) 881-2462 (937) 222-2462</td>
<td><a href="http://www.cellulose.org">www.cellulose.org</a></td>
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<td>CISCA</td>
<td>Ceilings &amp; Interior Systems Construction Association</td>
<td>(630) 584-1919</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CISPI</td>
<td>Cast Iron Soil Pipe Institute</td>
<td>(423) 892-0137</td>
<td><a href="http://www.cispi.org">www.cispi.org</a></td>
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<td>CLFMI</td>
<td>Chain Link Fence Manufacturers Institute</td>
<td>(301) 596-2583</td>
<td><a href="http://www.chainlinkinfo.org">www.chainlinkinfo.org</a></td>
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<td>CRRC</td>
<td>Cool Roof Rating Council</td>
<td>(866) 465-2523 (510) 485-7175</td>
<td><a href="http://www.coolroofs.org">www.coolroofs.org</a></td>
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<td>CPA</td>
<td>Composite Panel Association</td>
<td>(703) 724-1128</td>
<td><a href="http://www.pbmdf.com">www.pbmdf.com</a></td>
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<td>CPPA</td>
<td>Corrugated Polyethylene Pipe Association</td>
<td>(800) 510-2772 (202) 462-9607</td>
<td><a href="http://www.plasticpipe.org">www.plasticpipe.org</a></td>
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<td>CRI</td>
<td>Carpet and Rug Institute (The)</td>
<td>(706) 278-3176</td>
<td><a href="http://www.carpet-rug.com">www.carpet-rug.com</a></td>
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<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
<td>(847) 517-1200</td>
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<td>CSA</td>
<td>CSA International (Formerly: IAS - International Approval Services)</td>
<td>(866) 797-4272 (416) 747-4000</td>
<td><a href="http://www.csa-international.org">www.csa-international.org</a></td>
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<td>CSI</td>
<td>Cast Stone Institute</td>
<td>(717) 272-3744</td>
<td><a href="http://www.caststone.org">www.caststone.org</a></td>
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<td>CSI</td>
<td>Construction Specifications Institute (The)</td>
<td>(800) 689-2900 (703) 684-0300</td>
<td><a href="http://www.csinet.org">www.csinet.org</a></td>
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<td>CSSB</td>
<td>Cedar Shake &amp; Shingle Bureau</td>
<td>(604) 820-7700</td>
<td><a href="http://www.cedarbureau.org">www.cedarbureau.org</a></td>
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<td>CTI</td>
<td>Cooling Technology Institute (Formerly: Cooling Tower Institute)</td>
<td>(281) 583-4087</td>
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<td>DHI</td>
<td>Door and Hardware Institute</td>
<td>(703) 222-2010</td>
<td><a href="http://www.dhi.org">www.dhi.org</a></td>
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<td>ECA</td>
<td>Electronic Components Association</td>
<td>(703) 907-8024</td>
<td><a href="http://www.ec-central.org">www.ec-central.org</a></td>
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<td>EIA</td>
<td>Electronic Industries Alliance</td>
<td>(703) 907-7500</td>
<td><a href="http://www.eia.org">www.eia.org</a></td>
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<td>EIMA</td>
<td>EIFS Industry Members Association</td>
<td>(800) 294-3462 (770) 968-7945</td>
<td><a href="http://www.eima.com">www.eima.com</a></td>
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<td>EJCDC</td>
<td>Engineers Joint Contract Documents Committee</td>
<td>(703) 295-5000</td>
<td><a href="http://www.ejdcc.org">www.ejdcc.org</a></td>
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<td>EJMA</td>
<td>Expansion Joint Manufacturers Association, Inc.</td>
<td>(914) 332-0040</td>
<td><a href="http://www.ejma.org">www.ejma.org</a></td>
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<td>ESD</td>
<td>ESD Association (Electrostatic Discharge Association)</td>
<td>(315) 339-6937</td>
<td><a href="http://www.esda.org">www.esda.org</a></td>
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<td>ETL</td>
<td>SEMCO Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA)</td>
<td>(800) 967-5352</td>
<td><a href="http://www.intertek-etsemko.com">www.intertek-etsemko.com</a></td>
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<td>FM Approvals</td>
<td>FM Approvals LLC</td>
<td>(781) 762-4300</td>
<td><a href="http://www.fmglobal.com">www.fmglobal.com</a></td>
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<td>FM Global</td>
<td>FM Global (Formerly: FMG - FM Global)</td>
<td>(401) 275-3000</td>
<td><a href="http://www.fmglobal.com">www.fmglobal.com</a></td>
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<td>FRSA</td>
<td>Florida Roofing, Sheet Metal &amp; Air Conditioning Contractors Association, Inc.</td>
<td>(407) 671-3772</td>
<td><a href="http://www.floridaroo.com">www.floridaroo.com</a></td>
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<td>FSA</td>
<td>Fluid Sealing Association</td>
<td>(610) 971-4850</td>
<td><a href="http://www.fluidsealing.com">www.fluidsealing.com</a></td>
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<td>FSC</td>
<td>Forest Stewardship Council</td>
<td>49 228 367 66 0</td>
<td><a href="http://www.fsc.org">www.fsc.org</a></td>
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<td>GA</td>
<td>Gypsum Association</td>
<td>(202) 289-5440</td>
<td><a href="http://www.gypsum.org">www.gypsum.org</a></td>
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<td>GANA</td>
<td>Glass Association of North America</td>
<td>(785) 271-0208</td>
<td><a href="http://www.glasswebsite.com">www.glasswebsite.com</a></td>
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<td>GBCI</td>
<td>Green Building Certification Institute</td>
<td>(800) 795-1746</td>
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<td>GRI</td>
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<td>GS</td>
<td>Green Seal</td>
<td>(202) 872-6400</td>
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<td>GSI</td>
<td>Geosynthetic Institute</td>
<td>(610) 522-8440</td>
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<td>HI</td>
<td>Hydraulic Institute</td>
<td>(973) 267-9700</td>
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<td>HI</td>
<td>Hydronics Institute</td>
<td>(908) 464-8200</td>
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<td>HMMA</td>
<td>Hollow Metal Manufacturers Association</td>
<td>(787) 490-4600</td>
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<td>HPVA</td>
<td>Hardwood Plywood &amp; Veneer Association</td>
<td>(703) 435-2900</td>
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<td>HPW</td>
<td>H. P. White Laboratory, Inc.</td>
<td>(410) 838-6550</td>
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<td>IAS</td>
<td>International Approval Services (Now CSA International)</td>
<td>(703) 290-0369</td>
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<td>ICEA</td>
<td>Insulated Cable Engineers Association, Inc.</td>
<td>(770) 830-0369</td>
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<td>ICRI</td>
<td>International Concrete Repair Institute, Inc.</td>
<td>(847) 827-0830</td>
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<td>International Electrotechnical Commission</td>
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<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers, Inc. (The)</td>
<td>(212) 419-7900</td>
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<td>IES</td>
<td>Illuminating Engineering Society</td>
<td>(212) 248-5000</td>
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<td>IESNA</td>
<td>Illuminating Engineering Society of North America (Now IES)</td>
<td>(847) 981-0100</td>
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<td>IEST</td>
<td>Institute of Environmental Sciences and Technology</td>
<td>(847) 981-0100</td>
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<td>IGCC</td>
<td>Insulating Glass Certification Council</td>
<td>(315) 646-2234</td>
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<td>IGMA</td>
<td>Insulating Glass Manufacturers Alliance</td>
<td>(613) 233-1510</td>
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<td>ILI</td>
<td>Indiana Limestone Institute of America, Inc.</td>
<td>(812) 275-4426</td>
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<td>ISO</td>
<td>International Organization for Standardization Available from ANSI</td>
<td>(202) 293-8020</td>
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<td>ISSFA</td>
<td>International Solid Surface Fabricators Association</td>
<td>(877) 464-7732</td>
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<td>ITS</td>
<td>Intertek Testing Service NA (Now ETL SEMCO)</td>
<td>(703) 264-1690</td>
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<td>ITU</td>
<td>International Telecommunication Union</td>
<td>(703) 264-1690</td>
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<td>KCMA</td>
<td>Kitchen Cabinet Manufacturers Association</td>
<td>(703) 264-1690</td>
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<td>LPI</td>
<td>Lightning Protection Institute</td>
<td>(800) 488-6864</td>
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<td>MBMA</td>
<td>Metal Building Manufacturers Association</td>
<td>(216) 241-7333</td>
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<td>MFMA</td>
<td>Maple Flooring Manufacturers Association, Inc.</td>
<td>(888) 480-9138</td>
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<td>MFMA</td>
<td>Metal Framing Manufacturers Association, Inc.</td>
<td>(312) 644-6610</td>
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<td>Material Handling (Now MHIA)</td>
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<td>MHIA</td>
<td>Material Handling Industry of America</td>
<td>(800) 345-1815</td>
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<td>MIA</td>
<td>Marble Institute of America</td>
<td>(440) 250-9222</td>
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<td>MPI</td>
<td>Master Painters Institute</td>
<td>(888) 674-8937</td>
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<td>MSS</td>
<td>Manufacturers Standardization Society of The Valve and Fittings Industry Inc.</td>
<td>(703) 281-6613</td>
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<td>NAAMM</td>
<td>National Association of Architectural Metal Manufacturers</td>
<td>(630) 942-6591</td>
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<td>NACE</td>
<td>NACE International (National Association of Corrosion Engineers International) (800) 797-6623 (281) 228-6200</td>
<td><a href="http://www.nace.org">www.nace.org</a></td>
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<td>NADCA</td>
<td>National Air Duct Cleaners Association (202) 737-2926</td>
<td><a href="http://www.nadca.com">www.nadca.com</a></td>
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<td>NAIMA</td>
<td>North American Insulation Manufacturers Association (703) 684-0084</td>
<td><a href="http://www.naima.org">www.naima.org</a></td>
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<td>NBGQA</td>
<td>National Building Granite Quarries Association, Inc. (800) 557-2848</td>
<td><a href="http://www.nbgqa.com">www.nbgqa.com</a></td>
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<td>NCMA</td>
<td>National Concrete Masonry Association (703) 713-1900</td>
<td><a href="http://www.ncma.org">www.ncma.org</a></td>
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<td>NCPI</td>
<td>National Clay Pipe Institute (262) 248-9094</td>
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<td>National Cable &amp; Telecommunications Association (202) 775-2300</td>
<td><a href="http://www.ncta.com">www.ncta.com</a></td>
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<td>NEBB</td>
<td>National Environmental Balancing Bureau (301) 977-3698</td>
<td><a href="http://www.nebb.org">www.nebb.org</a></td>
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<td>NECA</td>
<td>National Electrical Contractors Association (301) 657-3110</td>
<td><a href="http://www.necanet.org">www.necanet.org</a></td>
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<td>NeLMA</td>
<td>Northeastern Lumber Manufacturers’ Association (207) 829-6901</td>
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<td>NEMA</td>
<td>National Electrical Manufacturers Association (703) 841-3200</td>
<td><a href="http://www.nema.org">www.nema.org</a></td>
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<td>NETA</td>
<td>InterNational Electrical Testing Association (888) 300-6382 (269) 488-6382</td>
<td><a href="http://www.netaworld.org">www.netaworld.org</a></td>
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<td>NFPA</td>
<td>NFPA (National Fire Protection Association) (800) 344-3555 (617) 770-3000</td>
<td><a href="http://www.nfpa.org">www.nfpa.org</a></td>
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<td>NFRC</td>
<td>National Fenestration Rating Council (301) 589-1776</td>
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<td>NGA</td>
<td>National Glass Association (866) 342-5642 (703) 442-4890</td>
<td><a href="http://www.glass.org">www.glass.org</a></td>
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<td>NHLA</td>
<td>National Hardwood Lumber Association (800) 933-0318 (901) 377-1818</td>
<td><a href="http://www.natlhardwood.org">www.natlhardwood.org</a></td>
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<td>NLGA</td>
<td>National Lumber Grades Authority (604) 524-2393</td>
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<td>NOMMA</td>
<td>National Ornamental &amp; Miscellaneous Metals Association (888) 516-8585</td>
<td><a href="http://www.nomma.org">www.nomma.org</a></td>
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<td>NRCA</td>
<td>National Roofing Contractors Association (800) 323-9545 (847) 299-9070</td>
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<td>NRMCA</td>
<td>National Ready Mixed Concrete Association (888) 846-7622 (301) 587-1400</td>
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<td>NSF</td>
<td>NSF International (National Sanitation Foundation International) (800) 673-6275 (734) 769-8010</td>
<td><a href="http://www.nsf.org">www.nsf.org</a></td>
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<td>NSSSGA</td>
<td>National Stone, Sand &amp; Gravel Association (800) 342-1415 (703) 525-8788</td>
<td><a href="http://www.nssga.org">www.nssga.org</a></td>
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<td>NTMA</td>
<td>National Terrazzo &amp; Mosaic Association, Inc. (The) (800) 323-9736 (540) 751-0930</td>
<td><a href="http://www.ntma.com">www.ntma.com</a></td>
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<td>PCI</td>
<td>Precast/Prestressed Concrete Institute (312) 786-0300</td>
<td><a href="http://www.pci.org">www.pci.org</a></td>
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<td>PDCA</td>
<td>Painting &amp; Decorating Contractors of America (800) 332-7322 (314) 514-7322</td>
<td><a href="http://www.pdca.com">www.pdca.com</a></td>
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<td>PDI</td>
<td>Plumbing &amp; Drainage Institute (800) 589-8956 (978) 557-0720</td>
<td><a href="http://www.pdionline.org">www.pdionline.org</a></td>
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<td>PGI</td>
<td>PVC Geomembrane Institute (217) 333-3929</td>
<td><a href="http://pgi-tp.cee.uiuc.edu">http://pgi-tp.cee.uiuc.edu</a></td>
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<td>PLANET</td>
<td>Professional Landcare Network (800) 395-2522 (703) 736-9666</td>
<td><a href="http://www.landcarenetwork.org">www.landcarenetwork.org</a></td>
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<td>PTI</td>
<td>Post-Tensioning Institute (602) 870-7540</td>
<td><a href="http://www.post-tensioning.org">www.post-tensioning.org</a></td>
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<td>RCSC</td>
<td>Research Council on Structural Connections</td>
<td>(301) 340-8580</td>
<td><a href="http://www.boltcouncil.org">www.boltcouncil.org</a></td>
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<td>RFCI</td>
<td>Resilient Floor Covering Institute</td>
<td>(301) 340-8580</td>
<td><a href="http://www.rfci.com">www.rfci.com</a></td>
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<td>RIS</td>
<td>Redwood Inspection Service</td>
<td>(925) 935-1499</td>
<td><a href="http://www.redwoodinspection.com">www.redwoodinspection.com</a></td>
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<td>SCTE</td>
<td>Society of Cable Telecommunications Engineers</td>
<td>(800) 542-5040; (610) 363-6888</td>
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<td>SDI</td>
<td>Steel Deck Institute</td>
<td>(847) 458-4647</td>
<td><a href="http://www.sdi.org">www.sdi.org</a></td>
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<tr>
<td>SDI</td>
<td>Steel Door Institute</td>
<td>(440) 899-0010</td>
<td><a href="http://www.steeldoors.org">www.steeldoors.org</a></td>
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<tr>
<td>SEFA</td>
<td>Scientific Equipment and Furniture Association</td>
<td>(877) 294-5424; (516) 294-5424</td>
<td><a href="http://www.sefalabs.com">www.sefalabs.com</a></td>
</tr>
<tr>
<td>SEI/ASCE</td>
<td>Structural Engineering Institute/American Society of Civil Engineers (See ASCE)</td>
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<tr>
<td>SGCC</td>
<td>Safety Glazing Certification Council</td>
<td>(315) 646-2234</td>
<td><a href="http://www.sgcc.org">www.sgcc.org</a></td>
</tr>
<tr>
<td>SIA</td>
<td>Security Industry Association</td>
<td>(866) 817-8888; (703) 683-2075</td>
<td><a href="http://www.siaonline.org">www.siaonline.org</a></td>
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<tr>
<td>SJI</td>
<td>Steel Joist Institute</td>
<td>(843) 626-1995</td>
<td><a href="http://www.steeloist.org">www.steeloist.org</a></td>
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<tr>
<td>SMA</td>
<td>Screen Manufacturers Association</td>
<td>(561) 533-0991</td>
<td><a href="http://www.smainfo.org">www.smainfo.org</a></td>
</tr>
<tr>
<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractors' National Association</td>
<td>(703) 803-2980</td>
<td><a href="http://www.smacna.org">www.smacna.org</a></td>
</tr>
<tr>
<td>SPFA</td>
<td>Spray Polyurethane Foam Alliance</td>
<td>(800) 523-6154</td>
<td><a href="http://www.sprayfoam.org">www.sprayfoam.org</a></td>
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<tr>
<td>SPIB</td>
<td>Southern Pine Inspection Bureau</td>
<td>(850) 434-2611</td>
<td><a href="http://www.spib.org">www.spib.org</a></td>
</tr>
<tr>
<td>SPRi</td>
<td>Single Ply Roofing Industry</td>
<td>(781) 647-7026</td>
<td><a href="http://www.spric.org">www.spric.org</a></td>
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<tr>
<td>SSPC</td>
<td>SSPC: The Society for Protective Coatings</td>
<td>(877) 281-7772; (412) 281-2331</td>
<td><a href="http://www.sspci.org">www.sspci.org</a></td>
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<tr>
<td>STI</td>
<td>Steel Tank Institute</td>
<td>(847) 438-8265</td>
<td><a href="http://www.steeltank.com">www.steeltank.com</a></td>
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<tr>
<td>SWI</td>
<td>Steel Window Institute</td>
<td>(216) 241-7333</td>
<td><a href="http://www.steelwindows.com">www.steelwindows.com</a></td>
</tr>
<tr>
<td>SWRI</td>
<td>Sealant, Waterproofing, &amp; Restoration Institute</td>
<td>(816) 472-7974</td>
<td><a href="http://www.swrionline.org">www.swrionline.org</a></td>
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<tr>
<td>TCNA</td>
<td>Tile Council of North America, Inc.</td>
<td>(864) 646-8453</td>
<td><a href="http://www.tileusa.com">www.tileusa.com</a></td>
</tr>
<tr>
<td>TIA/EIA</td>
<td>Telecommunications Industry Association/Electronic Industries Alliance</td>
<td>(703) 907-7700</td>
<td><a href="http://www.tiaonline.org">www.tiaonline.org</a></td>
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<tr>
<td>TMS</td>
<td>The Masonry Society</td>
<td>(303) 939-9700</td>
<td><a href="http://www.masonrysociety.org">www.masonrysociety.org</a></td>
</tr>
<tr>
<td>TPI</td>
<td>Turfgrass Producers International</td>
<td>(800) 405-8873; (847) 649-5555</td>
<td><a href="http://www.turfgrassprov.org">www.turfgrassprov.org</a></td>
</tr>
<tr>
<td>TRI</td>
<td>Tile Roofing Institute</td>
<td>(312) 670-4177</td>
<td><a href="http://www.tileroofing.org">www.tileroofing.org</a></td>
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<tr>
<td>UL</td>
<td>Underwriters Laboratories Inc.</td>
<td>(877) 854-3577; (847) 272-8800</td>
<td><a href="http://www.ul.com">www.ul.com</a></td>
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<tr>
<td>USGBC</td>
<td>U.S. Green Building Council</td>
<td>(800) 795-1747</td>
<td><a href="http://www.usgbc.org">www.usgbc.org</a></td>
</tr>
<tr>
<td>USITT</td>
<td>United States Institute for Theatre Technology, Inc.</td>
<td>(800) 938-7488; (315) 463-6463</td>
<td><a href="http://www.usitt.org">www.usitt.org</a></td>
</tr>
<tr>
<td>WASTEC</td>
<td>Waste Equipment Technology Association</td>
<td>(800) 424-2869; (202) 244-4700</td>
<td><a href="http://www.wastec.org">www.wastec.org</a></td>
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<tr>
<td>WCMA</td>
<td>Window Covering Manufacturers Association</td>
<td>(212) 297-2122</td>
<td><a href="http://www.wcmanet.org">www.wcmanet.org</a></td>
</tr>
<tr>
<td>WCSC</td>
<td>Window Covering Safety Council</td>
<td>(800) 506-4636; (212) 297-2109</td>
<td><a href="http://www.windowcoverings.org">www.windowcoverings.org</a></td>
</tr>
<tr>
<td>WDMA</td>
<td>Window &amp; Door Manufacturers Association</td>
<td>(800) 223-2301; (847) 299-5200</td>
<td><a href="http://www.wdma.com">www.wdma.com</a></td>
</tr>
<tr>
<td>WMMPA</td>
<td>Wood Moulding &amp; Millwork Producers Association</td>
<td>(800) 550-7889; (530) 661-9591</td>
<td><a href="http://www.wmmpa.com">www.wmmpa.com</a></td>
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</table>
B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Description</th>
<th>Phone Numbers</th>
<th>Website</th>
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<tbody>
<tr>
<td>IAPMO</td>
<td>International Association of Plumbing and</td>
<td>(909) 472-4100</td>
<td><a href="http://www.iapmo.org">www.iapmo.org</a></td>
</tr>
<tr>
<td></td>
<td>Mechanical Officials</td>
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</tr>
<tr>
<td>ICC</td>
<td>International Code Council</td>
<td>(888) 422-7233</td>
<td><a href="http://www.iccsafe.org">www.iccsafe.org</a></td>
</tr>
</tbody>
</table>

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

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<tr>
<th>Agency</th>
<th>Description</th>
<th>Phone Numbers</th>
<th>Website</th>
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</thead>
<tbody>
<tr>
<td>CE</td>
<td>Army Corps of Engineers</td>
<td>(202) 761-0011</td>
<td><a href="http://www.usace.army.mil">www.usace.army.mil</a></td>
</tr>
<tr>
<td>DOC</td>
<td>Department of Commerce</td>
<td>(202) 482-2000</td>
<td><a href="http://www.commerce.gov">www.commerce.gov</a></td>
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<tr>
<td>DOD</td>
<td>Department of Defense</td>
<td>(215) 697-6257</td>
<td><a href="http://dodssp.daps.dla.mil">http://dodssp.daps.dla.mil</a></td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Energy</td>
<td>(202) 586-9220</td>
<td><a href="http://www.energy.gov">www.energy.gov</a></td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
<td>(202) 272-0167</td>
<td><a href="http://www.epa.gov">www.epa.gov</a></td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
<td>(866) 835-5322</td>
<td><a href="http://www.faa.gov">www.faa.gov</a></td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
<td>(888) 225-5322</td>
<td><a href="http://www.fcc.gov">www.fcc.gov</a></td>
</tr>
<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
<td>(888) 463-6332</td>
<td><a href="http://www.fda.gov">www.fda.gov</a></td>
</tr>
<tr>
<td>GSA</td>
<td>General Services Administration</td>
<td>(800) 488-3111</td>
<td><a href="http://www.gsa.gov">www.gsa.gov</a></td>
</tr>
<tr>
<td>HUD</td>
<td>Department of Housing and Urban Development</td>
<td>(202) 708-1112</td>
<td><a href="http://www.hud.gov">www.hud.gov</a></td>
</tr>
<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
<td></td>
<td><a href="http://www.nist.gov">www.nist.gov</a></td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety &amp; Health Administration</td>
<td>(301) 975-6478</td>
<td><a href="http://www.osha.gov">www.osha.gov</a></td>
</tr>
<tr>
<td>PBS</td>
<td>Public Buildings Service (See GSA)</td>
<td>(800) 321-6742, (202) 693-1999</td>
<td></td>
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<tr>
<td>PHS</td>
<td>Office of Public Health and Science</td>
<td></td>
<td><a href="http://www.hhs.gov/ophs">www.hhs.gov/ophs</a></td>
</tr>
<tr>
<td>RUS</td>
<td>Rural Utilities Service (See USDA)</td>
<td>(202) 690-7694</td>
<td><a href="http://www.state.gov">www.state.gov</a></td>
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<tr>
<td>SD</td>
<td>State Department</td>
<td>(202) 720-9540</td>
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<tr>
<td>TRB</td>
<td>Transportation Research Board</td>
<td>(202) 647-4000</td>
<td><a href="http://gulliver.trb.org">http://gulliver.trb.org</a></td>
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<tr>
<td>USDA</td>
<td>Department of Agriculture</td>
<td>(202) 334-2934</td>
<td><a href="http://www.usda.gov">www.usda.gov</a></td>
</tr>
<tr>
<td>USPS</td>
<td>Postal Service</td>
<td>(202) 720-2791</td>
<td><a href="http://www.usps.com">www.usps.com</a></td>
</tr>
</tbody>
</table>

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

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<td>ADAAG</td>
<td>Americans with Disabilities Act (ADA)</td>
<td>(800) 872-2253</td>
<td><a href="http://www.access-board.gov">www.access-board.gov</a></td>
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<tr>
<td></td>
<td>Architectural Barriers Act (ABA) Accessibility Guidelines for</td>
<td>(202) 272-0080</td>
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<tr>
<td></td>
<td>Buildings and Facilities Available from U.S. Access Board</td>
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<tr>
<td></td>
<td>Office</td>
<td>(202) 512-1800</td>
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<tr>
<td>DOD</td>
<td>Department of Defense Military Specifications and Standards</td>
<td>(215) 697-2664</td>
<td><a href="http://dodssp.daps.dla.mil">http://dodssp.daps.dla.mil</a></td>
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<tr>
<td></td>
<td>Available from Department of Defense Single Stock Point</td>
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<td>FED-STD</td>
<td>Federal Standard (See FS)</td>
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<td>MILSPEC</td>
<td>Military Specification and Standards Available from Department</td>
<td>(215) 697-2664</td>
<td><a href="http://dodssp.daps.dla.mil">http://dodssp.daps.dla.mil</a></td>
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<td>of Defense Single Stock Point</td>
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<td>UFAS</td>
<td>Uniform Federal Accessibility Standards Available from Access</td>
<td>(800) 872-2253</td>
<td><a href="http://www.access-board.gov">www.access-board.gov</a></td>
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<td>Board</td>
<td>(202) 272-0080</td>
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PART 2 - PRODUCTS - Not applicable.

PART 3 - EXECUTION - Not applicable.

END OF SECTION 01 42 00
SECTION 01 42 10 - ABBREVIATIONS - TERMINOLOGY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

<table>
<thead>
<tr>
<th>Symbol</th>
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<td>&amp;</td>
<td>and</td>
<td>AFH</td>
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<tr>
<td>@</td>
<td>at</td>
<td>AFM</td>
</tr>
<tr>
<td>1P</td>
<td>one pole</td>
<td>AGGR</td>
</tr>
<tr>
<td>2P</td>
<td>double pole</td>
<td>AHC</td>
</tr>
<tr>
<td>1S</td>
<td>single speed</td>
<td>AHU</td>
</tr>
<tr>
<td>2S</td>
<td>two speed</td>
<td>AIC</td>
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<tr>
<td>1W</td>
<td>one winding</td>
<td>ALUM</td>
</tr>
<tr>
<td>2W</td>
<td>two winding</td>
<td>ALT</td>
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<td>A</td>
<td>astragal, acid, compressed air, ampere</td>
<td>AM</td>
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<tr>
<td>AB</td>
<td>anchor bolt, air blender, auger boring</td>
<td>AMB</td>
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<tr>
<td>A/C</td>
<td>air condition, air conditioner</td>
<td>ANCT</td>
</tr>
<tr>
<td>AC</td>
<td>air compressor, alternating current, asphaltic concrete</td>
<td>ANG</td>
</tr>
<tr>
<td>ACB</td>
<td>air circuit breaker</td>
<td>AMP</td>
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<tr>
<td>ACL</td>
<td>across the line</td>
<td>ANOD</td>
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<td>ACLD</td>
<td>air cooled</td>
<td>ANN</td>
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<tr>
<td>ACOUS</td>
<td>Acoustical</td>
<td>ANS</td>
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<tr>
<td>ACSR</td>
<td>aluminum conduit or steel reinforced</td>
<td>ANT</td>
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<tr>
<td>ACU</td>
<td>air conditioning unit</td>
<td>AP</td>
</tr>
<tr>
<td>ACV</td>
<td>air control valve</td>
<td>APC</td>
</tr>
<tr>
<td>AD</td>
<td>area drain, automatic damper</td>
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<tr>
<td>ADDL</td>
<td>Additional</td>
<td>APPAR</td>
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<td>ADH</td>
<td>Adhesive</td>
<td>APPROX</td>
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<td>ADJ</td>
<td>adjust, adjustable</td>
<td>APPX</td>
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<td>Administration</td>
<td>ARCH</td>
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<td>A/E</td>
<td>Architect/Engineer</td>
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<tr>
<td>AF</td>
<td>air filter, amps frame</td>
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<tr>
<td>AFD</td>
<td>adjustable frequency drive</td>
<td>ASPH</td>
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<tr>
<td>AFF</td>
<td>above finished floor</td>
<td>ASST</td>
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<td>AFG</td>
<td>above finished grade</td>
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05-04-2012
01 42 10 - 1
ABBREVIATIONS – TERMINOLOGY
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<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>ATS</td>
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<td>ATM</td>
<td>Atmosphere</td>
</tr>
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<td>ATU</td>
<td>air terminal unit</td>
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<td>AUTO</td>
<td>Automatic</td>
</tr>
<tr>
<td>AUX</td>
<td>Auxiliary</td>
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<tr>
<td>AV</td>
<td>acid vent</td>
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<tr>
<td>AVE</td>
<td>Avenue</td>
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<td>AVG</td>
<td>Average</td>
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<td>AW</td>
<td>acid waste</td>
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<td>AWC</td>
<td>acoustical wall covering</td>
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<tr>
<td>B</td>
<td>base, boiler, blank, bottom, bottom bars</td>
</tr>
<tr>
<td>BB</td>
<td>base board, boiler burner, broad band</td>
</tr>
<tr>
<td>BBD</td>
<td>boiler blowdown, broad band data</td>
</tr>
<tr>
<td>B to B</td>
<td>back to back</td>
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<tr>
<td>B &amp; B</td>
<td>balled and burlapped</td>
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<td>B &amp; BB</td>
<td>breakers and bus bracing</td>
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<td>BAL</td>
<td>Balance</td>
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<td>BAR</td>
<td>Barrier</td>
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<tr>
<td>BARO</td>
<td>Barometer</td>
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<td>BAS</td>
<td>building automation system</td>
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<td>BAT</td>
<td>Batten</td>
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<tr>
<td>BCCMP</td>
<td>bituminous coated corrugated metal pipe</td>
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<tr>
<td>BD</td>
<td>board</td>
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<td>BDD</td>
<td>backdraft damper</td>
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<td>BDF</td>
<td>building distribution frame</td>
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<td>BF</td>
<td>boiler feed</td>
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<td>BFP</td>
<td>backflow preventer</td>
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<td>BFS</td>
<td>boiler feed system</td>
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<td>BHC</td>
<td>booster heating coil</td>
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<td>bituminous</td>
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<td>BKR</td>
<td>breaker</td>
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<td>beam</td>
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<td>BOC</td>
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<td>BOF</td>
<td>bottom of footing</td>
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<td>bottom</td>
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<td>BP</td>
<td>base plate</td>
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<td>BR</td>
<td>bare root, bedroom, bottom register</td>
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<td>built-up roof</td>
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<td>BUSY</td>
<td>in-use</td>
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<td>BW</td>
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<td>outside air</td>
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<td>OC</td>
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<td>ODPs</td>
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<td>outside face, overflow</td>
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<td>PB</td>
<td>pegboard, push button, pullbox power brick</td>
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<td>PCWR</td>
<td>process cooling water return</td>
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<td>process cooling water supply</td>
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<td>PD</td>
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<td>point of intersection, passive infrared</td>
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<td>PVC edge banding - 3mm thickness</td>
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<p>| SWBD | switchboard |
| SWC | soft wall covering |
| SWGR| switchgear |
| SX  | steam exhaust |
| SYM | symbol, symmetrical |
| SYS | system |
| T   | toilet, throw, top, tank, top bars, temperature, tile, tangent |
| T &amp; B| testing and balancing, top and bottom |
| T &amp; G| tongue and groove |
| TA  | tempered air, transfer air, toilet accessories |
| TB  | tackboard |
| TBC | tackboards, natural cork |
| TBP | tackboards, plastic |
| TC  | top of curb |
| TD  | temperature differential |
| TDC | transverse duct connection |
| TEFC| totally enclosed fan-cooled |
| TEL | Telephone |
| TEMP| temperature, temporary |
| TENV| totally enclosed non-ventilated |
| TRZ | Terrazzo |
| TERM| Terminal |
| TH  | total heat, total head (pumps) |
| THD | Total Harmonic Distortion |
| THOUT| Throughout |
| THRSLD| Threshold |
| THRU| Through |
| TL  | task light |
| TOC | top of caisson, top of concrete |
| TOF | top of footing |
| TONE| tone transfer |
| TOS | top of steel |
| TOW | top of wall |</p>
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END OF SECTION 01 42 10
SECTION 01 42 19 - REFERENCE STANDARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION

A. General:

1. ASTM standards are documents developed and established by American Society for Testing and Materials (ASTM) and meet approval requirements of ASTM procedures and regulations.
2. ANSI standards are documents developed and established by American National Standards Institute, Inc. (ANSI) and meet approval requirements of ANSI procedures and regulations.
3. NFPA standards (National Fire Codes) are documents developed and established by National Fire Protection Association, (NFPA) and meet approval requirements of NFPA procedures and regulations.
4. Other Reference Standards as indicated.
5. Specifications will indicate ASTM, ANSI, NFPA and other standards by number.

   a. Utilize the latest edition and amendments as published at the time of Contract Award.

      Exception: Where the locally adopted Codes or authorities having jurisdiction otherwise stipulate that a specific edition must be followed.

   b. Dates and titles of referenced standards appear on appropriate web sites:

      (1) ASTM: www.astm.org
      (2) ANSI: www.ansi.org/catalog/search.html
      (3) NFPA: http://www.nfpa.org/

   c. Web site indexes generally include all standards published by the subject organization; and may contain standards that are not referenced for this project.

6. Parallel metric standards apply as required, but may not be identified in specification sections.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 42 19
SECTION 01 43 39 - MOCK-UP'S

PART 1 - GENERAL

1.01 DESCRIPTION

A. Build each of the indicated mock-ups on site for review and approval before proceeding with any construction that may be affected by the construction represented by a corresponding mockup.

1.02 PROCEDURE FOR MOCK-UP CONSTRUCTION:

A. Extent, size, form and primary components are indicated on the drawings or in the specification section pertaining to the corresponding work.

B. Mock-up shall be located where indicated on the drawings or, if not indicated, shall be located where directed by the Owner/Architect/Engineer.

C. Mock-up shall not be provided until corresponding product data, shop drawings, samples and other preparatory submittals are approved.

D. Mock-up shall be rebuilt as necessary until approved by Owner/Architect/Engineer.

E. After approval, mock-up shall remain and serve as the standard for judging the acceptance or rejection of the appearance characteristics and workmanship of corresponding construction.

F. After completion and acceptance of the corresponding construction, mock-up shall be removed when directed by the Architect/Engineer unless approved mock-up has been located as part of the permanent construction.

G. Surrounding and other construction affected by mock-up construction or removal shall be completed as indicated or, if construction is not indicated, the site shall be restored to the condition existing before the mock-up construction.

PART 2 - PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials used in the initial mock-up construction shall comply as specified in the applicable sections for the work and as approved by submittal reviews.

B. Materials may be modified only to the extent required for mock-up approval by the Owner.

1. Modified materials shall comply with the specified requirements but may differ in appearance characteristics, such as color and texture.
2. Materials used in the construction of approved mock-up construction shall be used in the corresponding permanent construction.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Provide initial mock-up construction by methods proposed for the corresponding permanent construction.

1. Comply with installation and application requirements for each component as specified in the section applicable for the work.

B. Methods of construction may be modified only to the extent required for mock-up approval by the Owner.

1. Modified methods of construction shall comply with the specified requirements as well as approved details of workmanship.

C. Methods of construction used for the approved mock-up construction shall be used in the corresponding permanent construction.

3.02 BUILDING ENCLOSURE WALL MOCK-UP

A. Provide mock-up of the building enclosure wall assembly as indicated. A full size exterior building mock-up shall be required for approval and acceptance prior to beginning construction on the exterior skin of the building. Assume a size of 20 feet wide by 40 feet high of exterior wall that will replicate all exterior wall assembly materials approved for construction during the submittal process.

B. Mock-up shall include, at a minimum, the following features:

1. Corner with building return extending 10 feet from building corner.
2. Window with head, jam and sill flashed and detailed.
3. Window unit, with sun shade device if applicable
4. Storefront unit
5. Vertical and horizontal expansion joints.
6. Relief angle and flashing system.
7. Stone wall and flashing/weep system
8. Board formed concrete wall
9. Top of wall corbelling with gutter, flashing, and thru-wall downspout (what about heat trace detail?) Top of wall corbelling with gutter, flashing and thru-wall downspout.
10. Clay tile roof system, complete, extending back from face of building exterior a minimum of 10 feet. Provide roof corner condition with eave at mock-up face and gable (rake) condition on 10 foot return section.
11. Louver with birdscreen.
12. Stone shiner panel construction
13. Kalwall treatment, with removable section
14. Caulking and sealants
C. Sections specifying components of this mock-up include but are not necessarily limited to the following:

1. Section 04 05 05, Cold and Hot Weather Masonry Procedures.
2. Section 04 05 10, Masonry Cleaning.
4. Section 04 05 23, Masonry Accessories.
5. Section 04 42 03, Limestone and Granite.
6. Section 07 11 14, Asphalitic Emulsion Dampproofing.
7. Section 07 21 00, Building Insulation.
8. Section 07 27 26, Fluid Applied Air Barrier.
9. Section 07 32 13, Clay Tile Roofing.
10. Section 07 62 00, Flashing and Sheet Metal.
11. Section 07 92 13, Exterior Joint Sealants.
12. Section 08 44 13, Curtain Wall Systems.
13. Section 08 81 02, Exterior Glass and Glazing.
14. Section 08 91 00, Architectural Louvers.

3.03 SAMPLE WALL MOCK-UP

A. Provide three distinct sample wall mock-up panels of approximately 10 foot high by 16 foot long showing various options demonstrating the brick features of coursing bond, reveals and color mix options as indicated by the drawings. Comply with the applicable Sections specifying the necessary components.

3.04 HARDSCAPE MOCK-UP

A. Provide a site paving and site wall/seating mock-up located at the base of the building enclosure mock-up.

1. Assume a size of 20 feet by the width of the wall mock-up.
2. The mock-up shall include a typical 10 FT long site wall with seating cap.
3. Paving mock-up shall include sandstone paving, colored precast concrete paving, and grey concrete paving.
4. Mock-up shall be installed on compacted roadbase aggregate and sand set bed.

3.05 REMOVAL

A. Remove Mockups at conclusion of project or when directed by Owner. Restore or finish site to finish condition as indicated on drawings or to previous existing conditions.

END OF SECTION 01 43 39
SECTION 01 43 44 - COORDINATION DRAWINGS (CM)

PART 1 - GENERAL

1.01 DESCRIPTION – INTERIOR

A. Coordinate construction operations included in various Sections of Specifications to assure efficient and orderly installation of all parts of Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

B. Coordination drawings: Reproducible overlay drawings showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other services:
   1. In and above ceilings.
   2. Within walls.
   3. Within chases.
   4. In mechanical spaces.
   5. In electrical spaces.

C. Sleeve, coredrill and blockout layout drawings: Drawings showing proposed locations and sizes of sleeves, coredrills, blockouts, and embedded items in concrete walls, columns, floors and beams.

D. Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.

E. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

F. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

G. Work out all “tight” conditions involving Work of various Sections in advance of installation.

H. Contractor shall submit coordination drawings with all mechanical, electrical, fire protection, and building monitoring systems before Architect/Engineer review of any shop drawings or submittals for work in those trades.

I. Modifications required as result of failure to resolve interferences, provide correct coordination drawings, or call attention to changes required in other work as result of modifications shall be paid for by Contractor.

J. Coordination meetings scheduled by Construction Manager with all affected Contractors.
1.02 PRODUCTION OF COORDINATION DRAWINGS

A. Construction Manager shall provide minimum 1/4 IN scale background drawings, showing:

1. Partitions.
   a. Fire/smoke rated barriers.

2. Ceiling heights.
3. Structural framing locations and elevations.
4. Column lines.
5. Other work.

B. Contractors produce combined coordination layout drawings plan and sections of HVAC ductwork, hydronic, steam, condensate, fuel oil, fire protection piping, plumbing, special water systems, natural gas and medical gas systems electrical cable tray, conduit, conveying systems, equipment and other work.

C. Coordination Drawings shall be produced in CAD so they can be used for Shop Drawings and be updated at end of Project for Project Record Drawings.

1. Architect/Engineer will furnish Contractor electronic drawing files of architectural plan backgrounds in AutoCAD DWG format.
   a. CAD drawings floor plan backgrounds will indicate wall layout, column lines and room name and numbering.
   b. Architect/Engineer makes no representation as to accuracy or completeness of CAD files provided.

2. Have skilled CAD technician(s) produce following plans in same CAD program and version for Coordination Drawings and Shop Drawing submittals;
   a. Conveying systems.
   b. HVAC ductwork system.
   c. Piping systems.
   d. Plumbing systems.
   e. Fire protection system.
   f. Fire alarm system.
   g. Communication and security systems.
   h. Cable tray system.
   i. Lightning protection system.
   j. Building management system.

3. Indicate systems on separate CAD file with layers compliant with National CAD Standard to facilitate Coordination Drawings and Project Record Documents, using the background as an XREF to the coordination file.

4. Contractor may choose to create “paperspace views” and increase scale of plotted drawings to facilitate clarity of detail. Revised scale shall be indicated on plotted sheets.
D. Resolve major interferences at initial coordination meeting prior to production of any drawings.

E. Produce initial coordination drawings within 30 days after initial meeting.

F. Construction Manager arrange for production of said drawings not provided by that time.

G. Meet as required to resolve interferences and correct coordination drawings.

1.03 AFTER APPROVAL

A. After Contractors’ written approval of coordination drawings, Construction Manager determine method used to resolve interferences not previously identified.

B. Construction Manager shall give written approval of changes to coordination drawings prior to start of work in affected area.

C. Maintain one copy of current approved Coordination Drawings at project site in Construction Manager’s office.

1.04 PRECEDENCE OF SERVICES FOR COORDINATION DRAWINGS

A. In event of conflicts involving location and layout of work; use following priority to resolve disputes:

1. Structure and partitions have highest priority.
2. Equipment location and access.
3. Ceiling system and recessed light fixtures.
4. Gravity drainage lines.
5. High pressure ductwork and devices.
6. Large pipe mains, valves and devices.
7. Pneumatic tube and material conveying systems.
8. Low pressure ductwork, diffusers, registers, grilles, HVAC equipment.
10. Small piping, tubing, electrical conduit, and devices.

a. Conduits installed in corridors shall be maintained at least 9 inches above finished ceiling. Conduits shall be grouped within a 12-inch width.

b. The space utilized for conduit shall be selected to allow access to all devices that normally require adjustment, repair, resetting, etc.

11. Sleeves through rated partitions.

1.05 PRODUCTION OF LAYOUT DRAWINGS

A. Construction Manager provide scale plan and elevation drawings.
B. Contractors indicate location and size of their required sleeves, blockouts and embedded items.

1. At floor slabs and walls to be core drilled or cut, find and mark all reinforcing in both faces located by means of x-ray, pachometer, or profometer.
2. Submit sketch showing location of rebar and proposed cores for review.

1.06 SUBMITTALS

A. Project information:

1. Contractor’s approved Coordination Drawings.
   a. Letter indicating one copy of approved Coordination Drawings available at project site.
   b. One copy of approved Coordination Drawings to Architect/Engineer for information, if requested.

2. Contractor’s proposed sleeve, coredrill and blockout layout drawings.
   a. One copy of drawing to Architect/Engineer for information.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 43 44
SECTION 01 45 00 - QUALITY CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUPPLEMENTAL TESTING

A. If required, the following testing shall be performed at the expense of the contractor installing the material being tested:

1. Material Substitution: Any tests of basic material or fabrication equipment offered as a substitute for specified item on which a test may be required in order to prove its compliance with the specifications.
2. Mechanical/Electrical: Tests on mechanical and electrical systems required to insure their proper installation and operation.
3. Any test that fails shall be paid for by the installing contractor subject to the following conditions:
   a. Quantity and nature of tests will be determined by the Consultant.
   b. All tests shall be done in the presence of the Owner or Owner’s representative.
   c. Proof of noncompliance will make the installing contractor liable for any corrective action which the Owner feels is prudent including complete removal and replacement of defective material.

B. Nothing contained herein is intended to imply that the installing contractor does not have the right to have tests performed on any material at any time for information and job control so long as the Consultant or Owner does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

C. Consultant shall determine the type and number of tests to be performed on the project.

1.03 TEST REPORTS

A. Reports of all tests made by testing laboratories shall be distributed by the testing laboratory as follows:

1. 1 copy – CMGC.
2. 1 copy – Applicable supplier or subcontractor.
3. 1 copy – Owner.
4. 1 copy – Consultant.
5. Other copies - as directed.

1.04 QUALITY CONTROL SYSTEM

A. General: The contractor shall establish a quality control system to perform sufficient inspection and tests of all items of work, including that of all subcontractors, to ensure
conformance to the Contract Documents for materials, workmanship, construction, finish, functional performance and identification. This control shall be established for all construction except where the Contract Documents provide for specific compliance tests by testing laboratories or Consultants employed by the Owner.

1. The quality control system is the means by which the Contractor assures that construction complies with the requirements of the Contract Documents. Controls shall be adequate to cover all construction operations and should be keyed to the proposed construction schedule.

B. The Contractor shall designate a quality control representative on staff to review the work to insure compliance with the contract documents by weekly jobsite visits for observation. The designated employee shall not be involved in the performance of the work. The quality control representative shall review the work and make necessary corrections to bring the work into compliance prior to scheduling the Architect/Engineer for the final punchlist review.

C. Records: The Contractor shall maintain correct records on an appropriate form for all inspections and tests performed, instruction received from the Owner and actions taken as a result of those instructions. These records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective action taken. The Contractor shall document inspections and tests as required by each Section of the Specifications.

1.05 INDEPENDENT TESTING AGENCY SERVICES

A. The Owner will employ and pay for the services of an independent Testing Agency to perform the Inspections, special inspections, tests and other services when required by sections of the specification. Services shall be performed in accordance with requirements of governing authorities and with specified standards.

1. Contractor shall cooperate with Testing Agency personnel and shall furnish tools, sample of materials, design mixes, equipment and assistance as requested.
2. Contractor shall provide and maintain, for the sole use of the Testing Agency, adequate facilities for the safe storage and proper curing of concrete testing cylinders on the project site for the first 24 hours after casting as required by ASTM C 31, Method of Making and Curing Concrete Test Specimens in the field.
3. Contractor shall notify Testing Agency sufficiently in advance of operations to allow for completion of initial tests and proper assignment of inspection personnel.
4. Contractor shall notify the testing agency sufficiently in advance of cancellation of required testing operations. The Contractor shall assume responsibility for costs incurred due to the failure to provide such notice.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 45 00
SECTION 01 45 23 - TESTS AND INSPECTIONS

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. General:

1. Work shall be subject to inspection, testing and approval by testing agency, inspector and public authorities having jurisdiction.
2. Approval as result of inspection or testing shall not be construed to be an approval of a violation of provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
3. Testing, inspections and approvals presuming to give authority to violate or cancel provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations shall not be valid.
4. It shall be duty of Contractor to cause Work to remain accessible and exposed for testing and inspection purposes.
5. It shall be duty of Contractor to notify testing agency, inspector and public authorities having jurisdiction when Work is in conformance with Contract Documents and is ready for testing and inspection.
6. It shall be duty of Owner and Contractor to provide access to, and means for testing and inspections of such Work required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
7. Any portion that does not comply shall be corrected and shall not be covered or concealed until authorized by testing agency, inspector and public authorities having jurisdiction.
8. Tests, inspections and approvals of portions of Work required by Contract Documents or by codes, laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time.
9. Contractor shall give testing agency, inspector, public authorities having jurisdiction, and Architect/Engineer, if requested, timely notice of when and where tests and inspections are to be made so that they may be present for such procedures.
10. In event such procedures for testing, inspection and approval reveal portions of Work fail to comply with requirements established by Contract Documents, or by governing codes, laws, ordinances, rules or regulations, all costs made necessary by such failure, including those of repeated procedures and compensation for Architect/Engineer's services and expenses, shall be at Contractor's expense.
11. Required certificates of testing, inspection and approval shall, unless otherwise required by Contract Documents, be secured by Contractor and promptly delivered to Architect/Engineer, inspector and public authorities having jurisdiction.

B. If Architect/Engineer, Owner, public authorities having jurisdiction, testing agency, or inspector is to observe tests, inspections and approvals required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations or orders of public authorities having jurisdiction, they will do so promptly, and where practicable, at normal place of testing. Test and inspection method standards: See technical sections and governing codes, laws, ordinances, rules, and regulations.
C. Qualifications of independent testing agencies:

4. See technical sections for additional requirements.

D. Testing Equipment Calibration: Shall be by accredited calibration agency, at maximum 12-month intervals, by devices of accuracy traceable to either:

1. National Institute of Standards and Technology.

1.02 DESCRIPTION

A. Owner will arrange and pay for following testing and inspections performed by testing agency or special inspector:

1. Edit list for project
2. Site excavation and rough grading inspection: Section 31 20 00.
3. Soil compaction inspection and testing: Section 31 23 33.
4. Excavation inspection: Section 31 23 33.
5. Earth retention systems inspection and concrete testing: Section 03 30 00.
6. Drilled pier excavation inspection and testing: Section 31 63 29.
7. Concrete testing and evaluation of installed work: Section 03 30 00.
8. Concrete reinforcing testing and inspection: Section 03 30 00.
9. Concrete floor finish tolerance testing: Section 03 35 00.
11. Masonry accessory installation inspection: Section 04 05 23.
13. Concrete masonry inspection: Section 04 20 00.
14. Structural steel welding, bolts and stud testing and inspection, except testing to qualify welders: Section 05 12 00.
15. Metal roof deck inspection: Section 05 31 00.
16. Fireproofing testing and inspection: Section 07 81 16.
17. Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

B. Contractor shall arrange for, and bear all related costs for following with Owner provided independent testing agency or entity acceptable to Owner:

1. Re-testing due to failure of initial test or due to nonconformance with Contract Documents. All re-testing shall be performed in the presence of the Owner or their representative.
2. Re-inspections of Work due to failure of Work to pass initial inspection or due to nonconformance with Contract Documents.
3. Evidence of noncompliance will make the installing contractor liable for any corrective action which the Owner feels is prudent, including complete removal and replacement of defective material(s).

1.03 JOBS CONDITIONS

A. Employment of independent testing agency does not relieve obligation of Contractor to comply with Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 PERFORMANCE

A. Perform indicated inspections, sampling and testing of materials and methods of construction.

B. Use test and inspection or sampling methods or both conforming to methods indicated.

C. Report each test and inspection or sampling or both as indicated.

D. Report results called for by test method, in form specified.

E. Retest failed products and systems.

3.02 REPORTS

A. The Contractor shall maintain correct records on an appropriate form for all inspections and tests performed, instruction received from the Owner and actions taken as a result of those instructions. These records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, proposed or directed remedial action, corrective action taken, etc.) The Contractor shall document inspections and tests as required by each section of the Specifications.

B. Submit reports and logs promptly to Architect/Engineer, Structural Engineer, Contractor, inspector, and public authorities having jurisdiction. Reports of all tests made by testing laboratories shall be distributed as follows:

1. 1 copy – CMGC
2. 1 copy – Applicable Supplier or Subcontractor
3. 1 copy – Owner
4. 1 copy – Architect/Engineer
5. Other copies as directed.

C. Include following for test or inspection reports or both:

1. Project name and number.
2. Project location.
3. Product and specification section applicable.
4. Type of test or inspection or both.
5. Name of testing agency, if used.
6. Name of testing or inspecting personnel, or both.
7. Date of test or inspection or both.
8. Record of field conditions encountered; i.e., temperature, weather.
9. Test location.
10. Observations regarding compliance.
11. Test method used.
12. Results of test.
13. Date of report.
14. Signature of testing or inspecting personnel or both.

D. Maintain log of tests which have failed:

1. Type of test or inspection or both.
2. Date of test or inspection or both.
3. Test or inspection number or both.
5. Date of retest or inspection or both.
6. Results of retest.
7. Method of retest.

3.03 INDEPENDENT TESTING AGENCY DUTIES AND LIMITATIONS OF AUTHORITY

A. Cooperate with Architect/Engineer and Contractor.

B. Provide qualified personnel promptly on notice.

C. Promptly notify Architect/Engineer and Contractor of irregularities, or deficiencies of work which are observed during performance of services.

D. Testing agency is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of Work.
3. Perform any duties of Contractor.

E. The Owner will employ and pay for the services of an independent Testing Agency to perform the inspections, special inspections, tests and other services when required by sections of the specification. Services shall be performed in accordance with requirements of governing authorities and with specified standards.

1. Contractor shall cooperate with Testing Agency personnel and shall furnish tools, sample of materials, design mixes, equipment and assistance as required.
2. Contractor shall provide and maintain, for the sole use of the Testing Agency, adequate facilities for the safe storage and proper curing of concrete testing cylinders on the project site for the first 24 hours and casting as required by ASTM C 31, Method of Making and Curing Concrete Test Specimens in the field.
3. Contractor shall notify Testing Agency sufficiently in advance of operations to allow for completion of initial tests and proper assignment of inspection personnel.
4. Contractor shall notify the testing agency sufficiently in advance of cancellation of required testing operations. The Contractor shall assume responsibility for costs incurred due to the failure to provide such notice.

3.04 CONTRACTOR'S DUTIES

A. Cooperate with testing agency personnel, inspector and public authorities having jurisdiction and provide access to work.

B. Provide preliminary representative samples of materials to be tested, in required quantities.

C. Furnish copies of mill test reports.

D. Furnish labor and facilities:
   1. To provide access to work to be tested.
   2. To obtain and handle samples at site.
   3. To facilitate inspections and tests.
   4. Storage and curing facilities for testing agency’s exclusive use.

E. Notify appropriate testing agency, inspector or public authorities having jurisdiction sufficiently in advance of operations

END OF SECTION 01 45 23
SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes requirements the basic requirements for temporary services, utilities, and facilities which will indirectly enable adequate construction progress and processes, and will accommodate other necessary activities at the project site except as otherwise indicated, the costs of providing and using temporary services are included in the Contract Sum.

1.03 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect/Engineer, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.04 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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


1.05 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch (60-mm-) OD line posts and 2-7/8-inch (73-mm-) OD corner and pull posts, with 1-5/8-inch (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

2.02 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect/Engineer, and construction personnel office activities and to accommodate project meetings specified in other Division 1 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 15 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.

C. Drinking water and private toilet.

D. Coffee machine and supplies.

E. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).

F. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

G. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

H. Store combustible materials apart from building.

2.03 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 1 Section "CLOSEOUT PROCEDURES".

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

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

1. Locate facilities to limit site disturbance as specified in Division 1 Section "SUMMARY OF WORK."

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

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to City of Boulder’s water service facilities for construction operations. Clean and maintain water service facilities in accordance with the municipality’s requirements. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Contractor shall be responsible for water usage costs.
D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Install sanitary facilities in available locations which will best serve the needs of personnel at the project site.
2. Toilet rooms in existing buildings or in new construction may not be used without written approval of the Owner.

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

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

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Connect temporary service to Owner's existing power source, as directed by Owner. Power consumption shall not disrupt owners need for continuous service.
2. Owner to pay for power consumed.
3. Provide power outlets for construction operations, branch wiring, distribution boxes, and flexible power cords as required.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

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

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. If a mobile phone is designated as the field office phone then it shall be a local number. Install one telephone line(s) for each field office.

1. Provide a dedicated telephone line for each facsimile machine in each field office.
2. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Architect/Engineer's office.
e. Engineers' offices.
f. Owner's office.
g. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

J. Electronic Communication Service: Provide in the primary field office, as a minimum, the following connections, features and/or services:

1. DSL or Cable internet service with a broadband modem/router.
2. Modem/router must be equipped with a hardware firewall.
3. Modem/router must provide either a wired Ethernet/Fast Ethernet/Gigabit Ethernet connection conforming with IEEE standard 802.3/802.3ab or provide a Wireless Ethernet (Wi-Fi) connection conforming with IEEE standard 802.11 b/c/g.
4. Alternative: A Local Area Network (LAN) connection may be provided as an alternative so long as conformance with the above listed IEEE standards is maintained and explicit documented connection and authentication procedures are also provided.
5. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these 3 functions.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect/Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Refer to Division 00 11 00 “Summary of Work” for parking areas for construction personnel.

D. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 “Construction Waste Management”.

1. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
E. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
F. Temporary Elevator Use: Refer to Division 14. Verify Sections for temporary use of new elevators.

G. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

H. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 0 Section "SUMMARY OF WORK."

B. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 1 Section "TEMPORARY EROSION AND SEDIMENTATION CONTROL."

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

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

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

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
I. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage and maintain appearance of walkway for duration of the Work.

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

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.


1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.05 MOISTURE AND MOLD CONTROL


B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.
C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect/Engineer.
   c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.06 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

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

1. Materials and facilities that constitute temporary facilities are property of Contractor.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "CLOSEOUT PROCEDURES."

END OF SECTION 01 50 00
SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Sections:
   1. Division 01 50 00 Section "Temporary Facilities and Controls" for temporary site fencing.
   2. Division 31 verify Section "Site Clearing" for removing existing trees and shrubs.

1.03 REFERENCES

A. ANSI Z133.1 Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush.


1.04 DEFINITIONS

A. Caliper: Diameter of a trunk measured by the average of the smallest and largest diameters at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.

B. Construction Branch Pruning: Physical cutting of any branch which interferes with construction.

C. Root Pruning: Physical cutting of plant roots to minimize root damage and promote healing.

D. Tree Protection Fencing: Temporary fencing installed prior to site preparation and demolition which protects a group of trees or shrubs.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of the following:
   2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.

C. Schedule: Submit construction schedule which includes time frame for work near existing plant material. Provide transplanting and tree removal schedule including tree transplants and locations. Obtain approval by Landscape Architect prior to beginning of transplanting work and construction near restricted area.
   1. Species and size of tree.
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning.
   4. Description of pruning to be performed.
   5. Description of maintenance following pruning.

D. Work Methods: Submit proposed methods and schedule for effecting tree and plant protection for approval, including proposed methods, materials, and schedule for root pruning, construction pruning, aeration and subsequent tree fertilization. Mark plan location of root pruning and siltation fencing in field with paint for approval by Landscape Architect. Any root pruning which is required due to construction work adjacent to existing trees and shrubs designated to remain shall occur any time ground can be worked except when tree or shrubs are in leaf. Root pruning when tree or shrubs are in leaf may occur only with approval by Landscape Architect.

E. Qualification Data: For qualified arborist and tree service firm.

F. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

G. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

H. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

I. Use sufficiently detailed photographs or videotape.

J. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
1.06 QUALITY ASSURANCE

A. Arborist Qualifications: Company having adequate capacity and facilities to meet the specified requirements. All tree pruning and cleaning shall be performed by a landscape contractor with a minimum 5 years documented experience. Evidence to this effect shall be provided by the supplier if required by the Architect/Engineer.

B. Regulatory Requirements: City permits are necessary for pruning or removal of all trees in the right-of-way.

C. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

D. Pre-installation Conference: Conduct conference at Project site prior to construction.

   1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

      a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
      b. Enforcing requirements for protection zones.
      c. Arborist's responsibilities.
      d. Field quality control.
      e. Attendance required by: Owner, Architect/Engineer, Contractor(s), Manufacturer(s)/Supplier(s), other parties who are involved.

1.07 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
   8. Stockpiling of topsoil.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

D. All plant materials to remain or be moved will be tagged by the Landscape Architect/Engineer to assist the Contractor in identifying the trees. Contractor to notify Landscape Architect seven (7) days before tree relocation.
E. Maintain all plant materials within tree protection areas. Designated tree protection areas of trees, shrubs, and grasses are to remain untouched and unharmed.

F. Tree arborist shall determine and document value of each tree or other plant materials within the limits of work line that is designated to remain. Contractor shall reimburse client for the value of any of these trees or other plant materials that are lost or damaged during construction.

1.08 MAINTENANCE

A. Maintenance Services: Performed by a landscape contractor for the first year after final completion of all site construction.

B. Maintenance Period: Begin maintenance immediately upon start of construction. Continue maintenance until one year after final completion of all site construction.

C. Maintenance to Include:

1. Quarterly review and monitoring of tree conditions.
2. Maintaining guying and lightening protection. Repair or replace when required.
3. Water at a sufficient frequency to saturate root system and keep soil moist.
4. Pruning, including removal of dead or broken branches, and treatment of pruned areas or other wounds.
5. Disease control.

D. Protection: In accordance with paragraph 3.3 PREPARATION.

E. Root Zone Fertilization: Root zone fertilize all trees affected by construction. The first root zone fertilization shall occur within 6 months after completion of site construction and the second within 12 months. Use a liquid application with an 18 inch soil probe. Fertilization mix shall be submitted to the Landscape Architect for acceptance prior to application.

F. Pesticides: Apply pesticides, with permission of owner, in accordance with manufacturer’s instructions. Remedy damage resulting from improper use of pesticides.

G. Maintenance Reports: Provide maintenance report including date and detailed summary of work completed on site, to the Landscape Architect after each maintenance visit.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Washington Cedar Mulch.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
B. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.

   a. Height: 6 feet.
   b. Gates at tree protection areas shall be 6'-0" width minimum for maintenance vehicles and be 6'-0" height galvanized chain link fence.
   c. Metal Fence Posts: 9 ft. galvanized steel posts, driven a minimum of 3 ft. into the ground. Space 10 ft. o.c. maximum.

C. Siltation Control Fencing

1. Fencing: 30" height. Siltation fencing complying with local codes.
2. Posts: Attached to tree protection fencing.

D. Soil/Mulch:


PART 3 - EXECUTION

3.01 NEW CONSTRUCTION

A. Curb cuts should not be closer than the dripline of the tree without permission from the Landscape Architect.

B. New sidewalks, paving or asphalt within the drip line of the tree must allow breathing space for tree roots. The following should be used as a guideline: For trees up to 4 inches in trunk caliper, 25 square feet of porous area is needed. For each additional 2 inches of tree caliper, 10 more square feet are needed.

C. Where grade change is required, the same area must be provided either by construction of a drywell where the level is to be raised or by building a retaining wall where the level is to be lowered. The grade within the drip line of the tree is not to be changed without Landscape Architect approval.

D. Avoid cutting surface roots wherever possible. Sidewalks and paving levels would be contoured sufficiently to avoid such cutting.

3.02 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

C. Verify all utility locations in the field prior to digging.

3.03 PREPARATION

A. Clearly mark the tree protection fence locations as indicated, boxing and all construction/demolition limits in the field.

B. Mark individual tree root pruning areas and location of siltation fencing with paint.

C. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground noting action to be taken with each plant.

D. Contact and accompany Landscape Architect on a joint review of construction/demolition limits, tagging and painting prior to the installation of the tree protection fencing and start of work.

E. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

F. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
   1. Apply 4-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

G. Contractor to verify limits of existing R.O.W. Contractor to obtain all necessary permits from appropriate jurisdictions prior to commencing activity within the R.O.W.

3.04 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before start of demolition work and clearing and grubbing operations in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Chain-Link Fencing: Following approval of staking by the Landscape Architect/Engineer, install fencing to comply with ASTM F 567 and with manufacturer's written instructions.
   2. Install fencing as approved. No fencing is allowed within 3 feet outside the drip line of trees.
   3. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect/Engineer.
   4. Install posts 10'-0" o.c. maximum.
5. Access Gates: Install where approved; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect/Engineer. Install one sign spaced approximately every 50 feet on protection-zone fencing, but no fewer than two signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Architect/Engineer.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect/Engineer and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.05 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "EARTH MOVING."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
3.06 SILTATION CONTROL

A. Fencing: Provide silt control at Tree Protection Areas by attaching silt fence to the uphill side of the protective fencing. Place lower 6 inches of silt fence in trench below grade. Backfill trench.

B. Drainage: Maintain positive drainage from Tree Protection Areas. Divert runoff from site around Tree Protection Areas.

3.07 TREE REMOVALS

A. Schedule: Obtain approval of schedule prior to starting work.

B. Notification: Trees to be removed according to the Tree Protection Plans shall be tagged by the Contractor and approved by the Architect/Engineer prior to removal.

C. Stump Removal: Remove tree stumps by Landscape Architect approved means to a depth of 12 inches below the proposed finished surface grade in lawn areas and 36” below finish grade in paved areas as determined by the Engineer. Remove wood chips from site. Fill stump removal areas with existing soil. Chemicals which will harm future landscape above stumps may not be applied to aid in stump removal.

D. Disposal: Dispose of all removals from the site at an approved disposal or recycling facility. Contractor may grind tree removals to be used for mulching purposes if mulch is approved by the Landscape Architect. Removals or mulch become the property of the Contractor.

E. Protection: Contractor responsible for protection of all trees designated to remain or transplanted during removal procedures.

3.08 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.

2. Cut Ends: Do not paint cut root ends.

3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.

4. Cover exposed roots with burlap and water regularly to prevent scarring or excessive drying.

5. Backfill as soon as possible according to requirements in Division 31 Section "EARTH MOVING."

B. Root Pruning at Edge of Protection Zone: Prune roots 12 inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-line spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

D. Root Protection: If tree roots larger than 2 inches in diameter are encountered with digging or trenching, tunnel under for any improvements if possible. Dig trench by hand only.

1. Conform to Paragraph 3.5 A-D this section.
2. Notify Landscape Architect to allow physical inspection of excavation around root zones to determine damage and health of tree. Do not tear the roots out. Removal of 2 inches or larger diameter roots encountered during construction is not allowed without permission of Landscape Architect.
3. Upon approval by Architect/Engineer, wrap cut roots 2 inches and larger with burlap to prevent scarring or excessive drying.

3.09 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
   a. Type of Pruning: Cleaning, Thinning.
3. Cut branches with sharp pruning instruments; do not break or chop.
4. Do not apply pruning paint to wounds.

B. Chip removed branches and dispose of off-site.

3.10 CONSTRUCTION BRANCH PRUNING

A. Prune any branches of trees to be preserved which interfere with construction only at the direction of the Landscape Architect. Approval of all proposed pruning is required prior to start of work. Pruning is an incidental pay item associated with the transplanting of existing trees, the planting of new trees, and the care of existing trees to remain. Payments for such incidental items shall be drawn from the project budget.

B. Remove any branches which are weak or dead.

C. Any pruning included as part of the project shall be done by a licensed tree company and in accordance with good pruning practices as approved by the Landscape Architect. Pruning shall maintain balance, form, and function of tree.
3.11 TEMPORARY TREE GUYING

A. Upon review of on-site root pruning and construction grading limits, the Landscape Architect shall determine whether the existing trees designated to remain should be temporarily guyed.

B. Complete tree guying using materials and techniques designated by the Landscape Architect in accordance with Division 32 and complete in a timely manner.

3.12 WATERING

A. Apply supplemental watering to a depth of 10”-12” (18 inches max.) with a deep root feeder if loss of grasses or heating of the roots occurs during construction or as directed by Landscape Architect. Approximately 100 gallons per tree shall be applied.

B. Contractor to water existing trees as determined by Landscape Architect to promote healthy, thriving plant material.

C. Contractor and Landscape Architect to determine appropriate water pressure.

3.13 EXCAVATION INSULATION

A. Provide mitigation from moisture and temperature fluctuations by pinning 3 layers of burlap onto the entire face of excavations exposed for more than 24 hours.

B. Wet burlap insulation immediately following installation.

C. Keep moist for the entire period the excavation remains open.

D. Remove insulation prior to backfilling

3.14 CHEMICALS, FERTILIZATION, AND INSECT SPRAYING

A. No chemicals shall be applied or used around or near existing trees.

B. No fertilizers, insect sprays or other chemicals shall be applied before or during root or branch pruning process.

3.15 CONCRETE WASHOUT

A. Provide concrete washout in areas which drain away from the Tree Protection Areas as approved. The Landscape Architect shall approve concrete washout area prior to the start of any site work.

3.16 REGRADING

A. All grading within protected areas shall proceed only after review and approval by the Landscape Architect.
B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from tree root areas. No "cutting of grades in root area shall be allowed.

C. Raising Grade: All fill within protected areas must be approved by the Landscape Architect. Tamping of fill earth shall be allowed; compaction of fill earth shall not be allowed.

3.17 FIELD QUALITY CONTROL/DAMAGE PENALTIES

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

B. Trees labeled as requiring “General Protection” or “Special Protection” adjacent to construction areas and in other key locations are identified on the Drawings. Loss of any of these trees due to Contractor neglect or improper construction activities will result in liquidated damages for the assessed value of the tree as determined by the licensed arborist. Damage to a portion of these trees will be assessed by the arborist and a portion of the liquidated damages will be assessed to the Contractor. A list of tree values for the project will be on file in the Landscape Architect’s office. Any damaged tree not on this list shall be evaluated by the Architect/Engineer as necessary to comply with this penalty.

C. A fine of $1,000 will be levied against the Contractor for each incident of construction (including construction traffic) inside tree protection areas.

D. Trees or roots visibly damaged will cause the Owner to withhold from the Contractor an assessed amount conforming to the requirements stipulated above, for a period of two years. After that period the impact of the damage to any tree will be assessed by the Landscape Architect.

E. If any trees or shrubs designated to be saved are damaged and replacement is required, a number and diameter of trees or shrubs of the same species and variety, as specified by the Landscape Architect, shall be furnished and planted by the Contractor. The total inch diameter of the replacement trees or shrubs shall equal the diameter of the tree or shrub to be replaced as measured by The Guide For Establishing Value of Trees and other Plants, published by the International Society of Arboriculture. The Contractor shall not be liable for any loss or damage which occurs while the Contractor is complying with instruction given by the Landscape Architect working on the Project.

3.18 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect/Engineer.

   1. Submit details of proposed root cutting and tree and shrub repairs.
   2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
   3. Treat damaged trunks, limbs, and roots according to arborist’s written instructions.
4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect/Engineer.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect/Engineer determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
2. Provide two new trees of 6 inches caliper size for each tree being replaced that measures more than 6 inches in caliper size.
   a. Species: Species selected by Architect/Engineer.

3. Plant and maintain new trees as specified in Division 32 Section "Plants."

C. Soil Aeration: Where directed by Architect/Engineer, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk.

1. Aerate to a 20 inch depth using an aeration “grow gun,” avoiding damage to surface absorbing feeder roots.
2. Inject filler material to hold aeration fractures open.

3.19 ADJUSTING

A. Tree Protection Area Access: When construction traffic is unavoidable as concurred by the Contractor and Landscape Architect the following procedure shall be followed:

1. Obtain approval from the Landscape Architect for Tree Protection Area access.
2. Install protective fencing by hand to delineate the construction corridor. Fencing location must be approved on site by the Landscape Architect.
3. Install a 12-inch layer of wood chips overlaid with continuous 3/4-inch plywood sheets on the existing grade for the entire area of the traffic route to allay rutting and slightly reduce soil compaction.
4. Remove all materials and return area to preconstruction condition within one week of the work.

B. Excavation Insulation: If in the Contractor’s opinion, climate conditions do not necessitate the installation of burlap insulation at an excavation, the Contractor may submit to the Landscape Architect a written request to omit the burlap insulation. Submit request to the Landscape Architect 24 hours prior to excavation.

3.20 CLEANING

A. Removal of Protection: Except as otherwise indicated or requested by Engineer, temporary protection devices and facilities installed during course of the work shall be removed only after all work which may injure or damage trees and plants is completed.
B. Removal: Remove all excess material during construction period and haul off-site.

C. Repair: Repair surface damage caused by fence posts. Restore to match surrounding conditions.

3.21 PROTECTION

A. Protect planting areas and plants at all times against damage of any kind for the duration of the maintenance. If any plants become damaged or injured, they shall be treated or replaced as directed by the Landscape Architect at no additional cost to the Owner. The contractor shall not be responsible for acts of vandalism or acts of God during the maintenance period.

B. Protect tree roots in accordance with 3.8 this Section.

C. Branch Protection: Contact Landscape Architect if it appears that construction will damage to the branches of any tree. The Landscape Architect will determine action to be taken. If pruning is required, perform in accordance with paragraph 3.10 this Section.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off the Owner’s property.

END OF SECTION 01 56 39
SECTION 01 57 13 - TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES:

A. Silt fence adjacent to perimeter curb and gutter or as shown on plan.
B. Straw bales as required or as shown on the plan.
C. Construction rock vehicle tracking pad.
D. Other erosion control devices as directed by the Architect/Engineer, or required for permits to control erosion and sedimentation.

1.03 RELATED SECTIONS

A. Division 01 33 00 Section "SUBMITTAL PROCEDURES"
B. Division 31 Section "EARTH MOVING"
C. Division 33 Section "STORM DRAINAGE UTILITIES"

1.04 REFERENCES

A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:


1.05 REGULATORY REQUIREMENTS

A. Obtain Erosion Control Permit from governing authority.
B. Contractor shall be responsible for preparing report.

1.06 SUBMITTALS

A. Completed Erosion Control Permit Application.
B. Erosion Control devices other than specified silt fence, straw bales and construction rock vehicle tracking pad.
C. Erosion and sediment control drawings to document LEED SSp1 compliance.

PART 2 - PRODUCTS

2.01 SILT FENCE
   A. Provide silt fence with reinforced backing and staking materials.
   B. Mirafi Envirofence 10550, Mirafi Siltfence 10800 or approved substitute.

2.02 STRAW BALES
   A. Straw bales shall be standard 36" x 24" x 18", with stakes.

2.03 CONSTRUCTION ROCK VEHICLE TRACKING PAD:
   A. Six inch minimum thickness of 2-inch to 3-inch crushed rock.

2.04 GENERAL
   A. All other erosion control devices shall be as specified in the “Urban Drainage Storm Criteria Manual”.

PART 3 - EXECUTION

3.01 TIMING:
   A. Install temporary erosion control devices immediately following completion of site demolition and rough grading.
   B. Keep temporary erosion control devices in-place until site is landscaped and/or paved.

3.02 SILT FENCE
   A. Set posts.
   B. Excavate a 4" x 4" trench upslope along the line of posts.
   C. Install fabric.
   D. Backfill and compact excavated trench.
   E. Follow manufacturer’s installation guidelines.

3.03 STRAW BALES
   A. Excavate 4-inch trench the width of the bales.
   B. Install straw bales with edges tightly abutting.
C. Stake each straw bale with two stakes.

3.04 MAINTENANCE

A. Contractor is responsible for maintaining temporary erosion control devices throughout project.

B. Remove and replace straw bales that have become sediment laden and ineffective.

C. Remove and replace silt fence that has become damaged, sediment laden, and/or ineffective.

END OF SECTION 01 57 13
SECTION 01 57 23 - BASIC SITE MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Construction Storm Water Requirements
   2. Post-Construction Storm Water Requirements

B. Related Sections:
   1. Division 31 Sections "EARTHMOVING" and "BACKFILL."

1.03 SUBMITTALS

A. Storm Water Management Plan (SWMP): Prior to any construction activity disturbing 1 acre of land or more, an approved SWMP and a Storm water Permit for Construction Activity application from the Colorado Department of Public Health and Environment (CDPHE) are required. The SWMP shall be prepared in accordance with the CDPHE requirements for "Contents of the Storm water Management Plan" and the UDFCD’s Urban Storm Drainage Criteria Manual, Volume 3, “Best Management Practices” (UDFCD Drainage Criteria Manual). Storm water quality management and erosion control measures are to be constructed and maintained in accordance with the SWMP and the UDFCD Drainage Criteria Manual.

1.04 QUALITY ASSURANCE

A. Construction Sites, General: All construction sites that disturb any land must take appropriate erosion control and storm water detention measures to contain water run-off from site.

B. Construction Sites – One Acre and Larger: All construction sites that are 1 acre and larger must prepare and submit a Storm Water Management Plan (SWMP) for approval before any work begins. The SWMP must conform to all the requirements contained herein.
PART 2 - PRODUCTS

2.01 STORM WATER MANAGEMENT PLAN

A. Preparation Standards: Design of the SWMP and the Storm Water Quality and Erosion Control Plan shall include the following elements:

1. Protection for adjacent properties (including public right-of-way) from erosion and/or sediment deposition.
2. Protection for public streets from the deposit of sediment from run-off or vehicles tracking mud at construction access routes.
3. Stabilization for all disturbed areas as defined in the UDFCD Drainage Criteria Manual.
4. Protection for all storm sewer inlets from the entry of sediment-laden water.
5. Long-term stability of cut and fill slopes and the successful establishment of permanent vegetative cover on exposed soil.
6. The following standard notes:
   a. “All temporary erosion control facilities shall be installed before any construction activities take place”.
   b. “Solid waste, industrial waste, yard waste and any other pollutants or waste on any construction site shall be controlled through the use of BMPs. Waste and/or recycling containers shall be provided and maintained by the owner or contractor on construction sites where there is the potential for release of waste. Uncontained waster that may blow, wash or otherwise be released from the site is prohibited. Sanitary waste facilities shall be provided and maintained by the owner or contractor”.
   c. “Ready-mixed concrete, or any materials resulting from the cleaning of vehicles or equipment containing or used in transporting or applying it, shall be contained on construction sites for proper disposal. Release of these materials is prohibited”.
   d. “Cover shall be applied within 14 days to inactive soil stockpiles, and shall be maintained for stockpiles that are proposed to remain in place longer than 30 calendar days”.
   e. “BMPs shall be implemented to prevent the release of sediment from construction sites. Vehicle tracking of mud shall not be allowed to enter the MS4 or waters of the State. Sediment tracked onto public streets shall be removed immediately”.
   f. “Techniques shall be used to prevent dust, sediment or debris blowing from the site”.
   g. “Stormwater discharges from construction activities shall not cause or threaten to cause pollution, contamination or degradation of waters of the State”.
   h. “All earth disturbances shall be designed, constructed and completed to limit the exposed area of any disturbed land to the shortest possible period of time”.
   i. “Bulk storage structures for petroleum products and other chemicals shall have adequate protection so as to contain all spills and prevent any spilled material from entering the MS4 or waters of the State”.
   j. Any disturbance to temporary and permanent BMPs resulting from construction activity shall be repaired or replaced within 48 hours.
PART 3 - EXECUTION

3.01 PERMITTING

A. Contractor shall develop the SWMP in accordance with all of the requirements herein and utilizing the most recent SWMP guidance document prepared by the CDPHE and good engineering hydrologic and pollution control practices and submit to the University for approval.

B. Contractor shall apply for and obtain a CDPHE storm water general permit for construction activities. Provide copies of the permit to the University prior to the start of construction operations.

3.02 CONSTRUCTION

A. The Contractor will be required to have the SWMP on site at all times and shall be prepared to respond to maintenance of specific BMPs.

B. The Contractor shall inspect all BMPs at least every 14 days and within 24 hours after any precipitation or snow melt event that causes surface run-off. Inspections of BMPs shall be conducted by an individual who has successfully completed formal training in erosion and sediment control by an organization acceptable to the University. A certification of successful completion of such training shall be provided upon request.

C. The Contractor shall amend the SWMP whenever there is a change in design, construction, operation, or maintenance, which has an effect on the potential for discharge of pollutants to the MS4 or receiving waters, or if the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activities.

D. Records of inspection are to be maintained on site with the SWMP. Inspection records are to be available at the project site at all times and shall be made available to the University upon request.

E. Prior to commencement of work, all general contractors, subcontractors and utility agencies shall obtain and comply with the approved, current SWMP for the project.

3.03 POST CONSTRUCTION

A. At the conclusion of all construction activities and as a part of construction close-out, contractor shall remove all temporary BMPs and inactivate the stormwater permit.

END OF SECTION 01 57 23
SECTION 01 58 13 - PROJECT IDENTIFICATION SIGN

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Project Signs: Provide Project identification signs as indicated. Unauthorized signs are not permitted.

1. Provide labor, equipment, and materials for fabrication of a project sign as specified by the Project Architect/Engineer.

2. Project sign(s) shall be required for all major renovation and new construction projects. The location(s) shall be at a point on or adjacent to the worksite where its visibility to the passing public is most apparent.

3. The maximum size of project sign backgrounds shall be 40 sq. ft. In most cases, an 8' x 4' plywood panel is recommended. For smaller projects, sign backgrounds may be less, but in no case shall be smaller than 16 sq. ft.

PART 2 - PRODUCTS

2.01 SIGN FABRICATION AND DESIGN

A. Fabricate project sign of two treated 4" x 4" wood posts for 4'-0" x 8'-0" backgrounds or two treated 4" x 4" wood posts for smaller backgrounds. Posts shall be set in 12-inch-diameter holes at least 3 feet deep and filled with concrete. Backgrounds shall be at least 3/4-inch-thick exterior A/C plywood, "Duraply" pre-treated surface, sheet metal overlay cemented to background, or other approved surface. Seal edges of plywood with paint. Supporting posts shall receive two coats of exterior grade paint or stain.

B. Design of the sign, including graphics, lettering, and colors, shall be furnished by the Project Architect/Engineer and approved by the University. At a minimum, the sign shall include the following information:

1. An artist's conception of the completed building or other facility as envisioned by the Project Architect/Engineer.

2. Project name in prominent sized lettering.

3. Name of principal occupant or use.

4. Owner's name: "University of Colorado Boulder." Use approved style lettering and "CU" logo.

5. Under owner's name add: "Project Manager: Department of Facilities Management."

6. Project Architect/Engineer and Principal Consultants' names. Include city and state of each, and telephone number of Project Architect/Engineer.

7. Include "Project Start date," and "Project Completion date."
PART 3 - EXECUTION

3.01 EXAMINATION

A. Project sign shall be in place prior to the start of construction, and shall not be removed until the point of substantial completion.

B. Location(s), number(s), size, configuration, and other details of the installation, including height above grade, shall be furnished and approved by the Project Architect/Engineer with the approval of the University.

C. An experienced professional sign painter shall be hired and approved by the Project Architect/Engineer and the University to prepare the graphics and lettering for the sign.

D. If, at the end of the project, the sign is not reusable, it shall be disposed of as directed by the University.

END OF SECTION 01 58 13
SECTION 01 60 00 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:
   1. Products.
   2. Transportation and Handling.
   4. Manufacturer's Instructions.
   5. Product Options.
   6. Products List.
   7. Substitutions.

B. Related Sections:
   1. Division 1 Section "QUALITY CONTROL."
   2. Division 1 Section "OPERATIONS AND MAINTENANCE DATA."

1.03 DEFINITIONS

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

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

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

A. Conform to applicable specifications and standards.

B. Comply with size, make, type and quality specified, or as specifically approved in writing by the Consultant.

C. Manufactured and Fabricated Products:
   1. Two or more items of the same kind shall be identical, by the same manufacturer.
   2. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

1.05 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.06 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instruction, with seals and labels intact and legible.

B. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.07 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including one copy to the Consultant and one copy to the Contractor.

B. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.08 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Consultant will review requests for substitutions with reasonable promptness, and notify, by Addendum, of the decision to accept or reject the requested substitution.
1.09 PRODUCT LIST

A. Within 15 days after signing of agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.10 SUBSTITUTIONS

A. Will only be considered prior to bid or in the event that Equipment is not available and as indicated in Division 1 Section “SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT.”

1.11 SYSTEMS DEMONSTRATION

A. Prior to final inspection, demonstrate operation of each system to Consultant and Owner.

B. Instruct Owner's personnel in operation, adjustment, and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 60 00
SECTION 01 61 00 - ACCEPTABLE MANUFACTURERS AND PRODUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. The performance of product, material, or system is result of manufacturing, fabrication, installation procedures, use, and maintenance. Therefore, Architect/Engineer endeavors to specify quality levels for products, materials, or systems that are advertised to conceptually meet performance goals and desired attributes for the project.

1. For most conceptually equal systems and materials, Architect/Engineer may specify multiple manufactures.
2. In some cases, based on quality and attribute goals for project, the number of manufacturers may be limited.

B. Product, material, or system substitutions:

C. Prior to Bid: See Division 0 Section “SUBSTITUTIONS PRIOR TO BIDDING”.

1.02 DEFINITIONS

A. Following definitions are applicable to acceptable manufacturers and products listed in technical specification sections:

1. "Base" manufacturer:
   a. Manufacturer listed as "Base" in Part 2 of specification section.
   b. Manufacturer listed as "Base" is particular manufacturer of a specific product used as basis of design.

2. "Optional" manufacturer:
   a. Manufacturer listed as "Optional" in Part 2 of specification section.
   b. More than one manufacturer may be listed as "Optional."
   c. Manufacturers listed as "Optional" are particular manufacturers of products similar to specific product used as basis of design.
   d. Listing manufacturer as "Optional" indicates acceptance of that manufacturer as supplier of a product, but only to the extent product complies with specified requirements, including salient qualities provided by "Base" manufacturer's product.

(1) Salient qualities include, but are not necessarily limited to following:

   (a) Purpose and function.
   (b) Material and finish.
   (c) Strength, durability and other applicable physical properties.
   (d) Compatibility and performance attributes for indicated application.
   (e) Capacity and operating characteristics, where applicable.
(f) Size and configuration to extent required for fit with adjoining and adjacent conditions and within spatial limitations.

(g) Appearance, including exposed dimensions, profile, texture, pattern and color, where visible to personnel in finished space, or from exterior.

e. Contractor is responsible for costs to provide dimensional, operational, structural, utility or any other related adjustments to fit an "Optional" manufacturer's product into the Work.

f. See Division 0 Section "SUBSTITUTIONS PRIOR TO BIDDING”.

3. "Base Product:"

a. Term indicates specific product or system used as basis for design.

b. Manufacturers listed as "Optional Manufactures" may submit their equivalent products, but only if product complies with specified requirements, including salient qualities of "Base Product."

(1) Products proposed by "Optional" manufactures must also comply with descriptive requirements listed in technical specification.

(2) Optional Products that obviously differ in appearance and quality of "Base Product" will be rejected.

c. Refer to preceding paragraph for additional requirements.

PART 2 - PRODUCTS - Not applicable.

PART 3 - EXECUTION - Not applicable.

END OF SECTION 01 61 00
SECTION 01 65 00 - DELIVERY, HANDLING, AND STORAGE OF MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 JOB CONDITIONS

A. Comply with applicable codes.
B. Accomplish work to avoid damage to property.
C. Provide fire protection.

PART 2 - EXECUTION

2.01 PRODUCT DELIVERY

A. By manufacturer’s normal means.
B. In original labeled containers.
C. Where applicable, with UL labeling on packages.
D. Contractor responsible for acceptance at site.
E. Schedule deliveries to avoid delaying Work, and to minimize space and duration of storage on site. Sequence deliveries to avoid unnecessary additional construction of temporary protection.
F. Schedule and coordinate deliveries to avoid interference with the Owner’s operation.
G. Inspect items for damage upon delivery, reorder as required to avoid delays.
H. Comply with environmental packaging requirements specified in Division 01 Section "Environmental Requirements".

2.02 PRODUCT HANDLING AND STORAGE

A. Use methods to avoid damage to item or structure.
B. Protect weather fragile items from weather damage.
C. Handle and store bulk aggregates to avoid contamination.
D. Store to allow air circulation.
E. Store only in authorized areas. Coordinate on site storage with Owner and other contractors working on site.
F. Replace or repair damaged items.
G. Uncrate, assemble, if required, and remove debris.

H. When off-site storage is utilized, perform rehandling to move items to site at no added cost.

2.03 CLEANUP

A. Remove excess materials from site.

B. Turn over to Owner, excess materials scheduled to remain.

C. Clean debris from site and storage area.

D. Comply with construction waste recycling requirements specified in Division 1 Section "CONSTRUCTION WASTE MANAGEMENT".

E. Comply with environmental cleaning product requirements specified in Division 1 Section "CLOSEOUT PROCEDURES".

F. Restore site storage areas to original condition or as directed by Architect/Engineer or Owner.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 65 00
SECTION 01 73 00 – EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1. Installation of the Work.
2. Cutting and patching.
3. Coordination of Owner-installed products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. Related Sections:

1. Division 1 Section "SUBMITTAL PROCEDURES".
2. Division 1 Section "CLOSEOUT PROCEDURES".

1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

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

1.04 QUALITY ASSURANCE

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

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect/Engineer of locations and details of cutting and await directions from the Architect/Engineer before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   a. Primary operational systems and equipment.
   b. Fire separation assemblies.
   c. Air or smoke barriers.
   d. Fire-suppression systems.
   e. Mechanical systems piping and ducts.
   f. Control systems.
   g. Communication systems.
   h. Conveying systems.
   i. Electrical wiring systems.
   j. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Equipment supports.
   e. Piping, ductwork, vessels, and equipment.
   f. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect/Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

E. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.
   1. For projects requiring compliance with sustainable design and construction practices and procedures, utilize products for patching that comply with requirements of Division 1 36 Section "ENVIRONMENTAL REQUIREMENTS."

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect/Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
      a. Description of the Work.
      b. List of detrimental conditions, including substrates.
      c. List of unacceptable installation tolerances.
      d. Recommended corrections.
   2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 INSTALLATION

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

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

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

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

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

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

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/Engineer.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.03 CUTTING AND PATCHING

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

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

B. Temporary Support: Provide temporary support of work to be cut.

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

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 1 Section "Summary."

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 31 verify Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.04 OWNER-INSTALLED PRODUCTS

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

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

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.
3.05 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Utilize containers intended for holding waste materials of type to be stored.
   4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.

B. Clean-up During Construction: Each contractor shall keep the building and premises free from all surplus material, waste material, dirt and rubbish caused by Contractor’s employees or work, and at the completion shall remove all such surplus material, waste material, dirt and rubbish, as well as tools, equipment and scaffolding, and shall leave the work area clean and spotless, unless more exact requirements are specified. In case of dispute, the owner may remove all such items and charge the cost of such removal to the contractor.
   1. Each sub-contractor shall perform clean-up daily and shall transport rubbish to an on-site location designated by the Contractor who will arrange for its removal.

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

D. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

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

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

G. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
H. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 74 19 Section "Construction Waste Management and Disposal."

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

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

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

3.06 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 1 Section "GENERAL COMMISSIONING REQUIREMENTS."

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

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

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

E. Manufacturer's Field Service: Comply with qualification requirements in Division 1 Section "QUALITY REQUIREMENTS."

3.07 PROTECTION OF INSTALLED CONSTRUCTION

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

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

3.08 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

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

B. Restore permanent facilities used during construction to their specified condition.
C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

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

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

END OF SECTION 01 73 00
SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Owner has established that this Project shall include proactive measures for waste management participation by all parties to the contract.

1. The purpose of this program is to ensure that during the course of the Project all diligent means are employed to pursue practical and economically feasible waste management and recycling options.

2. Upon award, each subcontractor shall be required to furnish documentation from suppliers or manufacturers regarding waste management and recycling options for those products and procedures furnished.

3. Waste disposal to landfills shall be minimized.

B. Definitions:

1. Waste: Any material that has reached the end of its intended use. Waste includes salvageable, returnable, recyclable and reusable construction materials that would otherwise be discarded or destroyed.

2. Construction waste: Solid wastes including, but not limited to, building materials, packaging materials, debris and trash resulting from construction operations.

3. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

5. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

6. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.

7. Hazardous waste: Any material or byproduct of construction that is regulated by the Environmental Protection Agency and that may not be disposed in any landfill or other waste end-source without adherence to applicable laws.

8. Trash: Any product or material unable to be returned, reused, recycled or salvaged.

9. Landfill: Any public or private business involved in the practice of trash disposal.

10. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site.

1.02 PERFORMANCE GOALS AND REQUIREMENTS

A. General: Develop waste management plan that results in End-of-Project rates for salvage/recycling of a minimum of 75 percent by weight of total waste generated by the Work.

1. Hazardous waste and soil and land clearing debris (trees etc.) are specifically excluded for waste management calculations.
B. Salvage/Recycle: Owner’s goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:

1. Demolition Waste: Concrete.
2. Recycle/Relocate Tree and Plant Material: Relocate and recycle tree and plant materials as indicated in Division 01 56 39 Section "Temporary Tree and Plant Protection".

C. Construction Waste:

1. Masonry and CMU.
2. Lumber.
4. Wood trim.
5. Metals.
6. Roofing.
7. Insulation.
8. Carpet and pad.
11. Electrical conduit.
12. Packaging: Regardless of salvage/recycle goal indicated above, salvage and recycle 100 percent of the following uncontaminated packaging materials:
   a. Paper.
   b. Cardboard.
   c. Boxes.
   e. Polystyrene packaging.
   f. Wood crates.
   g. Plastic pails.

1.03 CONTRACTOR TO IDENTIFY OTHER MATERIALS IN THE CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN SUBMITTALS:


B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit copies of report. Include separate report for demolition and construction waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
C. Waste Reduction Calculations: Before request for Substantial Completion, submit copies of calculated end of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

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

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

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

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

H. LEED Submittal: LEED letter template for Credit MR 2.1 and 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

I. Qualification Data: For refrigerant recovery technician.

J. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.04 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

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

C. Waste Management Conference: Environmental Project Manager shall conduct conference at Project site to review methods and procedures related to waste management including but not limited to, the following:

1. Review and discuss Waste Management Plan.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.
1.05 CONSTRUCTION WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

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

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

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

D. Waste Management Plan shall include locations of sorting and waste storage facilities on Site Plan of project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 CONSTRUCTION WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Implement waste management plan as approved by Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract. Comply with the following procedures:

1. Define specific areas to facilitate separation of materials for recycling, salvage, reuse or return.
2. Separate construction waste by type at Project site to the maximum extent practical.
3. Recycle and waste bin areas are to be maintained in an orderly manner and clearly marked to avoid contamination of materials. Inspect containers and bins weekly for contamination and remove contaminated materials if found.
4. Do not mix recyclable materials.
5. Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
6. Store materials away from construction area. Do not store within drip line of remaining trees.
7. Store components off the ground and protect from weather.
8. Remove construction waste off Owner’s property and transport to appropriate receiver or processor.

B. Hazardous Wastes: Store in secure areas and comply with the following:

1. Hazardous wastes shall be separated, stored and disposed of in accordance with local and EPA regulations and additional criteria listed below:
   a. Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
   b. Disposal of fluorescent tubes to open containers is not permitted.

C. Unused fertilizers shall not be co-mingled with construction waste.

D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within seven days of submittal return.
2. Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.

E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with environmental controls specified in Division 01 Section 01 50 00 Temporary Facilities, Construction Controls and Facilities.

F. Submit “Waste Reduction Progress Reports” each month as part of Application For Payment.

1. Materials identified in the Report shall be reported by weight.
2. Where weight is not applicable, Contractor shall report materials by units applicable to material recipient.
3. Procure receipts or other validation of waste management procedures and include them as part of the submittal.
3.02 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

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

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner’s Use:

1. Clean Salvaged items.
2. Pack or create items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner’s storage area designated by Owner.
5. Protect items from damage during transport and storage.
6. Door and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper, cardboard, and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: List below is provided for information only. Available recycling receivers and processors include, but are not limited to, the following:

1. Eco-Cycle 303-444-6634.
4. Western Disposal Services 303-444-2037.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

3.04 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill for incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials on site.
C. Burning: Burning of waste materials will be permitted only at designated areas on Owner’s property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are fully extinguished.

D. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner’s property.

E. Disposal: Transport waste materials off Owner’s property and legally dispose of them.

END OF SECTION 01 74 19
PART 1 - GENERAL

1.01 SUMMARY: This section includes requirements of manufacturers of equipment and materials for services to be performed at the project site in regard to installation, startup, and testing of equipment. The Equipment Vendor shall be responsible to provide any additional Technical Advisory Services needed to install and place the equipment provided in successful operation along with the equipment and appurtenances being erected.

1.02 SERVICES REQUIRED:

A. Services with equipment and materials furnished under this Contract:

1. Furnish the services of qualified, competent field representative and necessary assistants for equipment and materials furnished under this Contract, as required to perform all manufacturers' Technical Advisory Services called for in the specifications. Field representative shall be certified by the manufacturer of the specified product or system as having the necessary knowledge and experience to perform the required functions.

2. Where such service is specified, installing Equipment Vendor will not perform any Work related to the installation or operation of equipment or materials furnished under this Contract without direct observation and guidance of the supplier's or manufacturer's field personnel unless Engineer concurs otherwise.

3. The Equipment Vendor's field personnel shall perform the following:

   a. Observe the installation, start-up, and testing of equipment.
   b. Instruct and guide installing Contractor in proper procedures.
   c. Approve the commissioning plan and participate in the commissioning.
   d. Supervise the loop checking of the control systems, initial start-up, operational check, and any required adjustments of equipment.
   e. Instruct Owner's designated personnel in proper operation and maintenance of all Equipment and Materials.

4. Field representative shall be acceptable to Owner and Engineer and shall not be changed during the installation operations without Owner's consent unless field representative proves unsatisfactory to CMGC.

5. Field representative shall report directly to Installation Contractor and CMGC all reports instructions, etc.

6. All start-up, adjustments, and testing of Equipment will be performed in the presence of Owner's Project Representative or Owner's designee and Manufacturer's field representative, unless otherwise agreed, and such operations will be in accordance with Equipment Vendor's instructions. No start-up or testing will be undertaken without Equipment Vendor's approval.

7. It shall be the duty of manufacturer's field representative during the progress of installation, startup and testing, and such other times as may be required, to instruct Owner's designated personnel in the proper operation and maintenance of the equipment. Such instruction shall terminate only when both the field representative and Engineer are satisfied that the Owner's personnel are properly instructed.
PART 2 - PRODUCTS: Specified in applicable Sections.

PART 3 - EXECUTION

3.01 OPERATION AND TESTING:

A. Duties of the manufacturer's field representative during installation shall include:

1. Reporting manufacturer's field representative's observations in writing to the installing Contractor and CMGC, with copies to Commissioning Contractor, at least once each week unless otherwise agreed.
2. Determining when equipment is ready for start-up and operational checks.

B. Placing equipment in operation:

1. Installation Contractor shall place all equipment and materials furnished by this Contract (and those furnished by Owner or others under separate contract) into successful operation according to instructions of the supplier or manufacturer (or field representative), including making of all required adjustments, tests, operation checks, and the following:
   a. Cleaning, sounding, blowing-out, and flushing of the lubricating oil system.
   b. Lubrication (lubricants including the initial fill and any additional required up to final acceptance by the Owner shall be supplied by the Contractor).
   d. Final alignment checks and measurements made under observation of Engineer and Owner. Alignment checks shall include opening connections if required to ensure there are no abnormal stresses on equipment from pipes, ducts, or other attachments. Alignment shall be within tolerances specified by the manufacturer, and measurements shall be recorded and furnished to Resident project Representative.

2. After "run-in" and acceptance of alignment, major equipment shall be affixed in place by the installation contractor using standard tapered dowels with jack-out nuts at head end to facilitate removal.

3. All above operations shall be recorded on forms furnished by Commissioning Contractor

4. Provide all necessary field representatives and assistants as part of the Work to accomplish the above operations until such time as individual items, systems, equipment, or sections of the plant are acceptable for operation by Owner.

5. Provide field representatives and assistants on continuous basis as required to complete events, such as (blowing out steam lines), without interruption once they have been started.

6. With advice of Installation Contractor, Owner will provide fuel, electricity, water, and air for placing equipment in operation, and Owner's operating personnel will assist.
C. Performance Tests:

1. Equipment and materials furnished under this Contract:

   a. The Installation Contractor along with the Commissioning Contractor will conduct acceptance tests after installation to determine if the equipment and materials installed as part of the Work perform in accordance with Contract Documents (and as guaranteed). Final acceptance of equipment and materials (or substantial completion) will be based on acceptable results of a PTC-6 test.

   b. No tests will be conducted on equipment or materials for which manufacturer's field service is specified unless manufacturer's field representative is present and declares in writing that the equipment and materials are ready for such test.

   c. Installation Contractor shall coordinate with the Owner when the Owner can make the facilities ready for testing.

   d. The tests will be made as set forth in the Contract Documents unless the interested parties mutually agree upon some other manner of testing.
SECTION 01 77 00 – CLOSE-OUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1. Substantial Completion and Final Inspection procedures.
2. Final Settlement and Payment.
3. Warranties and Special Guarantees.
4. Final cleaning.

B. Related Sections:

1. Division 1, Section 01 73 00, Para 3.5 "Execution" for progress cleaning of Project site.
2. Division 1 Section "OPERATION AND MAINTENANCE DATA" for operation and maintenance manual requirements.
3. Division 1 Section "PROJECT RECORD DOCUMENTS" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Divisions 2 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION AND FINAL INSPECTION

A. The Contractor shall comply with procedures stated in the General Conditions of the Contract for Notice of Completion, Final Inspection, Notice of Substantial Completion and Notice of Acceptance.

B. Should the Architect/Engineer/Engineer or the Principle Representative determine that the work is not substantially complete, or the punch list items exceed 25, the Contractor will be immediately notified, in writing, stating reasons. The Contractor shall, after completing the work, resubmit certification and request for final inspection. The Contractor will be responsible for all costs beyond two Architect/Engineer walk-throughs.

C. Owner may occupy designated portions of the Project under provisions stated in the General Conditions of the Contract.

D. Contractor shall have all LEED documentation uploaded to LEED project website within 30 days of Certificate of Occupancy.
1.04 CLOSE-OUT FORMS
   A. The Architect/Engineer will complete the Notice of Approval of Beneficial Occupancy,
      Closing-out Checklist and Contract Close-out forms and forward them to the Contractor.
      Comply with procedures stated in General Conditions of the Contract.

1.05 FINAL SETTLEMENT AND PAYMENT
   A. Contractor shall comply with procedures stated in the General Conditions of the Contract
      before final settlement and payment are made.
   B. The Contractor shall also submit the following prior to the final application for payment:

      Check AIA forms

      1. Contractor’s Affidavit of Payment of Debit and Claims: AIA G706.
      2. Contractor’s Affidavit of Release of Liens (claims): AIA G706A, with:

         a. Consent of Surety to final payment: AIA G707.
         b. Contractor’s release of waivers of claims.
         c. Separate release of waivers of claims for subcontractors, suppliers and others
            with claim rights, against property of owner, together with list of those parties.

1.06 GUARANTEE INSPECTION
   A. The Contractor shall comply with procedures stated in the General Conditions of the
      Contract for Guarantee Inspections after completion of the work.

1.07 WARRANTIES AND SPECIAL GUARANTEES
   A. The Contractor shall comply with procedures and criteria outlined in the General
      Conditions of the Contract for all warranties and special guarantees of the work.

1.08 OPERATION AND MAINTENANCE DATA
   A. Refer to Division 1 Section “OPERATION AND MAINTENANCE DATA.”
   B. Mechanical - By Mechanical Contractor: Refer to Divisions 21, 22 and 23.
   C. Electrical - By Electrical Contractor: Refer to Divisions 26, 27 and 28.

1.09 DEMONSTRATIONS
   A. Refer to Division 1 Section “PRODUCT REQUIREMENTS” for demonstration
      requirements.
   B. Mechanical - By Mechanical Contractor: Refer to Divisions 21, 22 and 23.
   C. Electrical - By Electrical Contractor: Refer to Divisions 26, 27 and 28.
PART 2 - PRODUCTS

2.01 MATERIALS

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

1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

B. The University requires floor care products to be from the same product line. (Different brands may interact disastrously.) The following products may be ordered through Construction Stores, but they typically are not stocked at Stores. Order shall be placed at least two weeks in advance of anticipated use to avoid delays in the Work.

1. Strippers:
   a. Johnson Wax; Freedom.
   b. Butchers; Time Buster or Full Impact.
   c. Airkem; Air Strip.

2. Sealers:
   a. Johnson Wax; Over & Under or Technique.
   b. Butchers; Iron Stone.
   c. Airkem; Gemini or Laser.

3. Finishes:
   a. Johnson Wax; Show Place or Above.
   b. Butchers; Main Stay.
   c. Airkem; Gemini or Laser.

2.02 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, and maintenance materials in quantities specified in each Section, in addition to that used for construction of work. Coordinate with Owner, deliver to Project site and obtain receipt prior to final payment.

B. At the completion of the project, all loose keys for hose bibs; adjustment keys and wrenches for door closers and panic hardware; and keys for electric switches, electrical panels, etc., shall be accounted for by the Contractor and turned over to the Owner.
PART 3 - EXECUTION

3.01 FINAL CLEANING

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

B. Cleaning: With the exception of clean-up of the site and cleaning specifically assigned to Contractors under various sections of the specifications, employ professional cleaners for final cleaning of exterior and interior of the building. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

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

   a. Exterior: In addition to items specified below, any new surfaces on exterior, concrete, metal, etc., shall be carefully and thoroughly cleaned.

   b. Glass: Both sides of all glass in work areas shall be carefully and thoroughly cleaned by professional window cleaners and left absolutely clean and free from paint, grease, dirt, etc.

   c. Hardware: Clean and polish all hardware and leave clean and free from paint, grease, dirt, etc.

   d. Plumbing: Clean and polish all plumbing fixtures, fittings, and exposed plated piping. Leave clean and free from paint, grease, dirt, etc. Remove all labels.

   e. Electrical: Clean and polish all electric fixtures, including glassware, switch plates, etc. and leave clean and free from paint, grease, dirt, etc.

   f. Equipment: Carefully and thoroughly clean all items of equipment, mechanical, electrical, cabinets, ductwork, etc. up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

      (1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.

   g. Floors: Thoroughly clean all floors. Vacuum and clean carpeting. Shampooing of preexisting carpet is required once project is complete. Contractor is responsible for this.

      (1) Contractors are responsible for cleaning (stripping floors if necessary) then applying the required two coats of sealer and three coats of finish before releasing the building for occupancy.

      (2) Campus safety standards require at least two (2) coats of Sealer be applied to a cleaned floor, and at least three (3) coats of Finish must be applied on top of the sealer.

      (3) Floor Cleaning Procedures:

          (a) Sweep floor clean of debris.
(b) Cord off area if necessary.
(c) Put up Caution signs.
(d) Mix Stripper or Cleaning solution according to label.
(e) Apply solution to floor.
(f) Start setting up equipment.
(g) Place RED abrasive pad on buffer (buffer less than 300 rpms).
(h) Begin stripping or cleaning floor working with buffer moving it side to side across the floor.
(i) Use HEPA filtered water vacuum to begin to suck up slurry. Use of HEPA filtered water vacuum is required on existing floor tile which contains asbestos.
(j) Apply additional coats of water and re-vacuum up floor.
(k) Mop floor with clean water, change rinse water often.
(l) Mop floor a second time.
(m) Mop floor to dry completely.
(n) Clean up equipment.
(o) Wash red pad with clean water.

(4) Sealing Procedures:

(a) Using a new mop head or clean wax mop and clean bucket, apply first coat of approved sealer to floor.
(b) Allow floor to dry completely (at least 20 minutes).
(c) Apply second coat of sealer.
(d) Allow floor to dry.

(5) Finishing (Waxing) Procedures:

(a) Using a clean wax mop and bucket apply first coat of approved finish (wax).
(b) Allow floor to dry completely (at least 20 minutes).
(c) Apply second coat of finish (wax).
(d) Allow floor to dry completely (at least 20 minutes).
(e) Apply third coat of finish (wax).
(f) Allow floor to dry completely (at least 30 minutes).
(g) Wash mop and bucket with clean water.
(h) If floor is dry - remove caution signs and open area up.

(6) Burnishing Procedures: The next working day perform the following:

(a) Sweep floor clean of debris.
(b) Spot mop floor to remove spots and dirt.
(c) Set up High Speed Burnisher to make for a safe environment.
(d) Start Burnishing. Walk forward in a straight line.
(e) At end of row, turn around and start forward again.
(f) Repeat steps 5 & 6 until finished.
(g) Clean up equipment and pad.

C. Completion: The entire work inside and out, and the entire premises shall be in first-class, clean condition upon completion before being accepted by the Owner.
D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

E. Construction Waste Disposal: Comply with waste disposal requirements in Section "Construction Waste Management and Disposal."

END OF SECTION 01 77 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. Compile product data and related information appropriate for the University's maintenance and operation of products furnished.

B. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of specifications.

C. Instruct the University's Facilities Management personnel in the maintenance of Products and in the operation of equipment and systems.

1.03 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of the described products.
2. Completely familiar with requirements of this section.
3. Skilled as a technical writer to the extent required to communicate essential data.
4. Skilled as a draftsman competent to prepare required drawings.

1.04 SUBMITTALS

A. Product Data: Prepare product data in the form of an instructional manual for use by the University of Colorado, Facilities Management personnel. Quantities are listed in Part 1.8.

B. Format:

1. Submit electronically in PDF format as one document, bookmarked according to CSI standards.
2. Title shall be "OPERATING AND MAINTENANCE INSTRUCTIONS", and shall include the following:
   a. Name of project and date of completion (month and year).
   b. Project number.
   c. Identify of general subject matter covered in the manual (e.g., Architectural, Mechanical, Electrical and/or Civil).
C. Table of Contents: An electronically-written table of contents shall be provided for each volume, arranged according to CSI standards. Table of contents shall include the following:

1. Name of responsible installing principal contractor, address, and telephone number.
2. A list of each product being included, indexed to the content of the volume.
3. List with each product, the name, address, and telephone number of:
   a. Maintenance contractor, as appropriate.
   b. Identity of the area of responsibility of each.
   c. Identify each product by product name and other identifying symbols.

D. Product Data:

1. Local source of supply for parts and replacement.
2. Include only those sheets that are pertinent to the specific product, with the following information:
   a. Clearly identify the specific product or part installed.
   b. Clearly identify the data applicable to the installation.
   c. Delete references to inapplicable information.

E. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:
   a. Relations of component parts of equipment and systems.
   b. Control and flow diagrams.
2. Coordinate drawings with information in project record drawings to ensure correct illustration of completed installation.
3. Do not use project record drawings as maintenance drawings.

F. Other Informational Submittals: Provide written text, as required, to supplement product data for the particular installation:

1. Organize in a consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.

G. Warranties: Provide a copy of each warranty, bond, and service contract issued. Provide information sheets for the University of Colorado, Facilities Management's personnel and give:

1. procedures in the event of failure.
2. Instances that might affect the validity of warranties or bonds.

A. Submit copies (per schedule shown in paragraph in 1.8) of complete manual in final form.
B. Content for architectural products include applied materials and finishes.

1. Manufacturer's data, giving full information on products:
   a. Catalog number, size, and composition.
   b. Color and texture designations.
   c. Information required for reordering special manufactured products.

2. Instructions for care and maintenance:
   a. Manufacturer's recommendation for types of cleaning agents and methods.
   b. Cautions against cleaning agents and methods that are detrimental to the product.
   c. Recommended schedule for cleaning and maintenance.

C. Content for moisture-protection and weather-exposed products.

1. Provide manufacturer's data, giving fully information on products:
   a. Applicable standards.
   b. Chemical composition.
   c. Details of installation.

2. Provide instructions for inspection, maintenance, and repair.

D. Provide list of all paints and coatings used including manufacturer, type, and color. Indicate location is used in the project.

1.06 MANUAL FOR NON-ARCHITECTURAL EQUIPMENT AND SYSTEMS

A. Submit copies (per schedule shown in paragraph 1.8) of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate shall contain.

1. Description of unit and component parts (Consultant-approved submittals):
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data, and tests.
   c. Complete nomenclature and Commercial number of all replaceable parts.

2. Operating Procedures:
   a. Start-up, break-in, routine, and normal operating instructions.
   b. Summer and winter operating instructions.
   c. Special operating instructions.

3. Maintenance Procedures:
   a. Routine operations.
c. Disassembly, repair, and reassembly.
d. Alignment, adjustment, and checking.

4. Servicing and Lubrication Schedule, including a list of lubricants required.

5. Manufacturer's operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance and replacement:
   a. Predicted life of parts subject to wear.
   b. Items recommended to be stocked as spare parts.

8. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

C. Content for each electric and electronic system, as appropriate, shall contain.

1. Description of system and component parts:
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data, and tests.
   c. Complete nomenclature and Commercial number of replaceable parts.

2. Operating Procedures:
   a. Routing and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.

3. Maintenance Procedures:
   a. Routing operations.
   c. Disassembly, repair, and reassembly.
   d. Adjustment and checking.
   e. Manufacturer's printed operating and maintenance instructions.
   f. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of the University of Colorado, Facilities Management's personnel.
1.07 COORDINATION

A. Special Instructions: Instruction from the University of Colorado, Facilities Management Personnel:

1. Fully instruct the University of Colorado, Facilities Management personnel's designated operating and maintenance personnel in the operation, adjustment, and maintenance of all products, equipment, and systems as required elsewhere in the specification.
2. Operating and Maintenance manual may be required as the basis of instruction.

1.08 OPERATION & MAINTENANCE MANUAL QUANTITIES / SCHEDULE

A. If not compiled into one CD or DVD, provide one each per discipline:

1. Architectural.
2. Electrical (Including as-built drawings).
3. Mechanical & Controls (Including shop drawings).
4. Elevators (Including shop drawings).
5. Fire Alarms (Including shop drawings).

1.09 SUBMITTAL SCHEDULE

A. Submit one electronic copy to the Consultants and one to the University of a draft of proposed formats and outlines of contents upon completion of the submittal process. The Consultants and the University staff will review the draft and will submit comments through the consultants.

B. Submit electronic copies of complete manual(s) in final form 15 days prior to final inspection or acceptance. Comments will be submitted after final inspection.

C. Submit specified number of CDs or DVDs of approved data in final form prior to acceptance.

PART 2 - PRODUCTS  (Not Applicable)

PART 3 - EXECUTION  (Not Applicable)

END OF SECTION 01 78 23
SECTION 01 78 36 - WARRANTIES AND GUARANTEES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Execute and provide notarized Project Warranty on form furnished at end of section.

B. Provide special written warranties or guarantees or both for products, equipment, systems and installations required by other sections of Contract Documents for duration indicated.

C. Provide manufacturer’s warranties or guarantees or both required by other sections of Contract Documents for products, equipment and systems for duration indicated.

1. Where manufacturer’s standard warranties or guarantees or both expire before duration required by other sections of Contract Documents, obtain and pay for extensions as part of Contract Price.

D. Provide all warranties or guarantees or both prior to final payment.

E. Warranties or guarantees or both required by Contract Documents shall commence on date of Substantial Completion of Work, or designated portion thereof, unless otherwise indicated in Certificate of Substantial Completion.

1.02 SUBMITTALS

A. Contract Closeout Information:

1. Full executed and notarized Project Warranty on included form.
2. Transmittal letter indicating Owner’s receipt of 3-ring binder containing all product equipment and system warranties or guarantees or both required by other sections of Contract Documents.

1.03 JOB CONDITIONS

A. If for any reason, Contractor cannot warrant or guarantee or both, any portion of Work using products or construction methods indicated or required by other sections of Contract Documents, notify Architect/Engineer in writing during bid period, and before contracts are awarded, indicating reasons and names of products and data on substitutions that can be warranted or guaranteed or both.

1. Should Contractor fail to notify Architect/Engineer, Contractor will be held to having agreed to warrant or guarantee or both, for the Work indicated.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION

3.01  PROJECT WARRANTY

A.  Execute and provide notarized Project Warranty on form furnished at end of section.
   1.  Provide Contractor’s name, address, signature and date.
   2.  Notarial Act and notarization: Warranty document is required to be signed, dated, and sealed with Notary Public seal or stamp in accordance with state and territorial notary laws.

B. The Contractor shall comply with procedures and criteria outlined in the General Conditions of the Contract for all warranties and special guarantees of the work.

3.02  PRODUCT, EQUIPMENT & SYSTEM WARRANTIES AND GUARANTEES

A. Compile approved warranties and guarantees or both required by other sections of Contract Documents.

B. Bind or assemble in 3-ring binders, completely indexed by specification section, with each warranty or guarantee or both clearly labeled.

C. Identify each warranty or guarantee or both in manner consistent with names and identification numbers used in Contract Documents.

D. Neatly type or draft all warranties or guarantees or both not furnished in printed form.

E. Organize warranties or guarantees or both for ease of reference.

F. Provide transmittal letter containing:
   1.  Date.
   2.  Project title.
   3.  Contractor’s name and address.
   4.  Title and number of warranties or guarantees or both.
   5.  Indicating Owner’s receipt.
   6.  Deliver to Owner prior to final payment with copy of transmittal letter indicating the University’s receipt.

END OF SECTION 01 78 36
PART 1 - GENERAL

1.01 DESCRIPTION

A. Definitions:

1. Documents required for construction: Complete set of all documents required by Contract Documents, including but not limited to:
   c. Addenda.
   d. Shop Drawings.
   e. Product Data.
   f. Samples and Mock-ups.
   g. Project Information.
   h. Change Orders.
   i. Directives, Clarifications, Interpretations, etc.
   j. Field test records.
   k. Warranties.

2. Field documents: Complete set of all documents required for construction.
   a. Used for construction of project.
   b. Contract drawings in form of prints.

3. Periodic Update Documents: Complete separate set of all documents required for construction with exception of samples and mock-ups.
   a. Do not use for construction of project.

4. Project Record Documents: Complete set of all documents required for construction with exception of samples and mock-ups.

5. LEED Submittal Documents: Complete set of all documents required for submittal to US Green Building Council.

1.02 SUBMITTALS

A. Contract closeout information:

1. Copy of transmittal letter to Owner.
   a. At completion of project, turn over Project Record Documents to Owner with letter of transmittal.
   b. Submit Record Documents in containers used for Periodic Update Documents.
c. Provide Transmittal Letter containing:

   (1) Date.
   (2) Project title.
   (3) Contractor’s name and address.
   (4) Title and number of each Project Record Document.
   (5) Certification that Project Record Documents submitted are complete, accurate and reflect actual construction of project.
   (6) Owner’s signature indicating receipt and acceptance of Project Record Documents.

2. Copy of Record Drawing files on compact disk to Architect/Engineer.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 POSTING PRIOR TO CONSTRUCTION

   A. After Contract is executed, but prior to start of construction, obtain Contract Drawings and Project Manual/Specifications that will be used for Field Documents and Periodic Update Documents.

   B. Obtain copies of all addenda and post all above documents.

3.02 FIELD DOCUMENTS

   A. Maintain minimum of one copy at project site.

   B. Label each document “FIELD.”

   C. These documents will be used for construction of project.

   D. Make documents available at all times for review by Architect/Engineer, Owner and authorities having jurisdiction.

3.03 PERIODIC UPDATE DOCUMENTS

   A. Progress Application for Payment will not be approved if record documents are not current.

   B. Maintain one copy at project site.

   C. Label each document "PROJECT RECORD" in 1 inch or larger printed letters.

   D. Record drawing information in colored pencil with different colors for the various systems and defined by color legend.

   E. Do not use these documents for construction purposes.
F. Make documents available at all times for review by Architect/Engineer, Owner and authorities having jurisdiction.

G. Maintain in clean, dry, legible condition.

H. Maintain Contract Drawings in stackable, enclosed cardboard file drawers designed to hold drawings horizontally.
   1. Provide index of contents of each file drawer on the outside of the drawer.

I. Maintain all other Periodic Update Documents in stackable, enclosed file boxes designed to hold specific type of document.
   1. Provide index of contents on the outside of each box.

3.04 POSTING AND UPDATING OF PERIODIC UPDATE DOCUMENTS

A. Post and update on weekly basis.

B. Contract drawings: The Project Record Documents are intended to indicate all changes and deviations from the original Contract Documents and permanently record the “as-built” condition of material, equipment and structure. Mark legibly to record actual construction including but not limited to:
   1. Depths of various elements of foundations in relation to first floor level.
   2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
   3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure to include, but not limited to, valves, dampers, controls, junction boxes, clean-outs, access doors and other items requiring access or maintenance.
   4. Field changes of dimension and detail.
   5. Changes made by change order, field order, clarifications, interpretations, directives, etc.
   6. Addenda.
   7. Provide the Architect/Engineer with a set of legibly marked-up original construction drawings showing all changes to the drawings made by Addenda, RFIs, Change Orders, and other directives and amendments. These changes shall be legibly red-lined on the record drawings to show the actual installed condition. Record drawings simply tabulating the RFIs, Change Orders, directives, and amendments on the drawings shall be returned for clarification of installed conditions and red-line mark-up.
   8. Fire protection and alarm systems shop drawings.

C. Project Manual/Specifications: Type on each section to record all changes including, but not limited to:
   1. Addenda.
   2. Change order or field order.
   3. Clarifications, interpretations, directives, etc.
   5. Indicate manufacturer, makes, and models used for actual construction of project.
6. All changes and corrections to the Project Manual shall be clearly indicated.

D. Any work concealed prior to recording of required information must be uncovered.

E. Do not conceal work for which information must be recorded until all required information is recorded on Periodic Update Documents.

F. Once all required information is recorded on Periodic Update Documents, restore work at Contractor’s expense.

3.05 PRODUCTION OF PROJECT RECORD DOCUMENTS

A. Utilize set of Contract Drawings.

B. Submittals: Submit the Project Record Documents in conformance with Division 1 Section "Contract Closeout" and prior to the final application for payment. The final Application for Payment will not be approved prior to the submittal of Record Documents.

C. Record Drawings:
   1. Clean set of Contract Drawings with Architect/Engineer’s seals and signatures removed shall be used for Record Drawings.
   2. Skilled draftsperson shall transfer all changes, corrections, entries, and other items from Periodic Update Documents to prints utilizing red pen.
   3. Label each document “PROJECT RECORD PRODUCED BY CONTRACTOR” and date in prominent place.
   4. Scan Record Drawings into electronic Adobe PDF file format.
      a. 300 dpi resolution.
      b. Name each pdf file to match Contract Drawing identification (i.e. "A-103G.pdf").

5. Provide Owner original Record Drawings, and CD-R of scanned drawings in PDF file format.

3.06 ENVIRONMENTAL RECORD DOCUMENTS

A. Comply with “Environmental Closeout Submittals” paragraph in Division 1 Section "Submittal Procedures".

B. Provide environmental submittals as specified, including USGBC LEED NC v2.2 Green Building Rating System documentation documents.

C. Label each document “ENVIRONMENTAL.”

D. These documents will be used for documentation of specified sustainable construction practices.
E. In addition to specified environmental submittals, provide U.S. Green Building Council LEED documentation according to specifications and requirements of LEED NC version 2.2 used for the Project.

END OF SECTION 01 78 39
SECTION 01 86 23 - INSTRUMENTS AND CONTROLS DESIGN CRITERIA

PART 1 - GENERAL

1.01 FUNCTION:

A. Instruments and control systems are used to directly or indirectly monitor and control the equipment provided and auxiliaries and include primary sensing elements, final control elements, computing devices, analyzers, transmitters, and certain electrical devices such as switches and push buttons.

B. Scope:

1. The Item 1 Contractor (the Contractor that furnishes the steam turbine generator, steam turbine generator enclosure, surface condenser, fire suppression system, and control system) shall be responsible for the integration of the new integrated control systems’ control points and graphics into the existing SCADA (Wonderware). The controls company (company to provide the control system that is subcontracted by the Item 1 Contractor) shall work with individual equipment vendors to provide a list of all the points that are required to be integrated into the control system. The list shall include point attributes (analog, digital, virtual, input, output, alarm, engineering units, HMI graphics, trend, alarm, etc.), communication method between the SCADA and field controllers, file including all point names and addresses, and a sequence of operations. The turbine vendor shall cooperate with the integrator during the integration work, generation of graphics and validation of points. The Item 1 Contractor’s contract with the control system provider shall include integration into the existing SCADA. The subcontract with the control system provider shall require the control system provider to contract the services of the local integrator familiar with the existing SCADA architecture and the Owner’s requirements. Item 1 shall include furnishing a complete and fully functional control system for the WDEP modifications for the new steam turbine generator addition. The control system furnished shall include, but not be limited to the controls for all equipment furnished in this item, the controls for the other item in this bid package (cooling tower with VFD), and other items in subsequent packages such as the condensate pumps and the cooling tower pumps.

2. Design and furnish (and install on vendor furnished equipment and panels) instruments and control systems as necessary to properly monitor and control all equipment and systems furnished.

3. Furnish PLC or multiple PLC’s as specified under each equipment package with external watch dog and associated software and hardware for a complete local control system.

4. Provide redundant Ethernet hub for interface to PLC,s, HMI, and Plant Control System.

5. Provide hardware interlocks to the Owner’s Control System as required for proper operation and safety.

C. Unless specified otherwise for particular applications, instruments and devices provided shall satisfy the applicable specifications of Division 25 Section "MEASUREMENT AND CONTROL INSTRUMENTATION HARDWARE" and Division 25 Section "CONTROL SYSTEM HARDWARE."
1.02 DESIGN CRITERIA – CONTROL SYSTEM

A. Control System

1. The plant control system will be a PC based control system that will use Wonder Ware as the HMI software program.
2. Operator workstations are located in the control room.
3. Each control system cabinet shall be wired for 120VAC UPS control power.

B. Control System Logic Design

1. The Logic Design configuration shall be designed to provide control and status information to the operator. The latest control strategies, manufacturer's recommendations and applicable codes shall be utilized for the configuration design. Soft alarms shall be developed to provide the operator with cause of trip indication.
2. Where redundant transmitters or switches are provided, instruments shall be partitioned to separate I/O cards.
3. The controls shall be monitored by the plant control system. All indication, alarms and events shall be integrated into the plant control to facilitate remote monitoring from the operator workstations.
4. No trip string is allowed and each permissive and/or trip shall be alarmed individually.
5. Critical control interlocks and trip signals shall be hardwired between control subsystems, and required and recommended interlocks shall be designed to be fail-safe.

1.03 Automatic and safe control from minimum to maximum load while simultaneously meeting all performance guidelines and guaranties.

A. All required and recommended operational alarms and control, including skid mounted systems.

1.04 Instrumentation shall be provided as necessary to fulfill the functions described above as follows:

A. Pressure transmitters and gauges on inlet and outlet of all flow processes where differential pressure is an indication of performance such as:

1. Lube oil system.
2. Air removal system.

B. Temperature and pressure compensation steam flow.

C. Thermocouples and thermometers on inlet and outlet of all flow processes where differential temperature is an indication of performance such as:

1. Inlet Port
2. Extraction port.
3. Exhaust port.
D. Liquid level transmitters and gauges or gauge glasses on any vessel where:

1. Level is automatically controlled by other devices.
2. Knowledge of tank or vessel level is necessary to provide basis for operator action.
3. Knowledge of vessel level is the only indication of the volume of fluid in the vessel.
4. If liquid level transmitters are used as trip devices a backup level float for high and low level shall be used.

E. Provisions for the installation of test instrumentation necessary for the conductance of testing procedures in conformance with the ASME Power Test Codes such that the test equipment can be installed without interrupting operation of the unit.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 86 23
SECTION 01 86 26 - ELECTRICAL DESIGN CRITERIA

PART 1 - GENERAL

1.01 SCOPE

A. Furnish electrical equipment, control, and instrumentation as specified for equipment and systems supplied by this Contract including but not necessarily limited to the following:

1. All motors required to operate the equipment covered by this Contract. Motor construction, enclosure type, and terminal boxes shall be appropriately rated for the environment.
2. Unless otherwise noted, all 480V and above electrical distribution and control equipment and related wiring such as 480V and 13,800V MCCs, and 13,800-480V transformers shall be provided by the installation Contractor.
3. Unless otherwise noted, all control, instrumentation, feeder, and branch circuit raceways and wiring from devices and equipment provided by this Contract shall be provided by others, e.g., 120V branch circuits from Owner's panel boards, temperature sensors wired to motor protection relay, and power and control wiring to starters and contactors in MCC.

B. Related work specified elsewhere includes but is not limited to:

1. Division 25, Division 26, and Division 48 technical specifications included in this Contract.

1.02 DESIGN PARAMETERS

A. General:

1. Electrical utilities provided by other contracts:
   a. 480V, 3 phase, 3 wire, 60 hertz, distribution panels will be provided by others for the balance of plant turbine loads. Individual motor starters shall include control power transformers for 120VAC control circuits to/from equipment and devices.
   b. 120VAC UPS system will be provided for the critical turbine systems by others.
2. Skid mounted equipment shall have all devices requiring remote electrical power, controls, and/or instrumentation connections pre-wired to field terminal boxes. Separate boxes shall be provided based on the voltage level. 120VAC to control and 600VAC power wiring connections shall not be located in the same box. Wiring from Owner provided utilities and equipment shall be furnished and installed by others.
3. Critical loads shall be connected to UPS power and designated in each equipment section. Verify existing UPS Capacity.
4. Provide engineered documents including but not limited to general arrangement and plan drawings, equipment layout, load lists, logic diagrams and P&I Diagrams.
5. Submit for Owners review.
B. Grounding:

1. #4/0 soft drawn stranded bare tinned copper extensions (tails) from the ground grid for direct connection to equipment and structures provided by this Contract shall be provided by others.

2. Provide provisions for grounding every other steel support leg of all new structures directly to the ground grid with a ground tail exothermically welded to the steel.

3. Provide provisions for grounding all motors and skid mounted equipment to the buried ground grid or building structure. Provide grounding provisions to the equipment at diagonally opposite corners.

PART 2 - PRODUCT (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 86 26
SECTION 01 91 13 – COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUBMITTALS

A. Submittals shall be in accordance with Division 1 Section "SUBMITTAL PROCEDURES."

1.03 SUMMARY

A. Section Includes:

1. This section covers the services required for the Commissioning process to provide the UPM/operator of the facility with a high level of assurance that the mechanical and electrical systems have been installed in the prescribed manner and operate within the performance guidelines. Commissioning is intended to aid in the orderly transfer of systems to beneficial use by the UPM.

2. Verification Data Sheets: Refer to end of this Section for Test Procedures and Verification Data Sheets that have been prepared to reflect UCB Standards and Guide Specifications.

B. Services Required but Not Provided Under This Section:

1. Commissioning requires primary support from the contractors. The Commissioning process does not relieve any contractors from their obligations to complete all portions of work in a satisfactory manner.

C. Related Sections:

1. Divisions 13, 21, 23, 25, 26, and 48 equipment and system sections for various testing requirements and procedures.

1.02 DEFINITIONS

A. Commissioning Observations: Visual observations of all equipment, components, and preliminary work required to prevent delays during performances of construction, startup, calibration, and demonstration.

B. Pre-Functional Testing (PFT): The observations, tests, and data verification required to show that the workmanship, methods, and materials used in the installation of the system/subsystems are in accordance with the contract documents, and to determine that the systems are ready for operation and final demonstration. Calibration verifications (and adjustments) shall be performed as necessary to show that all measured values are within tolerances as specified in Divisions 13, 21, 22, 23, and 26.
C. Functional Performance Testing (FPT): This is an integrated test of all the systems and subsystems to demonstrate functional operation and performance during automatic, manual, emergency and failure modes. This is an actual hands-on operational test of all the equipment and systems associated with the steam turbine generator. All mechanical, electrical, controls, graphics, status and alarm systems will be tested to verify perform as designed and specified.

D. CMGC: Construction Manager and/or General Contractor, whichever is appropriate.

E. UPM: University Project Manager.

F. University Commissioning Agent (UCA) will be an independent third-party commissioning agent.

G. By the time the construction documents are issued for bidding, the University Commissioning Agent will have:

1. Reviewed and contributed to writing the Program Plan for the project.
2. Been involved in selection of consultants assisting the Architect/Engineer.
3. Performed a pre-design meeting with the consultants and required documents stating design intent. UCB Standards were used as basis of design.
4. Conducted reviews at various stages, including but not limited to schematic design, design development, 65-85% design and final.
5. Provided the Testing and Start-up Checklists for incorporation to the Specifications.
6. Participated in a pre-bid presentation to prospective contractors to familiarize them with the University’s expectations, processes and assistance to contractors.

H. The responsibility and functions of the University Commissioning Agent (UCA) will include:

1. The UCA will participate in a pre-construction meeting with the CMGC and the appropriate subcontractors.
2. The UCA will assist the contractors and consultants with technical issues that need University involvement in the decision.
3. The UCA shall assist the CMGC and UPM in the coordination of the testing, demonstration, and operator training of mechanical and electrical systems for the project, and shall inform the CMGC and UPM of the status, integration, and performance of the Division 13, 21, 22, 23, 25, 26, and 48 systems within the facility.
4. The UCA will perform construction inspections, spot-testing, verification, and provide performance and operating information to all parties, i.e., contractors, design professionals, the CMGC, and the UPM.
   a. Assist Division 9, 13, 21, 22, 23, 25, 26, and 48 Contractors in selection of access door locations for all Division 13, 21, 22, 23, 25, 26, and 48 concealed devices needing access unless already shown in contract documents.
5. The UCA will write the test procedures for the FPT and provide all of the forms to adequately verify and document performance of equipment and systems during the PFT and FPT tests.
6. UCA shall observe and coordinate testing as required to verify adequate system performance.
7. The UCA shall document the results of functional-performance testing (FTP) directly and/or ensure that all testing is documented by the appropriate technicians. The UCA shall provide standard forms to be used by all parties for consistency of approach and type of information to be recorded.

8. When disputes arise, the UCA may be involved when needed to determine the scope. The CMGC and UPM shall preside over resolution of the problem.

9. Acceptance: The UCA shall review and advise the CMGC and UPM of the date of beneficial use (for various subsystems where appropriate) and shall offer recommendations for start of the warranty period.

10. Review and approve Operating and Maintenance manuals.

11. Review and approve As-Built Drawings produced by the consultants based on the contractor's submitted red-lined documents, and submitted shop drawings.

12. The work performed by the UCA does not relieve the consultants from the duties and responsibilities that are included in their contracts, such as contract administration and observations.

I. Project Description: Refer to Division 0 Section "Summary of Work (Part A)".

1.03 SYSTEMS TO BE COMMISSIONED

A. The following equipment and systems are to be commissioned:

1. HVAC systems including steam.
2. Piping and plumbing systems.
3. DDC/EMCS/FMS/HMI control systems.
4. Fire protection/suppression systems.
5. Smoke-management systems (if applicable).
6. Fire detection and alarm systems.
7. Steam turbine generator with sound attenuated/weatherproof enclosure and associated condenser and cooling tower.
8. Electrical medium voltage (MV-13.8kV) switchgear, low voltage (600V or less) power distribution equipment and grounding system. All product information approved and included in the project.
9. Uninterruptible power supply systems.

B. The UCA shall prepare and submit pre-functional checklists (PFC) and functional performance testing (FPT) procedures to be used to verify automatic, manual, emergency and failure mode operation of the above systems.

1.04 COORDINATION

A. The CMGC shall be responsible for furnishing a copy of all construction documents, including, change orders, submittals and shop drawings to the UCA.

B. The UCA will coordinate with each contractor on the project, specific to the contractor's responsibilities for commissioning. The UCA will assist the contractor in understanding the pre-functional checklists and other test forms, and confirm that the work has been done.

C. The UCA will regularly apprise the CMGC and UPM of progress, pending problems and/or disputes of which they might not be aware.
1.05 SCHEDULE

A. Commissioning of systems will proceed per the criteria established in the sections that follow with activities to be performed on a timely basis. The UCA must be available to respond promptly to avoid construction delays.

B. Start-up and testing of subsystems may proceed prior to final completion of all systems to expedite progress.

C. If problems are observed, or deficiencies in performance are discovered, the responsible parties shall be notified, and actions to correct deficiencies coordinated in a timely manner.

D. Contractor schedules and scheduling is the responsibility of the CMGC. The UCA shall coordinate Commissioning scheduling with the CMGC and UPM.

1.06 SUBMITTALS

A. Commissioning Plan: With the assistance of the UCA, contractors shall submit the following items to the CMGC and UPM within 60 days after award of the contract but not less than 30 days prior to starting field test work on the project.

   1. The UCA will coordinate with the contractors to submit a schedule for the Commissioning process which is integrated with the construction schedule. Included will be the required work by all team members (UCA, Contractors, etc.).
   2. Test equipment/instrumentation to be used by the Contractors on this project, including name, model number, calibration, and date of certification of each instrument.
   3. Submit pre-functional checklists (PFC) and functional performance testing (FPT) procedures. These documents shall be approved by the Engineer of Record prior to starting of any field checking or testing.
   4. Observation forms.
   5. Pre-functional test checklists Samples of these are provided at the end of this section.
   6. Test data sheets.
   7. Software documentation review procedures.
   8. Final commissioning report format and table of contents.
   9. Control documents indicating sensors used, sensor location, control wiring diagrams showing inputs and outputs, and a written Sequence of Operation.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. In the quantities listed according to the Conditions of the Contract. All industry standard test equipment required for performing the specified tests shall be provided by Division 13, 21, 22, 23, 25, 26, and 48. Any proprietary vendor specific test equipment shall be provided by that vendor or manufacturer.
B. Any portable or hand-held setup/calibration devices required to initialize the temperature control systems shall be made available by the temperature control vendors (at no cost) to both the UCA and the Test and Balance Contractor.

C. The UCA shall verify that the instrumentation being used meets the following standards:

1. Be of sufficient quality and accuracy to test and/or measure system performance within the tolerances required.
2. Be calibrated at the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument.
3. Be maintained in good repair and operating condition throughout the duration of use on this project.
4. Be immediately recalibrated or repaired if dropped and/or damaged in any way during use on this project.

D. The UCA shall provide instrumentation as necessary to verify the accuracy and/or performance of instrumentation by others being used for startup, calibration, and test and balance procedures. Instruments normally required are:

1. Hand-held meters to record/verify results at various points in the system, such as digital thermometers, voltage/current meters, air and water flow meters, pressure gauges, etc.
2. Light meter to verify light levels when appropriate.
3. Octave band sound meter to measure the noise level of equipment (cooling towers, chillers, compressors, AHUs, generators, transformers, etc.) and/or octave band sound levels in spaces and/or at the property line.

PART 3 - EXECUTION

3.01 CONSTRUCTION OBSERVATION

A. The UCA shall observe on a regular basis (weekly or daily, when required) the installation of the systems. This is an additional and separate activity from that provided by the Engineer. Construction observation is required as part of the Commissioning and coordination process to be provided by the UCA as transmittals shall be identified in Part 1. Provide written reports to all parties on the observed items by purchaser name, purchaser location and purchaser’s order number.

1. Observe construction to be familiar with and report on progress of work.
2. Inspect materials and equipment prior to installation and document conformance to construction Approval documents and shop drawings.

B. Submittal Review: The UCA shall co-review the submittals and shop-drawings with the Engineer, and shall submit comments to the contractors through the Engineer.

3.02 MECHANICAL TESTING, BALANCING, AND CALIBRATION

A. Test and Balance: testing and balancing of air and water systems will be accomplished by an independent test and balance firm (refer to Division 23 Section "Testing, Adjusting,
and Balancing"). The UCA will spot-check 10% of this work to verify accuracy of results. Vibration testing may be required if any component is deemed to be a source of vibration.

B. Startup procedures for major equipment shall be performed by the respective equipment vendors per Division 13, 21, 22, 23, 25, 26, and 48 specifications. The UCA shall review vendors’ step-by-step test procedures to be followed for confirming proper operation of this equipment.

C. The UCA shall develop startup/testing procedures for other systems/equipment when vendor recommendations are incomplete or unavailable.

3.03 ELECTRICAL TESTING AND CALIBRATION

A. Electrical Testing Co-ordination and Calibration: The electrical contractor shall obtain the services of an independent NETA-certified electrical testing contractor to coordinate, test, calibrate, set, and certify all power circuit breaker and protective relay devices. Refer to Division 26 Section "Electrical Studies and Testing." Circuit breaker settings and protective relay settings shall be provided by the engineer performing the electrical studies under Division 26 Section "Electrical Studies and Testing." The UCA shall observe the testing of circuit breakers and relays and verify that these devices have been calibrated and set and all settings have been documented.

B. All electrical equipment shall be start up tested on site by 1) the respective equipment vendors with assistance from the Division 26 Electrical Contractor. The UCA will observe and verify the test results.

3.04 PREREQUISITES TO FUNCTIONAL PERFORMANCE AND ACCEPTANCE PROCEDURES

A. The UCA shall furnish sufficient personnel experienced in the technical aspects of each system to be commissioned. They shall develop and document the Commissioning procedures to be used. Provide pre-functional checklists (to the Contractor) that itemize prerequisites to the functional test procedures. Design these forms to assist the Contractors in keeping track of installation requirements and progress. Samples of these forms are provided at the end of this section.

B. Provide functional performance checklists and performance test data sheets, and/or list any test forms, startup sheets, and other installation documents that are to be provided by the Contractor for each system based on actual system configuration.

C. The majority of mechanical equipment requires safety devices to stop and/or prevent equipment operation unless minimum safety standards or conditions are met. These may include adequate oil pressure, proof-of-flow, non-freezing conditions, system static pressures, maximum head pressure, smoke detectors, etc. The Commissioning plan shall include observation of the actual performance of safety shutdowns in a real or closely-simulated condition of failure.

D. The UCA shall document the acceptance procedures for each system within Division 13, 21, 22, 23, 25, 26, and 48 disciplines. The acceptance procedures must incorporate the Commissioning standards and successful testing results as referred to throughout Division 13, 21, 22, 23, 25, 26, and 48 specifications.
1. In particular, the temperature control system shall have all I/O points individually verified for proper function, calibration, and operation. The UCA shall review proposed testing procedures and report formats and observe sufficient field testing to confirm that all I/O points have been properly tested and control loops properly tuned.

2. All control Sequence of Operation strategies shall also be reviewed and proper operation verified by the UCA. Any deficiencies shall be noted and the UCA shall follow up with the responsible party through the CMGC to verify that the deficiencies are corrected and retested.

3. The UCA shall observe and verify that point labeling and values displayed on the graphical interface screens are correct and that the screens properly represent the monitored process.

E. The UCA shall inform the appropriate installing contractor what tests will be performed and the expected results. Whereas some test results and interpretations may not become evident until the actual tests are performed, all parties should have a reasonable understanding of the requirements. The Commissioning plan must address those requirements and be distributed to all parties involved with that particular system.

F. Acceptance procedures must confirm the performance of systems to the extent of the design intent. When a system is accepted, the UPM must be assured that the system is complete, works as intended, is correctly documented, and training has been performed.

3.05 FUNCTIONAL PERFORMANCE TEST PROCEDURES

A. Scope of Functional Performance Tests:

1. Operating tests and checks to verify that all components, equipment, systems, subsystems, and interfaces between systems operate in accordance with contract documents. These tests shall include operating modes, interlocks, specified control responses, specific responses to abnormal or emergency conditions, and verification of the proper response of the building automation system controllers and sensors, including end-to-end accuracy.

2. The functional performance testing shall be done by the installing contractor. The UCA and the consulting engineer shall witness and verify the tests.

B. Participants in Functional Performance Tests:

1. The UCA shall coordinate the scheduling of tests.

2. Installing contractors shall provide the services of a technician(s) who is (are) familiar with the construction and operation of this system. Provide access to the contract plans, shop drawings, and equipment cut sheets of all installed equipment.

C. Documentation and Reporting Requirements:

1. Provide functional performance checklists/test-plan for each piece of equipment, system, and subsystem, including all flow-measuring devices, interfaces, interlocks, etc. Each item to be tested shall have a different entry line with space provided for comments. Separate checklists shall be prepared for each mode of operation. Provide space to indicate whether or not the mode under test responded as required. Also, provide space for all necessary parties to sign off on each checklist.
2. Data sheets used in functional performance testing of the proper operation of the control system shall include each controller to be verified; the system it serves, the service it provides, and its location. For each controller, provide space for recording the readout data for each input and output. Also, provide space for all necessary parties to sign off on each checklist.

3. All test procedures and data sheets shall be submitted to the Engineer for review.

D. Functional Performance Procedures:

1. The Commissioning Contractor shall coordinate and witness the functional performance tests and checks for all equipment and systems.
   a. Set the system equipment in the operating mode to be tested.
   b. Verify the position of each device and interlock identified on the checklist. Each item shall be signed off as acceptable (yes) or failed (no).
   c. This test shall be repeated for each operating mode that applies to the system being tested.
   d. Operating checks shall include verification of all safety cutouts, alarms, and interlocks during all modes of operation.
   e. Any equipment that cannot be fully tested during the project start-up phase due to weather conditions shall be retested when the outdoor conditions are appropriate. This concept is referred to as “seasonal testing”.

2. If, during a test, an operating deficiency is observed, appropriate comments shall be noted on the checklist data sheet. When the deficiency has been corrected, the device shall be retested and the results recorded on the checklist data sheet.

E. The UCA shall coordinate and witness the field verification of the final TAB report.

1. The UCA shall select, at random, 10% of the report data for verification.
   a. The TAB Contractor shall be given advance notice of the date of field functional performance testing, but shall not be informed in advance of the data to be verified.
   b. The TAB Contractor must use the same instruments (by model and serial number) that were used when the original data was collected.

2. Failure of an item is defined as:
   a. For all readings other than sound, a deviation of more than 10% from the original report.
   b. For sound pressure readings, a deviation of 3 decibels. (Note: variations in background noise must be considered).
   c. A failure of more than 10% of the selected items shall result in rejection of the final TAB report.

F. If deficiencies are identified during functional performance testing, the CMGC and UPM must be notified, and action taken to remedy the deficiency.

1. Once a system is ready for the UCA to observe testing or performance demonstration, should portions of the system not operate properly, the UCA will
make one follow-up visit to observe a re-test or second demonstration. Additional follow-up visits will be at the expense of the responsible contractor.

2. The final tabulated checklist data sheets shall be reviewed by the Architect/Engineer (A/E) to determine if functional performance testing is complete and the operating system is functioning in accordance with the contract documents.

3.06 SOFTWARE DOCUMENTATION REVIEW

A. Review software documentation for all DDC controlled systems. This includes review of vendor documentation, their programming approach, and the specific software routines applied to this project. Discrepancies in programming or sequences shall be reported to the GM/GC, Engineer of Record, and/or UPM.

B. Software review shall include:
   1. Programming approach.
   2. Software sequence of operation.

3.07 OPERATING AND MAINTENANCE (O&M) MANUALS

A. The UCA shall review the draft form of the O&M manuals provided by the Contractors. The review process shall verify that O&M instructions meet specifications and are included for all equipment furnished by the Contractor, and that the instructions and wiring diagrams are specific (edited where necessary) to the actual equipment provided for this project. The UCA shall review and require editing of these documents as necessary for final corrections by the Contractor.

B. The UCA shall review normal and emergency operating and maintenance procedure narratives for each system. These narratives shall include one-line system diagrams as needed to support and clarify the normal and emergency operating procedures. The narratives and diagrams shall be reviewed with the University’s operating personnel and then submitted to the Architect/Engineer for final review and comments. The narratives shall then be corrected by the Contractor before incorporation into the final O&M manuals. Include review and edit of the following:
   1. One-line system diagrams for narrative support shall be 8-1/2" x 11" or 11" x 17" in size and incorporated with each narrative in the O&M manual. Potential diagram sources are:

3.08 TRAINING

A. CMGC shall coordinate training sessions for the University’s staff for each system. Training drawings shall be with the appropriate schematics, handouts, and visual/audio training aids on-site with equipment.

   1. The CMGC will host each training session.
   2. The appropriate installing contractors shall provide training provided based on all the major systems including peculiarities specific to this project requirements.

END OF SECTION 01 91 13
SECTION 12 93 00 – SITE AND STREET FURNISHINGS

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Site and street furnishings including the following:
   a. Trash and recycling receptacles
   b. Benches
   c. Bike Racks

1.02 QUALITY ASSURANCE

A. Qualifications: Install work using skilled persons, proficient in the trades required, in a neat, orderly and responsible manner with recognized standards of workmanship.

1.03 DELIVERY, HANDLING AND STORAGE

A. Handle and store materials in manner to prevent damage or deterioration. The Contractor is responsible for damage and subsequent repairs or replacement.

PART 2 – PRODUCTS

2.01 FURNISHINGS

A. Trash Receptacles: Salvage existing trash receptacles where indicated on the Drawings.

B. Benches: Salvage existing benches where indicated on the Drawings.

C. Bike Racks: Salvage existing bike racks where indicated on the Drawings.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Show all items accurately located on drawings.
2. Obtain field verification of location for each item from Campus Landscape Architect and PTS before proceeding.
3. Set units plumb, level and free of warp of racking.
4. Install as recommended by the manufacturer, including anchorage devices.

END OF SECTION 12 93 00
SECTION 31 23 23.33 - FLOWABLE FILL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, and Division 1 Specifications, apply to the provisions of this section.

1.02 SECTION INCLUDES

A. This section specifies requirements for design, materials, production, and placement of low strength, flowable concrete backfill. Flowable backfill is an alternative to conventional compacted earth backfill.

1.03 RELATED SECTIONS

A. Section 31 20 00 "EARTH MOVING".

1.04 REFERENCES

A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:

B. ACI (American Concrete Institute).
   1. ACI 301 - 89 - Specifications for Structural Concrete for Buildings.
   2. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

   1. ASTM A 185-90 - Steel Welded Wire Fabric, Plain for Concrete Reinforcement.
   2. ASTM A 615 - Deformed and Plain Billet - Steel for Concrete Reinforcement.
   3. ASTM C 33 - Concrete Aggregates.
   4. ASTM C 94 - Ready Mix Concrete.
   5. ASTM C 116-91 - Fiber Reinforced Concrete and Shotcrete.
   7. ASTM C 309 - Liquid Membrane - Forming Compounds for Curing Concrete.
   8. ASTM C 494 - Chemical Admixtures for Concrete.
  10. ASTM C 920 - Elastomeric Joint Sealants.
  11. ASTM D 994 - Preformed Expansion Joint Fillers for Concrete (Bituminous Type).
  12. ASTM D 1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

D. PCA (Portland Cement Association).
1.05 SUBMITTALS

E. Mix Design.

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTION

A. Mix Design: A mix design shall be prepared in a testing laboratory by a Colorado Registered Professional Engineer competent in the field of materials engineering. In lieu of a mix design, documentation of field test data may be submitted. Samples of the mix, with its formula, shall be made available to the City for testing prior to construction. City reviewed mixes may be considered prequalified for subsequent usage. Flowability and strength requirements shall be as follows:

1. Slump: 10 inch minimum.
2. 28-day strength: 30-90 psi.
3. 90-day strength: 35-95 psi.

B. Flowable backfill shall be produced from a job mix formula as specified above.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Before depositing flowable backfill, debris shall be removed from the space to be occupied by the flowable backfill. Flowable backfill shall be held low enough from the pavement surface to allow adequate trench patching. Vibratory or other compaction equipment shall be used only when necessary to fill inaccessible voids.

B. Flowable backfill shall be allowed to cure for 24 hours before placing permanent pavement on it. Traffic shall not be allowed on flowable backfill during the first 6 hours after placement. Temporary pavement or fill can be used after a 6-hour initial set.

END OF SECTION 31 23 23.33
SECTION 32 01 90 - TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, and Division 1 Specifications, apply to the provisions of this section.

1.02 SUMMARY

A. This section includes:

1. Installation of Tree Protection Fencing
2. Installation of Boxing
3. Siltation Control
4. Transplanting
5. Tree Removals
6. Protection of Trees to Remain

B. Related Work:

1. Section 31 10 00 'Earthwork'
2. Section 31 11 16 'Buried Chilled Water Distribution Piping'
3. Section 31 20 00 'Earth Moving'
4. Section 32 91 13 'Soil Preparation'
5. Section 32 92 23 'Bluegrass Sodding'
6. Section 32 93 00 'Trees, Plants and Groundcovers'

1.03 REFERENCES

A. ANSI Z133.1 Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush.


D. Tree Care Industry Association (TCIA) Book of Standards, most recent edition.

1.04 DEFINITIONS

A. Tree Protection Fencing: Temporary fencing installed prior to site preparation and demolition which protects a group of trees or shrubs.

B. Boxing: Temporary wood box form installed prior to site preparation and demolition which protects individual trees and shrubs.
C. Root Pruning: Physical cutting of plant roots to minimize root damage and promote healing.

D. Construction Branch Pruning: Physical cutting of any branch which interferes with construction.

1.05 SUBMITTALS

A. Comply with Section 01 33 00. All submittals shall be accepted by the Campus Landscape Architect in writing before Work commences.

B. Schedule: Submit construction schedule to include time frame for work near existing plant material. Provide transplanting and tree removal schedule including tree transplants and locations. Obtain approval by Campus Landscape Architect prior to beginning of transplanting work and construction near restricted area.

C. Work Methods: Submit proposed methods and schedule for effecting tree and plant protection for approval, including proposed methods, materials, and schedule for root pruning, construction pruning, aeration and subsequent tree fertilization. Mark plan location of root pruning and siltation fencing in field with paint for approval by Campus Landscape Architect. Any root pruning which is required due to construction work adjacent to existing trees and shrubs designated to remain shall occur any time ground can be worked except when tree or shrubs are in leaf. Root pruning when tree or shrubs are in leaf may occur only with approval by Campus Landscape Architect.

1.06 QUALITY ASSURANCE

A. Comply with Division 1.

B. Qualifications:

1. Arborist: Company having adequate capacity and facilities to meet the specified requirements. All tree pruning and cleaning shall be performed by a landscape contractor with a minimum 5 years documented experience. Evidence to this effect shall be provided by the supplier if required by the Campus Landscape Architect.

C. Regulatory Requirements: City permits are necessary for pruning or removal of all trees in the right-of-way.

D. Pre-Installation Conference

1. Conduct pre-installation conference prior to construction.
2. Attendance required by: Owner, Architect, Contractor(s), Manufacturer(s)/Supplier(s), other parties who are involved.

1.06 PROJECT/SITE CONDITIONS

A. All plant materials to remain or be moved will be tagged by the Campus Landscape Architect to assist the Contractor in identifying the trees. Contractor to notify Campus Landscape Architect seven (7) days before tree relocation. All relocated plant material to be included in Maintenance – see 1.7.
B. Maintain all plant materials within tree protection areas. Designated tree protection areas of trees, shrubs, and grasses are to remain untouched and unharmed.

C. Construction activities, including stockpiling, in tree protection areas are prohibited.

D. Licensed tree arborist shall determine and document value of each tree or other plant materials within the limits of work line that is designated to remain. Contractor shall reimburse client for the value of any of these trees or other plant materials that are lost or damaged during construction using the Trunk Formula Method of tree valuation.

1.07 MAINTENANCE

A. Maintenance Services: Performed by a landscape contractor for the first year after final completion of all site construction.

B. Maintenance Period: Begin maintenance immediately upon start of construction. Continue maintenance until one year after final completion of all site construction.

C. Maintenance to Include:
   1. Quarterly review and monitoring of tree conditions.
   2. Maintaining guying. Repair or replace when required.
   3. Water at a sufficient frequency to saturate root system and keep soil moist.
   4. Pruning, including removal of dead or broken branches, and treatment of pruned areas or other wounds.
   5. Disease Control.

D. Protection: In accordance with paragraph 3.3- Preparation.

E. Root Zone Fertilization: Root zone fertilize all trees affected by construction. The first root zone fertilization shall occur within 6 months after completion of site construction and the second within 12 months. Use a liquid application with an 18 inch soil probe. Fertilization mix shall be submitted to the Campus Landscape Architect for acceptance prior to application.

F. Pesticides: Apply pesticides, with permission of owner, in accordance with manufacturer’s instructions. Remedy damage resulting from improper use of pesticides.

G. Maintenance Reports: Provide maintenance report including date and detailed summary of work completed on site, to the Campus Landscape Architect after each maintenance visit.

PART 2 - PRODUCTS

2.01 TREE PROTECTION FENCING

A. Fencing: Galvanized chain link fencing, 6 ft. high.

   1. Tree protection fencing is the property of the Contractor.
   2. Gates at tree protection areas shall be 6'-0" width min. for maintenance vehicles and be 6'-0" ht. galvanized chain link fence.
B. Metal Fence Posts: 9 ft. galvanized steel posts, driven a minimum of 3 ft. into the ground. Space 10 ft. o.c. maximum.

2.02 SILTATION CONTROL FENCING
A. Fencing: 30” height. Siltation fencing complying with local codes.
B. Posts: Attach to tree protection fencing.

2.03 SOIL AMENDMENTS/MULCH

PART 3 - EXECUTION

3.01 NEW CONSTRUCTION
A. Curb cuts should not be closer than the dripline of the tree without permission from the Campus Landscape Architect.
B. New sidewalks, paving or asphalt within the drip line of the tree must allow breathing space for tree roots. The following should be used as a guideline: For trees up to 4 inches in trunk caliper, 25 square feet of porous area is needed. For each additional 2 inches of tree caliper, 10 more square feet are needed.
C. Where grade change is required, the same area must be provided either by construction of a drywell where the level is to be raised or by building a retaining wall where the level is to be lowered. The grade within the drip line of the tree is not to be changed without Campus Landscape Architect approval.
D. Avoid cutting surface roots wherever possible. Sidewalks and paving levels would be contoured sufficiently to avoid such cutting.

3.02 EXAMINATION
A. Verification of Conditions: Examine areas and conditions under which the Work of this Section will be performed. Report unsatisfactory or questionable conditions to the Campus Landscape Architect. Do not proceed with the Work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.
B. Verify all utility locations in the field prior to digging.

3.03 PREPARATION
A. Marking of Construction/Demolition/Tree Preservation Limits
   1. Clearly mark the tree protection fence locations as indicated on the Drawings, boxing and all construction/demolition limits in the field.
   2. Mark individual tree root pruning areas and location of siltation fencing with paint.
3. Verify all trees to be removed, transplanted, or protected with Campus Landscape Architect. Tag all plant material with appropriate tags noting action to be taken with each plant.

4. Contact and accompany Campus Landscape Architect on a joint review of construction/demolition limits, tagging and painting before prior to the installation of the tree protection fencing and start work.

5. Limit of construction is generally defined as the limit of demolition. Contractor to immediately notify Campus Landscape Architect if work will occur outside the construction/demolition limits.

6. Limit of construction is generally defined as the limit of demolition. Contractor to immediately notify Campus Landscape Architect if work will occur outside the construction/demolition limits.

7. Contractor to verify limits of existing R.O.W. Contractor to obtain all necessary permits from appropriate jurisdictions prior to commencing activity within the R.O.W.

3.04 INSTALLATION OF FENCING

A. Fencing: Install tree protection fencing prior to start of demolition work and clearing and grubbing operations in accordance with the following:

1. Following approval of staking by the Campus Landscape Architect, install fencing at the tree protection areas.

2. Install fencing as approved. No fencing is allowed within three (3) feet outside the drip line of trees.

3. Install posts 10'-0" o.c. maximum.

4. Install gates where noted on the plans.

3.05 SILTATION CONTROL

A. Fencing: Provide silt control at Tree Protection Areas by attaching silt fence to the uphill side of the protective fencing. Place lower 6" of silt fence in trench below grade. Backfill trench.

B. Drainage: Maintain positive drainage from Tree Protection Areas. Divert runoff from site around Tree Protection Areas.

3.06 TREE REMOVALS

A. Schedule: Obtain approval of schedule prior to starting work.

B. Notification: Trees to be removed according to the Tree Protection or Landscape Plans shall be tagged by the Contractor and approved by the Campus Landscape Architect prior to removal.

C. Stump Removal: Remove tree stumps by approved means approved by Campus Landscape Architect to a depth of 12" below the proposed finished grade surface in lawn areas and 36" below finish grade in paved areas as determined by the Campus Landscape Architect. Remove wood chips from site. Fill stump removal areas with existing soil. Chemicals which will harm future landscape above stumps may not be applied to aid in stump removal. In locations where trees will be replanted in the location of an existing tree, the entire stump shall be removed to accommodate new tree planting.
D. Disposal: Dispose of all removals from the site at an approved disposal or recycling facility. Contractor may grind tree removals to be used for mulching purposes if mulch is approved by the Campus Landscape Architect. Removals or mulch become the property of the Contractor.

E. Protection: Contractor is responsible for protection of all trees designated to remain or transplanted during removal procedures.

3.07 ROOT PRUNING AND PROTECTION

A. Root Pruning

1. Prune roots where construction will sever roots.
2. Only clean cutting methods are acceptable. Root pruning is the physical cutting of tree roots to minimize root damage and promote healing. Unsuitable means for root pruning include trenching, vibrating plow, stump grinder. Any method which tears roots or disturbs the soil beyond the grading limit is unacceptable.
3. Hand trim roots at trench walls. Make clean cuts through roots.
4. Prune tree roots to a depth no greater than required by construction excavation, by approved means only. All roots shall be pruned by an approved method.

B. Backfill: Close trenches within 24 hours. Backfill root pruning trench with existing soil. Tamp lightly to set soil.

1. When trench closing is not possible within 24 hours, protect trench side in accordance with this Section.

C. Mulching: Apply wood mulch to a depth of 4 in. to 5 in. at minimum 10 ft. to 15 ft. radius around tree to reduce compaction and increase moisture retention. Soil shall be kept moist in root pruning areas.

D. Root Protection: If tree roots larger than two (2) inches in diameter are encountered with digging or trenching, tunnel under for any improvements if possible. Dig trench by hand only.

2. Notify Campus Landscape Architect to allow physical inspection of excavation around root zones to determine damage and health of tree. Do not tear the roots out. Removal of two (2) inches or larger diameter roots encountered during construction is not allowed without permission of Campus Landscape Architect.
3. Upon approval by Campus Landscape Architect, wrap cut roots two (2) feet and larger with burlap to prevent scarring or excessive drying.

3.08 CONSTRUCTION BRANCH PRUNING

A. Prune any branches of trees to be preserved which interfere with construction only at the direction of the Campus Landscape Architect. Approval of all proposed pruning is required prior to start of work. Pruning is an incidental pay item associated with the transplanting of existing trees, the planting of new trees, and the care of existing trees to remain. Payments for such incidental items shall be drawn from the project budget.

B. Remove any branches that are weak or dead.
C. Any pruning included as part of the project shall be done by a licensed tree company and in accordance with good pruning practices as approved by the Campus Landscape Architect. Pruning shall maintain balance, form and function of tree.

3.09 TEMPORARY TREE GUYING

A. Upon review of on-site root pruning and construction grading limits, the Campus Landscape Architect will determine whether the existing trees designated to remain should be temporarily guyed.

B. Complete tree guying using materials and techniques designated by the Campus Landscape Architect in accordance with Section 32 94 00 and complete in a timely manner.

3.10 AERATION

A. If areas inside the restricted area become compacted as determined by the Campus Landscape Architect, aerate to a 20 inch depth using an aeration "grow gun," avoiding damage to surface absorbing feeder roots.

B. Inject filler material to hold aeration fractures open.

3.11 WATERING

A. Apply supplemental watering to a depth of 10-12" (18" max) with a deep root feeder if loss of grasses or heating of the roots occurs during construction or as directed by Campus Landscape Architect. Apply a minimum of 10 gallons per DBH (diameter at breast height) per week.

B. Contractor to water existing trees as determined by Campus Landscape Architect to promote healthy, thriving plant material.

C. Contractor and Campus Landscape Architect to determine appropriate water pressure.

3.12 EXCAVATION INSULATION

A. Provide mitigation from moisture and temperature fluctuations by pinning 3 layers of burlap onto the entire face of excavations exposed for more than 24 hours.

B. Wet burlap insulation immediately following installation.

C. Keep moist for the entire period the excavation remains open.

D. Remove insulation prior to backfilling.

3.13 CHEMICALS, FERTILIZATION AND INSECT SPRAYING

A. No chemicals shall be applied or used around or near existing trees.

B. No fertilizers, insect sprays or other chemicals shall be applied before or during root or branch pruning process.
C. Trees identified by Owner or Landscape Consultant as having insect infestations shall be sprayed to help control any outbreaks during the construction period.

1. The company shall be licensed for pesticide applications with the Department of Agriculture and the applicator of any herbicide or pesticide shall comply with licensing standards of the Colorado Department of Agriculture Plant Division Pesticide Application rules and regulations.

3.14 CONCRETE WASHOUT

A. Provide concrete washout in areas which drain away from the Tree Protection Areas as indicated on the Drawings. The Campus Landscape Architect shall approve concrete washout area prior to the start of any site work.

3.15 GRADING AT TREE PROTECTION AREAS

A. All grading within protected areas shall proceed only after review and approval by the Campus Landscape Architect.

B. All fill within protected areas must be approved by the Campus Landscape Architect. Tamping of fill earth shall be allowed; compaction of fill earth shall not be allowed. No "cutting" of grades in root area shall be allowed.

3.16 FIELD QUALITY CONTROL/DAMAGE PENALTIES

A. Trees labeled as requiring "General Protection" or "Special Protection" adjacent to construction areas and in other key locations are identified on the Drawings. Loss of any of these trees due to Contractor neglect or improper construction activities will result in liquidated damages for the assessed value of the tree as determined by a licensed arborist. Damage to a portion of these trees will be assessed by the arborist and a portion of the liquidated damages will be assessed to the Contractor. A list of tree values for the project will be on file in the Campus Landscape Architect's office. Any damaged tree not on this list shall be evaluated by the Campus Landscape Architect as necessary to comply with this penalty.

B. A fine of $1,000 will be levied against the Contractor for each incident of construction (including construction traffic) inside tree protection areas.

C. Trees or roots visibly damaged will cause the Owner to withhold from the Contractor an assessed amount conforming to the requirements stipulated above, for a period of two years. After that period the impact of the damage to any tree will be assessed by the Campus Landscape Architect.

D. If any trees or shrubs designated to be saved are damaged and replacement is required, a number and diameter of trees or shrubs of the same species and variety, as specified by the Campus Landscape Architect, shall be furnished and planted by the Contractor. The total inch diameter of the replacement trees or shrubs shall equal the diameter of the tree or shrub to be replaced as measured by the Guide for Plant Appraisal by the Council of Tree and Landscape Appraisers, 9th edition. The Contractor shall not be liable for any loss or damage which occurs while the Contractor is complying with instructions given by the Campus Landscape Architect working on the Project.
3.17 ADJUSTING

A. Tree Protection Area Access: When construction traffic is unavoidable as concurred by the Contractor and Campus Landscape Architect the following procedure shall be followed:

1. Obtain approval from the Campus Landscape Architect for Tree Protection Area access.
2. Install protective fencing by hand to delineate the construction corridor. Fencing location must be approved on site by the Campus Landscape Architect.
3. Install a 12-inch layer of wood chips overlaid with continuous 3/4-inch plywood sheets on the existing grade for the entire area of the traffic route to allay rutting and slightly reduce soil compaction.
4. Remove all materials and return area to preconstruction condition within one week of the work.

B. Excavation Insulation: If in the Contractor's opinion, climate conditions do not necessitate the installation of burlap insulation at an excavation, he may submit to the Campus Landscape Architect a written request to omit the burlap insulation. Submit request to the Campus Landscape Architect 24 hours prior to excavation.

3.18 CLEANING

A. Removal Of Protection: Except as otherwise indicated or requested by Campus Landscape Architect, temporary protection devices and facilities installed during course of the work shall be removed only after all work which may injure or damage trees and plants is completed.

B. Removal: Remove all excess material during construction period and haul off-site.

C. Repair: Repair surface damage caused by fence posts. Restore to match surrounding conditions.

3.19 PROTECTION

A. Protect planting areas and plants at all times against damage of any kind for the duration of the maintenance. If any plants become damaged or injured, they shall be treated or replaced as directed by the Campus Landscape Architect at no additional cost to the Owner. The contractor shall not be responsible for acts of vandalism or acts of God during the maintenance period.

B. Protect tree roots in accordance with paragraph 3.7 this Section.

C. Branch Protection: Contact Campus Landscape Architect if it appears that construction will damage to the branches of any tree. The Campus Landscape Architect will determine action to be taken. If pruning is required, perform in accordance with paragraph 3.8 this Section.

END OF SECTION 32 01 90
SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, and Division 1 Specifications, apply to the provisions of this section.

1.02 SECTION INCLUDES

A. This work shall consist of furnishing all labor, machines and material required to construct a uniformly mixed aggregate over the subgrade.

1.03 RELATED SECTIONS

A. Section 31 20 00 - Earth Moving.
B. Section 32 12 16 - Asphalt Paving.

1.04 REFERENCES

A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:

   b. ASTM D 2922 Test Methods for Moisture-Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).
   c. ASTM D 3017 Test Method for Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).

1.05 SUBMITTALS

A. Contractor shall submit certification of aggregate gradation and source of supply for each different aggregate base course specified.
PART 2 - PRODUCTS

2.01 AGGREGATE BASE COURSE MATERIAL

A. Aggregate shall be crushed stone, crushed slag or crushed gravel. The following aggregate blend shall be used for the aggregate subbase:

<table>
<thead>
<tr>
<th>STANDARDS SIEVE SIZE</th>
<th>PERCENT PASSING BY WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 Inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>30-65</td>
</tr>
<tr>
<td>No. 8</td>
<td>25-55</td>
</tr>
<tr>
<td>No. 200</td>
<td>3-12</td>
</tr>
</tbody>
</table>

B. Aggregate material specified is the same gradation as CDOH Class 6 Aggregate base course.

PART 3 - EXECUTION

3.01 PLACING

A. General: If the required compacted depth of the aggregate base course exceeds six (6) inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed six (6) inches. When vibratory or other approved types of special compacting equipment are used, the compacted depth of a single layer may be increased to eight (8) inches upon approval.

3.02 MIXING

A. Methods: Unless otherwise specified, the Contractor shall mix the aggregate by any one of the three following methods, and if required, add the additive shown on the Drawings. When materials are to be used that require the mixing of commercial binders or fillers with the aggregate, a central mixing plant of the twin-pugmill type will be required. Other methods that assure a thorough and homogeneous mixture may be used, on written approval.

1. Stationary Plant Method. Aggregate base course and water shall be mixed in an approved mixer. After mixing, the aggregate shall be transported to the job site while it contains the proper moisture content and shall be placed on the project by means of approved aggregate spreader.

2. Travel Plant Method. After the material for each layer has been placed through an aggregate spreader or window sizing device it shall be uniformly mixed by a traveling mixing plant.

3. Road Mix Method. After material for each layer has been placed, the materials shall be mixed while at optimum moisture by means of motor graders or other approved equipment until the mixture is uniform throughout.

3.03 SHAPING AND COMPACTING

A. Compaction of each layer shall continue until a density of 95 percent of the maximum density determined in accordance with ASTM D 1557 has been achieved.
B. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed.

C. Water shall be uniformly applied during compaction in the amount necessary for proper consolidation.

D. The prepared surface upon which the surface course is to be placed will be tested with a 10-foot straightedge, or other approved device. The surface shall be tested prior to the application of any pavement, or synthetic turf. The variation above or below the testing edge of the straightedge between any two contacts with the surface shall not exceed 1/4 inch.

E. Any areas not complying with these tolerances shall be reworked to obtain conformity.

3.04 TESTING

A. A nuclear density gage shall be used during aggregate placement and rolling to ensure adequate compaction. (ASTM D 2922 and ASTM D 3017)

END OF SECTION 32 11 23
SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, and Division 1 Specifications, apply to the provisions of this section.

1.2 SECTION INCLUDES

A. Asphaltic concrete paving surface course and asphaltic concrete base course.
B. Asphalt patching.
C. Asphalt overlay.
D. Herbicide treatment.
E. Crack sealing.

1.3 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.
B. Section 01 40 00 - Quality Requirements.
C. Section 31 20 00 – Earth Moving.
D. Section 32 17 23 - Pavement Markings.

1.4 REFERENCES

A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:

1. “Standard Specifications for Road and Bridge Construction” Colorado Department of Transportation (CDOT).
   a. Section 211 - Herbicide Treatment.
   b. Section 401 - Plant Mix Pavements - General.
   c. Section 408 - Joint and Crack Sealant.
   d. Section 702 - Bituminous Material.
   e. Section 703 - Aggregates.

   a. ASTM D 979 - Sampling Bituminous Paving Mixtures.
c. ASTM D 1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.
e. ASTM D 2172 - Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.
g. ASTM D 2950 - Density of Bituminous Concrete in Place by Nuclear Methods.
h. ASTM D 3203 - Percent Air Voids in Compacted, Dense and Open Bituminous Paving Mixture Specimens.
i. ASTM D 3405 - Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements.
j. ASTM D 3549 - Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

B. The Asphalt Institute (AI)
   1. AI MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.
   2. AI MS-19 Basic Asphalt Emulsion Manual.
   3. AI SP-2 Superpave Mix Design

1.5 QUALITY ASSURANCE
   A. Perform work in accordance with CDOT Specifications.
   B. Mixing Plant: Conform to CDOT Specifications.
   C. Obtain materials from the same source throughout project construction.
   D. Installer qualifications: Asphaltic concrete paving installer shall have not less than five years experience on projects of similar size and scope.

1.6 WEATHER LIMITATIONS
   A. Do not place asphalt concrete when subgrade surface temperature is less than 40 deg F.
   B. Do not apply tack coats and asphaltic concrete in rainy weather or when base surface is wet or contains excess moisture which could prevent uniform distribution and required penetration.

1.7 SUBMITTALS
   A. Submit proposed mix design and certificate of compliance for approval prior to commencement of work for each asphalt grade and all different mixes to be supplied in accordance with Section 401 (CDOT).
      1. Aggregate Gradation
      2. HVEEM Stability
      3. Percent Air Voids
4. Percent Voids Filled with Asphalt (VFA)
5. Percent Voids Mineral Aggregate (VMA)
6. Asphalt Binder Material

B. Submit data on herbicide material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphaltic Cement: Comply with Subsection 702.01, CDOT Specifications, Viscosity Grade AC-10.

B. Aggregates:

1. Use locally available materials and gradations exhibiting satisfactory record of previous installations.

2. Bituminous Surface Coarse Aggregate: Crushed stone, crushed gravel, crushed slag, and sharp-edged natural sand, Subsection 703.04, Grade SX, CDOT Specifications.

3. Bituminous Base Course Aggregate: Crushed stone, crushed gravel, crushed slab, and sharp-edged natural sand, Subsection 703.04, Grade S, CDOT Specifications.

4. Asphalt Patching Aggregate: Crushed stone, crushed gravel, crushed slab, and sharp-edged natural sand, Subsection 703.04, Grade SX, CDOT Specifications.

5. Asphalt Overlay Aggregate: Crushed stone, crushed gravel, crushed slab, and sharp-edged natural sand, Subsection 703.04, Grade SX, CDOT Specifications.

C. Mineral Filler: Finely ground particles of limestone, Portland Cement or other inert material complying with Subsection 703.06, CDOT Specifications.

2.2 ACCESSORIES

A. Tack Coat: Emulsified asphalt, Grade CSS-1h complying with Subsection 702.04, CDOT Specifications.

B. Reclaimed asphalt complying with Subsection 406 CDOT Specifications.

C. Equipment used for paving shall comply with Section 401, CDOT Specifications.

2.3 HERBICIDE TREATMENT

A. Commercial chemical for weed control, registered by Environmental Protection Agency. Provide granular, liquid or wettable powder form.

2.4 CRACK SEALING MATERIAL

A. Hot poured asphalt material conforming to the requirements of ASTM D 3405 or ASTM D 1190.
2.5 CRITERIA FOR MIX DESIGN

A. The following are project criteria for asphalt mix designs:

1. Grading S and SX.
   a. HVEEM Stability – 28 minimum
   b. Percent Air Voids – Between 3 and 5
   c. Percent Voids filled with Asphalt – Between 65 and 78
   d. Percent Voids Mineral Aggregate – Between 14.5 and 15.5
   e. Asphalt Binder Material – PG 58-28 in accordance with CDOT Specifications

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of subgrade are correct. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

3.2 SURFACE PREPARATION

A. Provide grade and location stakes under this Section as required for asphaltic concrete paving work.

B. Fine Grading: For areas covered by this Section, finish fine grade to accurate levels so specified minimum thickness of paving can be maintained with accurate and uniform finish levels as indicated.


C. Proof Rolling: Operate heavy, rubber tired front loader or dirt-filled tandem wheeled dump truck over subgrade of paved areas. Where soft spots occur, remove loose materials and replace with road base aggregate compacted to level of subgrade at Contractor’s expense.

   1. Changes in weather such as freezing or precipitation occurring after subgrade is proof rolled and before asphalt paving operations begin will require reproof rolling prior to paving.
   2. Asphalt paving operations will begin within 24 hours after proof rolling.

D. Coordination:

   1. Cooperate with other trades, arrange timing to avoid damage to the work including exterior concrete, grading, utilities, and seeding.
   2. Before the start of paving, ascertain utility lines, lighting, wiring, piping, curb work, general grading and heavy trucking are complete so such operations will not damage paving work.
3.3 HERBICIDE TREATMENT

A. Apply chemical weed control agent in strict compliance with manufacturer’s recommended dosages and application instructions. Apply to compacted, dry subbase prior to application of prime coat.

3.4 CRACK SEALING

A. Conform to the requirements of CDOT, Section 408 - Joint and Crack Sealant.

1. Clean cracks of loose and foreign matter to a depth approximately twice the crack width.
2. Fill cracks with hot poured joint and crack sealant flush with the pavement surface.
3. Level off any excess sealant.

3.5 PLACING TACK COAT

A. Tack Coat:

1. Apply tack coat on asphalt or concrete surface over subgrade surface at a uniform rate between 0.05 gal/sy to 0.15 gal/sy of surface.
2. Apply to contact surfaces of curbs, gutters and previously constructed asphalt pavements.
3. Coat surfaces of manholes and inlets frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.
4. Allow tack coat to dry until tacky to touch prior to paving.

3.6 INSTALLING ASPHALT PAVEMENT

A. Mixing and Delivery:

1. Accurately weigh or measure dried aggregates and weigh or meter asphaltic cement to comply with job-mix formula requirements.
2. Transport mixtures from mixing plant to Project site in trucks having tight, clean compartments. If required, coat hauling compartment surfaces with a limewater mixture to prevent asphalt concrete mixture from sticking. Elevate and drain compartment of excess solution before loading mix.
3. Provide covers for asphaltic concrete mixture when delivering to protect mixture from weather and to prevent loss of heat.

B. Installation:

1. Place paving mixture only on clean, dry subgrade surfaces. Apply hot mix wearing surface in separate binder and surface courses, each of approximately one half total thickness required, with joints staggered. Temperature at time of placement shall be approximately 235 deg F. While mix is still hot, compact and finish off each course with power rollers as specified below.
2. Produce dense, watertight finish surfaces, free from roller marks or other marks and irregularities, conforming to levels and profiles indicated, with smooth transitions between elevations given. Bring surfaces flush with other materials and hold to a uniform dimension below curb tops.
3. Immediately correct surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.
4. Spread, tamp, finish mixture using hand tools in areas where use of machine spreading is not practical. Place mixture at rate that will ensure proper handling and compaction before mixture becomes cooler than acceptable working temperature.
5. Carefully make joints between old and new pavements, or between successive days work, to ensure continuous bond between adjoining work. Clean contact surfaces and apply tack coat. Construct joins of same texture, density, and smoothness as other sections of asphaltic concrete course.

C. Rolling:

1. Begin rolling when mixture will bear weight without excessive displacement.
2. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
3. 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.
4. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture thoroughly compacted.
5. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until all roller marks are eliminated and course has attained maximum density allowed.

D. Patching:

1. Remove and replace mixtures that become mixed with foreign materials, defective areas, and existing pavements at transitions with new paving.
2. Remove deficient areas for full depth of course. Saw-cut sides perpendicular and parallel to direction of traffic with edges vertical.
3. Apply tack coat before placing asphalt concrete mixture. Fill with fresh hot-mixed asphalt and compact by rolling to required surface density and smoothness.

E. Compaction Requirements:

1. Bituminous Surface Course: 95 percent maximum dry density according to ASTM D 2950 (50 Blow Marshall).
2. Bituminous Base Course: 95 percent of maximum dry density according to ASTM 2950 (50 Blow Marshall).

3.7 TOLERANCES

A. Flatness: Maximum variation of 0.25 inches measured with ten (10) foot straightedge.

B. Scheduled Compacted Thickness: Within 0.25 inch.

C. Variation from True Elevation: Within 0.10 inch.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00 - Quality Requirements. Testing laboratory services will be provided by the Owner.
B. Contractor shall notify the testing agency a minimum of 24 hours in advance of work requiring a testing service.

C. Asphalt Pavements: Check compaction and compliance with design mix by cutting test plugs where directed in accordance with ASTM D 979. Patch core holes. Test for compaction minimum of 95% of Marshall design density, aggregate gradation voids, and percent asphalt.

   1. One (1) test for density ASTM D 1188, ASTM D 2726, or D 2950 thickness, ASTM D 3549, and air voids ASTM D 3203 per 300 tons of asphaltic material placed.
   2. One (1) test for asphalt content ASTM D 2172 and aggregate gradation per 1500 tons of asphaltic material placed.
   3. All reports shall include densities to the nearest 0.1 lb. per ft and compaction to nearest 0.1%. If a nuclear device is used, the report shall contain the method used (back scatter or direct transmission geometry), results of the daily standardization checks and the adjusted manufacturers calibration curve. The manufacturer’s calibration curve shall be adjusted as required by ASTM D 2950 whenever a change in either the material to be tested or the testing equipment is made.

D. Subgrade: Compaction tests shall be taken every 2000 square feet and/or as directed by the Owner.

3.9 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury until cooled and hardened.

END OF SECTION 32 12 16
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, and Division 1 Specifications, apply to the provisions of this section.

1.2 SECTION INCLUDES

A. Site retaining walls.
B. Concrete sidewalks.
C. Concrete pavement.
D. Curb and gutters.
E. Crossspans.
F. Handicap ramps.

1.3 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.
B. Section 01 40 00 - Quality Requirements.
C. Section 31 20 00 – Earth Moving.
D. Section 32 11 23 – Aggregate Base Courses.
E. Section 32 17 23 – Pavement Markings.
F. Section 33 40 00 - Storm Drainage Utilities.
G. Section 33 30 00 - Sanitary Sewerage Utilities.

1.4 REFERENCES

A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:

B. ACI (American Concrete Institute).
   1. ACI 301 - Specifications for Structural Concrete for Buildings.
   2. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.

1. ASTM A 36 - Structural Steel.
2. ASTM A 185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
3. ASTM A 615 - Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.
4. ASTM A 706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
5. ASTM C 31 - Making and Curing Concrete Test Specimens in the Field.
6. ASTM C 33 - Concrete Aggregates.
7. ASTM C 39 - Compressive Strength of Cylindrical Concrete Specimens.
8. ASTM C 94 - Ready-Mixed Concrete.
9. ASTM C 143 - Slump of Hydraulic Cement Concrete.
11. ASTM C 171 - Sheet Materials for Curing Concrete.
12. ASTM C 172 - Sampling Fresh Mixed Concrete.
15. ASTM C 494 - Chemical Admixtures for Concrete.
16. ASTM C 618 – Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. ASTM C 881 - Epoxy-Resin-Base Bonding Systems for Concrete.
18. ASTM C 1116 - Fiber-Reinforced Concrete and Shotcrete.

1.5 QUALITY ASSURANCE

A. Reference Standards: Perform all cast-in-place concrete work in accordance with "Specifications for Structural Concrete for Buildings," ACI 301, unless amended or superseded by requirements of this section or notes on the drawings. Keep a copy of ACI 301 in Contractor's field office for duration of project.

B. Design Criteria

1. Concrete: See General Notes on Drawings and ACI 301, Chapter 3.
2. Formwork Design: The General Contractor shall assume all responsibility for the safety of the formwork and shall provide all necessary design, construction, materials and maintenance to produce the required concrete work safely. Design all formwork to have sufficient camber to maintain the tolerances specified. Strength shall be sufficient to compensate for the weight of the fresh concrete plus a construction live load of 50 psf minimum.
3. Testing Agency: All testing shall be done by an approved testing laboratory selected and paid by the Owner. Contractor shall furnish testing agency access to work, facilities, and incidental labor required for testing and inspection. Retention by the Owner of an independent testing agency shall in no way relieve the Contractor of responsibility for performing all work in accordance with the contract requirements.
4. Source Quality Control: The Architect, Engineer and Testing Agency shall be offered uninterrupted access to the ready-mix batching plant at all times that the work is in progress. Contractor shall obtain cementitious materials from the same source throughout project construction.
5. Record of Work: A record shall be kept by the General Contractor listing the time and date of placement of all concrete for the structure. Such record shall be kept until the completion of the project and shall be available to the Architect and Engineer for examination at any time.

6. Approval: All formwork surfaces that will provide the finish surface of exposed concrete must be approved by the Architect before depositing concrete.

1.6 SUBMITTALS

A. Mix Designs: Submit substantiating data for each concrete mix design contemplated for use to the Architect not less than six weeks prior to first concrete placement. Data for each mix shall, as a minimum, include the following:

1. Mix identification designation (unique for each mix submitted).
2. Statement of intended use for mix.
3. Mix proportions, including all admixtures used.
4. Manufacturer's data and/or certifications verifying conformance of all mix materials, including admixtures, with specified requirements.
5. Wet and dry unit weight.
6. Entrained air content.
7. Design slump.
8. Required average strength qualification data per ACI 301 3.9.1 and 3.9.2. Submit separate qualification data for each production facility which will supply concrete to the project.
9. Average strength qualification data (trial mix data or field test data per ACI 301 3.9.3). When field test data is used to qualify average strength, submit separate qualification data for each production facility which will supply concrete to the project.
10. Field test data submitted under paragraphs above shall include copies of the Concrete Testing Agency's reports from which the data was compiled.
11. Separate design mixes are required for each strength and class of concrete, each change in type and/or quantity of mix materials including admixtures, each change in slump limits, and each change in entrained air content.

B. Reinforcement Shop Drawings: Submit Shop Drawings as specified under Section 01 33 00 Submittal Procedures. Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices. Indicate exact locations of all openings, framing or special conditions affecting the work. Provide 1/4 inch scale elevations of all walls and grade beams with reinforcing shown.

C. Product Data: Submit data for proprietary materials and items, including reinforcement and forming accessories, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.

D. Joint Layout Plan: Submit a joint layout plan for all concrete pavements if a plan is not provided.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Reinforcing: Unload and store reinforcing bars so they will be kept free of mud. Store on timber skids while awaiting use.
B. Concrete.

1. Hauling Time: Discharge all concrete transmitted in a truck mixer, agitator, or other transportation device not later than 1-1/2 hours, or 300 revolutions of the drum after the mixing water has been added, whichever is earliest.

2. Extra Water: Deliver concrete to the job in exact quantities required by the design mix and shall conform to ASTM C 94. Should extra water be required before depositing the concrete, the Contractor's Superintendent shall have sole authority to authorize the addition of water. Any additional water added to the mix after leaving the batch plant shall be indicated on the truck ticket and signed by the person responsible. Where extra water is added to the concrete, it shall be mixed thoroughly for 30 revolutions of the drum at mixing speed. Water may be added at the site only once to each batch. Do NOT add water to concrete containing high range water reducers after the admixture has been introduced into the mix.

1.8 PROTECTION

A. Protect newly finished cast-in-place concrete from damage.

1.9 REGULATORY REQUIREMENTS

A. Conform to applicable local standards.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Concrete shall not be placed when subgrade surface temperature is less than 40 deg F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used shall be in accordance with ACI 301, paragraphs as listed, unless amended or superseded by requirements of following articles or General Notes on the Drawings.

B. Name brands listed in this section are intended to establish the level of quality and performance expected.

2.2 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to surface.

1. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

2.3 CEMENTITIOUS MATERIALS (ACI 301 2.1)

A. General: Unless otherwise specified, use one brand and type of cement throughout the project.

B. Portland Cement: ASTM C 150 Type I/II.

C. Fly Ash: ASTM C 618 Class F or C.

2.4 ADMIXTURES (ACI 301 2.2)

A. General: Unless specified, no admixtures may be used without specific written approval of the Engineer.

B. Air Entraining Agent: Conform to ASTM C 260. Master Builders "MB-VR" or "MB-AE" or approved equal. Add air entraining agent as required herein.

C. Water Reducing Admixture: Conform to ASTM C 494, Type A. Master Builders Pozzolith 322N or Polyheed 997 or approved equal. The admixture shall not contain more chloride ions than are present in municipal drinking water.

D. High-range, water reducing (HRWR) admixture (Super-plasticizer): Conform to ASTM C 494, Type F or G. Master Builders Rheobuild 1000 or approved equal. The admixture shall not contain more chloride ions than are present in municipal drinking water.

E. Non-Corrosive, Non-Chloride Accelerator: Conform to ASTM C 494, Type E. Master Builders Pozzutec 20 or approved equal. The admixture shall not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer shall have long term test data from an independent testing laboratory proving non-corrosive effects on reinforcing steel using an acceptable accelerated corrosion test method.

F. Calcium Chloride: Calcium Chloride or admixtures containing more than 0.50 percent chloride ions or 0.30 percent thiocyanates are not permitted.

G. Retarding Admixture: Conform to ASTM C 494, Type D. Master Builders Pozzolith Retarder or approved equal. The admixture shall not contain more chloride ions than are present in municipal drinking water.
H. Fibrous Reinforcement:

1. 100% Virgin, Polypropylene fibrillated fibers containing no reprocessed olefin materials and having tensile strength of not less than 80 ksi with multi-grade fiber lengths per manufacturer’s recommendation of concrete type and application. Current ICBO approval required. Conform to ASTM C 1116, Type III, 4.1.3., performance Level I. Fibers shall be between 3/8" and 3/4" in length. Multigraded fibers shall be manufactured in accordance with a graduation curve formula which will produce a blend of not less than 20 individual fiber designs.

2. Acceptable Products: “Fibermesh 300” by Propex or approved equal.

I. Certification: Written Conformance to above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Engineer.

2.5 AGGREGATES (ACI 301 2.4)

A. Continuously obtain each type aggregate from same source throughout the project.

1. Normal Weight Aggregates: Conform to ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

   a. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling, causing deleterious substances.

   b. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.

2.6 SCHEDULE OF CONCRETE MIXES

A. Criteria.

<table>
<thead>
<tr>
<th>Type</th>
<th>Use</th>
<th>Minimum 28 Day Strength PSI</th>
<th>Max W/C Ratio</th>
<th>Minimum Cement Materials (Lbs.)</th>
<th>Max Size Aggregate (Inches)</th>
<th>Slump Range Inches</th>
<th>Air Content (%)</th>
<th>Cement Type</th>
<th>Fiber-Mesh Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Curb &amp; Gutter</td>
<td>4,000</td>
<td>0.45</td>
<td>600</td>
<td>1&quot;</td>
<td>1-3</td>
<td>5-7</td>
<td>[I/III]</td>
<td>YES</td>
</tr>
<tr>
<td>2</td>
<td>Pavement</td>
<td>4,500</td>
<td>0.45</td>
<td>600</td>
<td>1&quot;</td>
<td>2-4</td>
<td>5-7</td>
<td>[I/III]</td>
<td>YES</td>
</tr>
<tr>
<td>3</td>
<td>Sidewalks and All Other Exterior Slabs on Grade</td>
<td>4,000</td>
<td>0.50</td>
<td>570</td>
<td>1&quot;</td>
<td>2-4</td>
<td>4-6</td>
<td>[I/III]</td>
<td>YES</td>
</tr>
<tr>
<td>4</td>
<td>All Other Concrete</td>
<td>4,000</td>
<td>0.50</td>
<td>570</td>
<td>1&quot;</td>
<td>2-4</td>
<td>4-6</td>
<td>[I/III]</td>
<td>NO</td>
</tr>
</tbody>
</table>

B. Notes to Schedule of Concrete Mixes.

1. W/C is the ratio of weight of water to weight of cementitious materials. The weight of water shall include all free water in the aggregate at the time of batching.

2. Minimum cementitious materials are the minimum weight of Portland Cement plus fly ash.
3. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

2.7 WATER

A. Potable.

2.8 SLUMP (ACI 301 3.5)

A. See Section 2.6 - Schedule of Concrete Mixes.

B. Concrete with High-Range Water-Reducer (HRWR) Admixture (Superplasticizer): 8” maximum slump for Rheobuild 1000 and 7” maximum slump for other HRWR admixtures unless otherwise directed by Engineer. Minimum slump shall be 6”.

2.9 ADMIXTURES (ACI 301 3.7)

A. All concrete required to be air entrained shall contain an approved air entraining admixture. All concrete shall contain the specified water reducing admixture and/or high range water reducing admixture (Superplasticizer). Use specified accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.

2.10 SELECTION OF PROPORTIONS (ACI 301 3.8, 3.9 AND 3.11):

A. Mix Design: Cost of concrete mix designs by Contractor.


C. All mixes shall be proportioned on the basis of trial mixtures and shall meet the provisions of ACI 301 3.9.3.3. Mixes shall contain identical materials and proportions intended for use in the project.

D. Fly ash, in proportions not greater than 20% by weight of the total amount of cementitious materials, may be used when accepted by the Engineer. Cement content and/or water-cement ratio for mixes containing fly ash shall be based on the total weight of cementitious materials (Portland Cement plus fly ash and micro silica, if any).

2.11 REINFORCING STEEL (ACI 301 5.2)

A. All reinforcing shall have a minimum yield strength of 60,000 psi, except embedded plate anchors which shall have a minimum yield strength of 40,000 psi (or 60,000 psi if ASTM A 706 reinforcing is used) unless shown otherwise on the Drawings.

B. All reinforcing shall conform to ASTM A 615, Deformed Billet Steel Bars or ASTM A 706, Low-Alloy Steel Deformed Bars. Finish: Plain.

C. All welded steel wire fabric shall conform to ASTM A 185, Plain type.
D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

2.12 CONSTRUCTION JOINT BONDING (ACI 301 6.1.4)
A. Bonding Compound: Acrylic or Styrene Butadiene Base: Hornweld, A.C. Horn, Inc.; SBR Latex, Euclid Chemical Co.; or approved equal.

2.13 EXPANSION JOINTS (ACI 301 6.2.2)
A. Fiber Expansion Joint: Conform to ASTM D 1751; 1/4" thickness unless shown otherwise on the Drawings.

2.14 PAVEMENT JOINT AND FILLER MATERIALS
A. Joint Filler: Asphalt impregnated fiberboard or felt, 1/2-inch thick. Recess top of all joint fillers where sealant is required 1" below surface for sealant.
B. Silicone Sealant: One-part low-modular neutral cure silicone sealant complying with ASTM C 920, Type S, Grade P, Class 25, and uses T and M, and as applicable to joints with concrete substrates, O.

2.15 ACCESSORIES
A. Compressible Form Tape: Bear #536 vinyl foam or equivalent.
B. Cone Ties: 1-1/4" diameter, 1-1/2" depth, plastic cone with suitable snap tie.
C. Chamfer Strips: 3/4", 45 degree PVC.

2.16 EPOXY ADHESIVES
A. With prior approval of the Architect and Engineer as to methods and procedures, make structural repairs with Euclid Chemical Company, Euco Epoxy 452MV or 620, or Sika Chemical Corporation Culma Dur Mortar, Sikadur Hi-Mod L.V., or Sikadur Hi-Mod. Where epoxy injection procedures are used, an approved low viscosity epoxy, made by the previously specified manufacturers, shall be used.
B. Epoxy Paste Adhesive for Embedment of Anchors: Shall be a solvent-free, two-part, moisture-insensitive epoxy which conforms to ASTM C 881, Type IV, Grade 3, Class B and C, and which possesses the following material properties (after 14 days of curing at 70 degrees F unless noted otherwise):
   1. Pot Life in mixed state: 30 minutes minimum.
   2. Modulus of Elasticity (ASTM D 695): 500,000 to 900,000 psi.
   3. Compressive Strength (ASTM D 695): 8,000 psi minimum.
   5. Tensile Strength (ASTM D 638): 1500 psi minimum.
   7. Pull-Out Strength: In 5000 psi min. concrete, using Grade 60 Rebar, embedded 10 bar diameters. Tensile Strength: 90,000 psi min.

2.17 BONDING COMPOUND FOR RESURFACING OR REPAIR

A. Bonding Compound: Euclid Chemical Company, Euco Weld; Larsen Products Weldcrete; Sika Chemical Corp. Sikabond, or equivalent.

2.18 CURING COMPOUND (ACI 301 12.2.1.7)

A. The compound shall conform to ASTM C 309, Type I-D, Class A, 18% solids content minimum, and have test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon (2 coats minimum). Manufacturer's certification required. Product shall be compatible with products applied directly to concrete surfaces.

2.19 ABSORPTIVE COVER

A. Burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard, complying with AASHTO M182, Class 2.

2.20 MOISTURE - RETAINING COVER

A. One of the following, complying with ASTM C 171:

1. Polyethylene film, (4 mils (0.004") thick minimum).
2. Waterproof paper.
3. Polyethylene - coated burlap.

2.21 EVAPORATION RETARDER

A. "Confilm" by Master Builders, Inc. or approved equal.

2.22 NON-SHRINK GROUT OR DRYPACK

A. Acceptable Manufacturer and Products:

1. Non-Metallic Grout: Use one of the following [where grout is exposed to view or weathering]:
   a. U.S. Grout Corporation “Five Star Grout”.
   b. Master Builders “Master flow 928”.
   c. L&M Chemicals “Crystex”.
   d. Euclid Chemical Company “Hi Flow.”
   e. Or approved equal.

2. Grout shall conform to CRD-C-621-80, Corps of Engineers “Specification for Non-Shrink Grout.”

B. Install per manufacturer's instructions.
PART 3 - EXECUTION

3.1 GENERAL

A. Install concrete work in accordance with ACI 301, paragraphs as listed, unless amended or superseded by following articles or General Notes on the Drawings.

B. Use ready-mixed concrete conforming to ASTM C 94. No job-mixed concrete allowed.

3.2 INSPECTION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of subgrade are correct.

C. All formwork surfaces that will provide the finish surface of exposed concrete must be approved by the Architect before depositing concrete. Completed installation of concrete reinforcement must be approved by the Testing Agency before depositing concrete.

3.3 PREPARATION

A. Moisten subgrade to minimize absorption of water from fresh concrete.

B. Coat surfaces of manholes and catch basin frames with oil to prevent bond with concrete pavement.

C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

D. Underslab surfaces shall be fine graded to smooth, level surface prior to installation of slab-on-grade edge and construction joint forms.

3.4 FORMWORK (ACI 301, CHAPTER 4)

A. Place and secure forms to correct locations, dimension, and profile.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Earth Cuts (ACI 301 4.1.3): Earth cuts may not be used as forms.

D. Chamfer Strips (ACI 301 4.2.4): Install 45 degree chamfer strips at exposed outside corners.

E. Anchors, Inserts, Blockouts, and Built-In Items: Anchor bolts, inserts, form blockouts, and other items built into the concrete shall be securely fastened to formwork or held in place with templates. Insertion into concrete after pouring will not be allowed.

3.5 PREPARATION OF FORM SURFACES (ACI 301 4.4)

A. Conform to ACI 301 4.4.
3.6 FORM REMOVAL (ACI 301 4.5)

A. Form Removal: Remove formwork supporting weight of concrete only after notifying Architect and Engineer and in a manner to insure safety of the structure. Under normal conditions, formwork may be removed when concrete is at least 14 days old and has reached 75 percent of specified strength. When structure is exposed to temperatures below 45 degrees F., leave formwork in place an additional period of time equaling the time structure was exposed to lower temperature. No live load permitted on new construction after form removal until concrete is at least 28 days old and has reached full specified strength.

B. Form Facing Material Removal: Form facing material which is removable without disturbing shores may be removed when concrete is at least seven (7) days old. Facing may be removed earlier if specifically permitted by the Architect and Engineer and acceptable curing compound is applied to all formed surfaces immediately after form removal.

3.7 FORM REUSE

A. Clean all form material suitable for reuse before erection. No form material will be acceptable for reuse if, in the opinion of the Architect, it will not produce a finished surface required by these Specifications or called for on the Drawings.

3.8 PLACING REINFORCEMENT (ACI 301 5.7)

A. Install reinforcing in accordance with ACI 301 Chapter 5, unless amended or superceded by the general notes on the Drawings.

B. Fiber reinforcement.

1. Concrete pavement and walks shall be reinforced with 1.5 pounds of 3/4 inch long Norcan fibers, or approved equal, per cubic yard of concrete.
2. Fiber shall be added to the concrete mix in accordance with the manufacturer's recommendations.
3. Use of fiber reinforcement will indicate lower slump values if the standard ASTM C 143 slump test is used. ASTM C 995 may be used to measure consistency and workability of fiber-reinforced concrete, if approved by the Owner and testing agency in writing.
4. Fiber may be added at the batch plant or at the job site; if added at the job site, follow manufacturer's instructions for additional mixing time after addition of fibers.
5. If mix design specifies the use of a superplasticizer, add and mix polypropylene fiber prior to adding the superplasticizer.
6. Use of polypropylene fiber reinforcement shall not change water requirements of mix.
7. Concrete pavement and walks shall be reinforced with fibers. Curb and gutters shall not receive fibrous reinforcements.

3.9 WELDING REINFORCEMENT (ACI 301 5.3)

A. Welding reinforcing bars not permitted except where specifically indicated. Protect exposed bars intended for bonding with future construction from corrosion by providing adequate covering. Use reinforcing conforming to ASTM A 706 where welding of reinforcing is required unless otherwise specified on the Drawings.
3.10 FIELD BENDING OF REINFORCEMENT

A. Reinforcement partially embedded in concrete shall not be field bent except as shown on the Drawings or specifically permitted by the Engineer.

3.11 CONCRETE PLACEMENT (ACI 301 CHAPTER 8)

A. Place concrete in accordance with ACI 301.

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

1. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

2. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

C. Guide the flow of concrete in walls for vertical drop between the reinforcing with a spout, down pipe, elephant trunk, or other appropriate method.

D. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.

E. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.

F. Place concrete continuously between predetermined construction joints.

3.12 CONSTRUCTION JOINTS OF STRUCTURAL MEMBERS (ACI 301 6.1)

A. Construction joints of Structural Members (ACI 301 6.1.4): Use specified Bonding Compound, applied as recommended. [Omit 6.1.4.2 and 6.1.4.3].

B. Doweled Connections: In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solidly with specified non-shrink grout or epoxy mortar as directed by the Engineer.

3.13 PAVEMENT JOINTS

A. Place expansion joints at a maximum of 50-foot intervals and at point of curb returns and point of curves. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances as shown on the drawings.

C. Provide scored or sawn joints at 5-ft intervals for sidewalks, 10-ft intervals for curb and gutters, 12-ft maximum each way for concrete pavement.
D. Seal all control and expansion joints. Scored joints shall not be sealed.

E. Joints shall separate concrete pavement into panels as recommended by the Portland Cement Association (PCA).

3.14 REPAIR OF SURFACE DEFECTS (ACI 301 CHAPTER 9)

A. Modify or replace concrete not conforming to required lines, details, and elevations.

B. Repair or replace concrete not properly placed resulting in excessive honeycombing and other defects. Patch, repair, or replace exposed concrete as directed by the Architect.

C. Patching of tie holes is required.

D. Repair defects in structural concrete elements as follows:

   1. Deep Defects Exposing Reinforcing: Chip to sound concrete and clean thoroughly to remove all loose concrete and dust. Apply thin coat of specified epoxy adhesive. Form and pour, or dry pack with specified non-metallic, non-shrink grout, prior to development of tack-free condition of epoxy bonder. Strip forms after grout has hardened and provide specified finish. Moist cure or apply specified clear curing and sealing compound immediately after finishing.

   2. Defects Greater Than 1/2" Depth, Not Exposing Reinforcing: Chip, clean and apply specified epoxy adhesive. Dry pack using specified non-metallic, non-shrink grout prior to development of tack-free condition of epoxy bonder. Provide specified finish and cure per Subparagraph (D.1).

E. Defects Less Than 1/2" Depth and Tie Holes:

   1. For concrete having a specified compressive strength of 5,000 psi or less: Chip and clean per Subparagraph (D.1). Dry pack, finish, and cure per Subparagraph (D.1).

   2. For concrete having a specified compressive strength greater than 5,000 psi: Chip and clean per Subparagraph (D.1). At Contractor's option, dampen surface and apply Sikatop Non-Sag mortar, or equivalent, followed by specified finish (no curing required); or apply thin coat of the specified bonding compound followed by dry pack, finish and cure per Subparagraph (D.1).

F. Other equivalent repair procedures may be used subject to review and acceptance by the Architect and Engineer.

3.15 FORMED SURFACE FINISHES (ACI 301, CHAPTER 10)

A. Formed surface finishes per ACI 301 10.4 and as follows:

   1. Rough Form Finish: Provide concrete surface having the texture imparted by the form facing material used, with tie holes filled and defective areas repaired and patched and all fins and other projections exceeding 0.25" in height rubbed down or chipped off. Provide for formed concrete surfaces not exposed to view.

   2. Smooth Form Finish: Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging form panels in an orderly and symmetrical pattern with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed. Provide for formed
concrete surfaces exposed to normal view or that are to be covered with a coating material directly applied to concrete in the finished building. This includes waterproofing, painting or similar systems. Fill tie holes and finish flush with and to match adjacent surfaces.

3.16 PAVEMENT FINISHING

A. Sidewalk Paving: Light broom or wood float and trowel joint edges. [Coordinate with site planner]

B. Curbs and Gutters: Light broom. [Coordinate with site planner]

C. Site Concrete Pavement: Light Broom. [Coordinate with site planner]

D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer’s instructions.

3.17 INSTALLATION OF EMBEDDED ITEMS (ACI 301 6.4)

A. Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

3.18 CURING (ACI 301 12.1)

A. General.

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimum moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete.

2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be ten (10) days for all concrete.

3. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period. During hot and cold weather, cure concrete in accordance with ACI 305 and ACI 306.

B. Curing Concrete (Pavement, Sidewalks and other Flatwork).

1. Perform curing of concrete by moisture curing, by moisture-retaining cover curing, or by liquid membrane curing.

2. Provide moisture curing by one of the following methods:

   a. Keep concrete surface continuously wet, covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping it continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers. Leave coverings in place a minimum of ten (10) days.
3. Provide moisture-cover curing as follows:
   a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practical width with sides and ends lapped at least 3” and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Provide weights for hold down as required.
   b. Leave coverings in place a minimum of ten (10) days.

4. Provide liquid membrane curing as follows:
   a. Spray concrete surface with specified liquid membrane-forming curing compound as soon as final finishing operations are complete (within 30 minutes). Apply two (2) coats uniformly in continuous operation by power-spray or roller. Apply each coat in accordance with manufacturer’s directions. Recoat areas subjected to rainfall within three hours after initial application.
   b. Curing compound shall be compatible with adhesives used for installation of flooring materials and floor sealers.

C. Curing other Concrete.

1. Provide curing and sealing compound to retaining walls as follows:
   a. Apply specified curing and sealing compound to concrete surfaces as soon as final finishing operations are complete (within 30 minutes). Apply two (2) coats uniformly in continuous operation by power-spray or roller. Apply each coat in accordance with manufacturer’s directions. Recoat areas subjected to rainfall within three hours after initial application.
   b. Maintain continuity of coating and repair damage during curing period.
   c. Obtain Architect’s and Engineer’s acceptance for use of membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, waterproofing, damp-proofing, painting, and other coatings and finish materials.

D. Curing Formed Surfaces: Where forms are used, cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by methods specified above for specified curing time.

E. Curing Unformed Surfaces: Cure unformed surfaces, such as retaining wall foundation by application of appropriate curing method.

3.19 FIELD QUALITY CONTROL (ACI 301, CHAPTER 16)

A. Field inspection and testing will be performed under provisions of Section 01 40 00 - Quality Requirements. Testing laboratory services by Owner as directed by the Architect or Engineer.

B. Concrete inspection and testing will be made in accordance with building code requirements, and Contract Documents, and will include the following:
   1. Testing concrete for strength, slump, air content, temperature, and unit weight.
2. Making and testing concrete cylinders, including furnishing cylinder containers for specimens.
3. Transporting and storing of all specimens involved in testing and inspection. Test cylinders are to be transported to laboratory not later than 24 hours after casting, nor earlier than 16 hours after casting.
4. Inspection of mixing and placing of concrete at the site, including recording of: amount and location of concrete placement, truck number and amount of water added to each load of concrete tested, time of transit, time mixed on job, time placement was completed, method of placing concrete, and any other pertinent information.

C. Test Specimens.

1. The Testing Laboratory will take specimens for strength of each class of concrete from different locations on the job as follows: At least one (1) set of four (4) cylinders for each 100 cubic yards or fraction thereof of all other concrete of each concrete mix used, but not less than one set for any one day's operations.
2. When more than 100 cubic yards of each type or category concrete is placed in any one day, the interval between test samples shall be at least 30 cubic yards in order to be representative of the entire day's operation.
3. Separate design mixes are required for each strength and class of concrete, each change in type and/or quantity of mix materials including admixtures, each change in slump limits, and each change in entrained air content.
4. Slump Tests: Determines slump concrete used for the strength tests. If slump is greater by 1/2" than the upper limits specified in the CONCRETE MIX DESIGN in Part 2 above, the concrete in that truckload will be rejected.
5. Air Content: Determine air content of concrete used for strength test. If air content is greater by 1% than the upper limits specified in the CONCRETE MIX DESIGN in Part 2 above, the concrete in that truckload will be rejected. Air entraining admixture may be added to concrete at the site to bring the concrete within the specified range. When this occurs, it shall be mixed thoroughly for 30 revolutions of the drum at mixing speed. Air entraining admixture may be added at the site only once to each batch.
6. One (1) additional test cylinder shall be taken during cold weather and cured on-site under same conditions as concrete it represents.
7. One (1) slump test and air content test shall be taken for each set of test cylinders taken.
8. Temperature: Determine temperature of concrete used for strength tests.
9. Architect may require the making of additional cylinders should there be reasonable causes to suspect that concrete being placed does not comply with specified concrete quality.
10. For concrete placed by pumping, test specimens and concrete used for determination of slump, air content, and weight are to be taken at the point of placement of the concrete. Additionally, the slump and air content of the first two (2) and every fourth truck load thereafter of concrete shall be determined prior to being placed into the pump.
11. Samples will be obtained in accordance with ASTM C 172.'
12. Making, curing and subsequent handling of test cylinders, except as modified herein, shall be in accordance with ASTM C 31. Testing shall be in accordance with ASTM C 39.
13. The cylinders shall be placed in laboratory storage under moist curing conditions at approximately 70 degrees F. within 24 hours after molding, and maintained therein until tested. Tests will be as follows:

   a. One (1) cylinder shall be tested at seven days for information.
   b. Two (2) cylinders shall be tested at 28 days for acceptance. The acceptance test results shall be the average strength of these two (2) cylinders.
   c. One (1) cylinder shall be tested at 56 days for information.

14. Test Reports: Reports of cylinder tests shall be submitted as specified above within five (5) days of laboratory testing. Test reports shall, as a minimum, include:

   a. Project data including project name and address, concrete supplier, supplier's delivery ticket number and mix identification number, Testing Agency's test or cylinder identification number, and location of pour.
   b. Results of field testing at time of sampling including date and time of sampling, amount of water added at site prior to sampling, ambient air temperature and concrete temperature, concrete slump and air content, and concrete wet unit weight.
   c. Results of laboratory testing including date test specimens were transported to laboratory, date and age of concrete at time of testing, compressive strength of each cylinder tested, average compressive strength of tested cylinders, and specified design strength of concrete represented by the test.

15. Additional Testing: Contractor shall bear the cost of testing and inspection resulting as a consequence of the following:

   a. Work not in compliance with the Contract Documents.
   b. Testing requested by the Contractor or Subcontractor such as additional cylinders for early breaks, etc.
   c. Testing to verify the adequacy of work done without prior notice, without proper supervision, or contrary to standard construction practice.

16. Reinforcing Steel Inspection: Concrete reinforcing shall be inspected by the Testing Agency prior to closing of concrete form work or placing of concrete. Inspect all reinforcing for conformance with Contract requirements. Submit written reports for conformance with Contract requirements. Submit written reports of all inspections in accordance with above requirements on a daily basis. Such reports shall include a description of each area inspected, deficiencies noted, and corrective action undertaken to resolve such deficiencies. Deficiencies observed shall immediately be brought to the attention of the Contractor's Field Superintendent and Reinforcing Placer's Foreman. In the event deficiencies are not corrected, or if an interpretation of the Contract Documents is required, the Engineer shall be immediately notified.

3.20 PROTECTION

   A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
3.21 EVALUATION AND ACCEPTANCE CRITERIA (ACI 301 CHAPTERS 17 AND 18)

A. Basis of evaluation and acceptance of work under this section shall be in accordance with the provisions of these chapters.

3.22 MISCELLANEOUS CONCRETE REQUIREMENTS

A. All other concrete work indicated on the Drawings shall be provided and installed, even though not specifically mentioned herein, to complete the work.

END OF SECTION 32 13 00
SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, and Division 1 Specifications, apply to the provisions of this section.

1.02 SECTION INCLUDES

A. The application of traffic paint and reflective media in accordance with the Manual on Uniform Traffic Control Devices - Part III and as modified and supplemented by this Section of these projects Specifications and the Drawings.

B. All on-site striping words and handicap parking designations shown on plans. Where not shown on plans, handicap designation shall be painted on surface per latest MUTCD standards.

1.03 RELATED SECTIONS

A. Section 32 12 16 - Asphalt Paving.

B. Section 32 13 00 – Rigid Paving.

1.04 REFERENCES

A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:


1. Section 627 - Pavement Marking.
2. Section 708 - Paints.

1.05 SUBMITTALS

A. Pavement Marking Paint: Submit a certification from the manufacturer or an approved independent laboratory that the Pavement Marking Paint used complies with the requirements of Part 2.

B. Thermoplastic Pavement Marking: Submit a certification from the manufacturer or an approved independent laboratory that the thermoplastic pavement marking complies with the requirements of Part 2.
1.06 QUALITY ASSURANCE

A. Paint markings shall not fade, crack, flake or peel within the warranty period.

PART 2 - PRODUCTS

2.01 PAINT

A. Pigment, Vehicle and Properties: (PT-3) of the finished paint shall meet specifications of Sections 708.01 and 708.05 Paints of the CDOT Specifications.

B. Glass beads are not required for on-site work.

2.02 THERMOPLASTIC PAVEMENT MARKING

A. Material, application and equipment: Conform to Section 627 - Pavement Marking, CDOT.

B. Glass beads are not required.

2.03 COLOR

A. Color for on-site pavement marking shall be as specified by Architect, or shown on the plans.

PART 2 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Description: Pavement markings shall be applied over the finished asphalt surface of concrete surface. See plans for locations.

B. Surface Preparation: Dirt, clay, silt and sand will be removed from the pavement prior to the application of paint.

C. Weather Limitations: No paint shall be applied to damp or wet pavement surfaces, nor when inclement weather threatens to interrupt normal progress of the work. Traffic paints shall not be applied at a surface temperature below 70 degrees F nor exceeding 95 deg F. During periods of high wind, painting shall be discontinued. Interpretation of “inclement weather” and “high wind” will be determined by the Architect/Engineer.

D. Application: Equipment shall conform to Section 627 - Pavement Marking, CDOT.

E. Paint shall be applied according to Section 627 - Pavement Marking, CDOT.

F. Thermoplastic pavement marking shall be applied according to Section 627 - Pavement Marking, CDOT.

H. Beneficial Occupancy: Newly painted surfaces shall be protected from damage by vehicles during the time required for paint to harden sufficiently to prevent displacement or pickup by tires of automobile traffic. If paint has not hardened sufficiently in 90 minutes, painting operations shall cease until the reason for slow drying has been corrected.

3.02 HANDICAP PARKING DESIGNATION

A. Provide international symbols for handicap parking painted in white graphic with blue color background.

3.03 PAINTED YELLOW ISLANDS

A. Spacing shall be 24 inches.
B. Lines shall be painted at a 45 degree angle.
C. Yellow stripe shall be 4 inches wide.

3.04 CROSSWALKS

A. Detail is shown on the plans.
B. Pavement marking material shall be paint.

3.05 DIRECTIONAL ARROWS

A. Detail is shown on plans.
B. Pavement marking material shall be paint.

END OF SECTION 32 17 23
SECTION 32 84 00 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work of this Section generally includes provisions for the installation of an underground landscape irrigation system including the following:

1. Static pressure verification and coordination of irrigation system installation with landscape material installation.
2. Trenching, stockpiling excavation materials, refilling and compacting trenches.
3. Complete irrigation system including but not limited to piping, valves, fittings, heads, controllers and wiring, and final adjustments to insure complete coverage.
5. Replacement of unsatisfactory materials.
6. Clean-up, Consultant Reviews, and Project Acceptance.
7. Tests.

1.02 RELATED SECTIONS

A. Examine all sections related to project work.

1.03 REFERENCES

A. Perform Work in accordance with the requirements of Conditions of the Contract and Division 1 General Requirements, as well as provisions of all applicable laws, codes, ordinances, rules, and regulations.

B. Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in Contract Documents.

1. American Society for Testing and Materials (ASTM) - Specifications and Test Methods specifically referenced in this Section.
2. Underwriters Laboratories (UL) - UL Wires and Cables.

1.04 QUALITY ASSURANCE

A. Installer Qualifications - Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specific type(s) in a neat, orderly and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and experience necessary for this Project, and financial stability, submit if requested by Consultant, prior to contract award the following:

1. List of three projects completed in the last 2 years of similar complexity to this Project. Description of projects shall include:
   a. Name of project and location
   b. Owner
   c. Brief description of work and project budget
B. Special Requirements:

1. Work involving substantial plumbing for installation of copper piping, backflow preventer(s), and related work shall be executed by licensed and bonded plumber(s). Secure a permit at least 48 hours prior to start of installation.

2. Tolerances - Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.

3. Coordination with Other Contractors - Protect, maintain, and coordinate Work with Work under other Section.

4. Damage To Other Improvements - Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to Owner.

C. Pre-Construction Conference - Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the Work. Conference shall be scheduled not less than 10 days prior to commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to Architect, Consultant, Contractor's Superintendent, and Installer.

1. Minutes of conference shall be recorded and distributed by Contractor to all parties in attendance within five days of conference.

10.5 SUBMITTALS

A. Prepare and make submittals in accordance with conditions of the Contract.

B. Materials List - Submit six copies of a complete materials list indicating manufacturer, model number, and description of all materials and equipment to be used. Show appropriate dimensions and adequate detail to accurately portray intent of construction.

C. Record Drawings (As-Builts):

1. At onset of irrigation installation secure Autocadd files of original irrigation design from Owner. At the end of every day, revise as-built prints for work accomplished that day in red ink. As-built field prints shall be brought up-to-date at the close of the working day every Friday by a qualified draftsperson. A print of record plan(s) shall be available at Project Site. Indicate zoning changes on weekly as-built drawings. Indicate non-pressure piping changes on as-builds. Upon completion of Project, submit for review, prior to final acceptance, final set of as-built bond, PDF and an Autocadd disk copy. All equipment shall drafted at new locations on Autocadd file by contractor for submittal. Dimensions, from two permanent points of reference (building corners, sidewalk, road intersections or permanent structures), location of following items will be used for verification:

   a. Connection to existing water lines.
b. Routing of sprinkler pressure lines (dimension maximum 100 feet along routing).

c. Sprinkler control valves.

d. Quick coupling valves.

e. Manual drains and stop and waste valves.

f. Drip line blowout stubs.

g. Control wire routing if not with pressure mainline.

h. Gate valves.

i. Control wire and communication cable splices

j. Locations of all sleeving including size, quantity and depth of sleeve

k. Flow sensors

2. Owner's Representative will not certify any pay request submitted by the Contractor if the as-built drawings are not current, and processing of pay request will not occur until as-builts are up-dated.

C. Operation Instructions - Submit 3 written operating instructions including winterization procedures and start-up, with cut sheets of products, and coordinate controller/watering operation instruction with Owner maintenance personnel.

1. Controller Charts:

   a. Do not prepare charts until Consultant has reviewed record (as-built) drawings.

   b. Provide one controller chart for each automatic controller installed.

      1) Chart may be reproduction of record drawing, if scale permits fitting of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.

      2) Chart shall be blue-line print of actual "as-built" system, showing area covered by that controller.

   c. Identify area of coverage of each remote control valve, using a distinctly different pastel color drawing over entire area of coverage.

   d. Following review of charts by Consultant, they shall be hermetically sealed between two layers of 20-mm thick plastic sheet

   e. Charts shall be completed and reviewed prior to final review of irrigation system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, unload, store, and handle materials, packaging, bundling, products in dry, weatherproof, condition in manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism. Deliver in original unopened packaging containers prominently displaying manufacturer's name, volume, quantity, contents, instructions, and conformance to local, state, and federal law. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, snow, ice, temperature extremes, fire, or jobsite damage.

B. Handling of PVC Pipe - Exercise care in handling, loading and storing, of PVC pipe. All PVC pipe shall be transported in a vehicle which allows length of pipe to lie flat so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have
been dented or damaged shall be discarded, and if installed, shall be replaced with new piping.

1.07 JOBSITE CONDITIONS

A. Protection of Property:

1. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to Work of this Section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of Owner, and all injury to living plants shall be repaired by Owner. All costs of such repairs shall be charged to and paid by Contractor.

2. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete, or other building material surfaces shall be repaired or replaced at no cost to Owner. Restore disturbed areas to original condition.

B. Existing Trees:

1. All trenching or other Work under limb spread (dripline) of any and all evergreens or low branching deciduous material shall be done by hand or by other methods so as to prevent damage to root system.

2. Prune any branches of trees to be preserved which may be damaged by construction.

3. Where it is necessary to excavate adjacent to existing trees use all possible care to avoid injury to trees and tree roots. Excavation, in areas where 2 inch and larger roots occur, shall be done by hand. Roots 2 inches or larger in diameter, except directly in the path of pipe of conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a trenching machine is operated close to trees having roots smaller than 2 inches in diameter, wall of trench adjacent to tree shall be hand trimmed, making clean cuts through roots. Trenches adjacent to trees shall be closed within 24 hours, and when this is not possible, side of trench adjacent to tree shall be kept shaded with moistened burlap or canvas.

C. Protection and Repair of Underground Lines:

1. Request proper utility company to stake exact location (including depth) of all underground electric, gas, or telephone lines. Take whatever precautions are necessary to protect these underground lines from damage. If damage does occur, Utility Owner shall repair all damage. Contractor shall pay all costs of such repairs unless other arrangements have been made.

2. Request Owner, in writing, to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities that were not staked are encountered and damaged by Installer, Owner shall repair them at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.

D. Replacement of Paving and Curbs - Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.
1.08 WARRANTY/GUARANTY

A. Manufacturer shall warrant materials against defects for a period of one year from date of Substantial Completion. Installer(s) shall guaranty workmanship for similar period.

B. Settling of backfilled trenches that may occur during guaranty period shall be repaired at no expense to Owner, including complete restoration of damaged property.

C. Expenses due to vandalism before substantial completion shall be borne by Contractor.

D. Owner will maintain turf and planting areas during warranty period, so as not to hamper proper operation of irrigation system.

1.09 MAINTENANCE

A. Furnish the following maintenance items to Owner prior to final Acceptance

1. Two Sets of special tools required for removing, disassembling, and adjusting each type of sprinkler head and valve supplied on this Project.
2. One eight foot valve key for operation of stop and waste valve.
3. Two six foot valve keys for operation of gate valves.
4. Two keys for each automatic controller.
5. Two quick coupler keys and two matching hose swivels for each type of quick coupling valve installed.
6. Two aluminum drain valve keys of sufficient length for operation of drain valves.

B. Winterization - include cost in bid for winterizing complete system at conclusion of sprinkling season (in which system received final acceptance) within 3 days notification by the Owner. System shall be voided of water using compressed air or similar method reviewed by Consultant. Reopen, operate, and adjust system malfunctions accordingly during April of the following season within 3 days of notification by the Owner.

1.10 EXTRA STOCK

A. In addition to installed system furnish the following items to Owner:

1. 10 Pop-up spray heads with nozzles of each type used. Two each of both conventional u-series and MP rotator nozzles.
2. 4 Rotor heads of each type used.
3. 100 l.f. of dripper pipe and 5 fittings each of elbows, tees and couplings
4. 4 high-pop spray heads

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General Piping:

1. Pressure Supply Line (from point of connection through backflow prevention unit) - Type "k" Hard Copper.
2. Pressure Supply Lines (downstream of backflow prevention units) - Class 200 PVC BE (1” - 2 1/2”) and Class 200 PVC RT (3” and larger).
3. Non-pressure Lines - Class 200 PVC BE.
4. PVC Sleeving - Class 160 PVC.
5. Drip Tubing - Irritrol Dura-Pol EHD 1645 3/4” with .050 inch wall thickness.
6. Inline emitter dripper Tubing - As shown on plan.

B. Copper Pipe and Fittings:
1. Copper Pipe - Type K, hard tempered.
2. Fittings - Wrought copper, solder joint type.
3. Joints - Soldered with solder, 45% silver, 15% copper, 16% zinc, and 24% cadmium and solidus at 1125~F and liquids at 1145~F.

C. Brass Pipe and Fittings:
1. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe.
2. Fittings - Medium brass, screwed 125-pound class.

D. Plastic Pipe and Fittings:
1. Identification Markings:
   a. Identify all pipe with following indelible markings:
      1) Manufacturer's name.
      2) Nominal pipe size.
      3) Schedule of class.
      4) Pressure rating.
      5) NSF (National Sanitation Foundation) seal of approval.
      6) Date of extrusion.
   
   2. Solvent Weld Pipe - Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B, Type 1, Grade 1.
      a. Fittings - Standard Wright, Schedule 40, injection molder PVC; complying with ASTM D1784 and D2466, cell classification 12454-B.
         1) Threads - Injection molded type (where required).
         2) Tees and ells - Side gated.
      b. Threaded Nipples - ASTM D2464, Schedule 80 with molded threads.
      c. Teflon Tape – All PVC male threaded fittings and nipples, excluding marlex fittings, shall receive wrapping of Teflon tape applied to threaded surfaces per pipe manufacturer's recommendations.
      d. Joint Cement and Primer - Type as recommended by manufacturer of pipe and fittings.
3. Gasketed End Pipe - Manufactured from virgin Polyvinyl Chloride compound in accordance with ASTM D2241 and ASTM D1784; cell classification 1254-B, Type 1, Grade 1.
   a. Fittings and Services Tees (3" and larger) - Ductile iron, grade 70-55-05 in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F-477.
   b. Gaskets - Factory installed in pipe and fittings, having a metal or plastic support within gasket or a plastic retainer ring for gasket.
   c. Lubricant - As recommended by manufacturer of pipe fittings.

C. Gate Valves:
   1. Gate Valves for 3/4 inch through 2 Inch Pipe - Brass construction; solid wedge, IPS threads, and non-rising stem with wheel operating handle.
   2. Gate Valves for 2-1/2 Inch and Larger Pipe - Iron body, brass or bronze mounted AWWA gate valves with a clear waterway equal to full nominal diameter of valve; rubber gasket or mechanical joint-type only. Valves shall be able to withstand a continuous working pressure of 150 psi and be equipped with a square operating nut.

F. Quick Coupling Valves - Brass two-piece body designed for working pressure of 125 PSI; operable with quick coupler. Equip quick coupler with locking rubber purple non-potable cover.

G. Valve Boxes:
   1. Gate Valves, Quick Coupling Valves, Drain Valves, Drip Line Blow-out Stubs, and Wire Splice or Stub Box - Carson Brooks #910-10, box as detailed. With purple non-potable lids.
   2. 1 inch through 2 inch Control Valves, Master Valves and Communication Splice box - Carson Brooks #1419-13B box as detailed. With purple non-potable lids.

H. Electrical Control Wiring:
   1. Low Voltage:
      a. Electrical Control Wire - AWG UFUL approved No. 14 direct burial copper wire or larger, if required to operate system as designed.
      b. Electrical Common Wire - AWG UFUL approved No. 12 direct burial copper wire or larger, if required to operate system as designed.
      c. Wire Colors:
         1) Control Wires - Red.
         2) Common Wires - White.
         3) Master Valve Wires - Blue.
         4) Spare Control Wires - Black.
         5) Spare Common Wires - Yellow.
d. If multiple controllers are utilized, and wire paths of different controllers cross each other, both common and control wires from each controller shall be different colors approved by Consultant.

1) Control Wire connections and splices shall be made with 3M DBY direct bury splice.

e. Communication Cable – Paige PE-54 or approved equal with 3M Gel-type connections installed within Preformed Super Serviseal Splice Kit.

2. High Voltage - Type required by local codes and ordinances, of proper size to accommodate needs of equipment serviced.

H. Electric Control Valves - Size and type shown on Drawings having manual flow adjustment and manual bleed nut.

I. Sprinkler Heads - As indicated on Drawings. Fabricated riser units in accordance with details on Drawings - with fittings and nipples of equal diameter as riser inlet in sprinkler body.

J. Backflow Preventer – Not Required.

PART 3 - EXECUTION

3.01 SITE CONDITIONS, LANDSCAPE PLAN REVIEW AND COORDINATION

A. Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor’s expense.

B. Contractor is responsible to notify Consultant of any field conditions that vary from the conditions shown on the Irrigation Construction Documents. If Contractor fails to notify Consultant of these conditions, Contractor will be held responsible for all costs associated with system adjustments required due to the change in field conditions.

3.02 INSPECTION

A. Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.

B. Grading operations, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.

C. Underground Utilities shall be installed prior to installation of irrigation system. If irrigation installation takes place prior to utility installation, Contractor shall notify Owner of this condition in writing prior to commencement of irrigation installation.
3.03 PREPARATION

A. Staking shall occur as follows:

1. Mark, with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact Consultant 48 hours in advance and request review of staking. Proposed locations of all trees shall be field staked by Contractor and approved by Owner/Landscape Architect prior to Consultant review of irrigation staking. Consultant will advise installer as to the amount of staking to be prepared. Consultant will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement of heads after staking.

2. Contractor shall contact Consultant if field spacing varies by +/- 10% of the spacing shown on the irrigation plans. If Contractor fails to notify Consultant of variances exceeding 10%, Contractor assumes full responsibility for the costs associated with any required system modifications deemed necessary by the Consultant or Owner.

3. If Project has significant topography, freeform planting beds, or other amenities, which could require alteration of irrigation equipment layout as deemed necessary by Consultant, do not install irrigation equipment in these areas until Consultant has reviewed equipment staking.

B. Install sleeving under asphalt paving and concrete walks, prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with STM D1557.

C. Trenching - Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.

1. Clearances:
   a. Piping 3 Inches and Larger - Make trenches of sufficient width (14 inches minimum) to properly assemble and position pipe in trench. Minimum clearance of piping 3 inches or larger shall be 5 inches horizontally on both sides of the trench.
   b. Piping Smaller than 3 inches - Trenches shall have a minimum width of 7 inches.
   c. Line Clearance - Provide not less than 6 inches of clearance between each line and not less than 12 inches of clearance between lines of other trades.

2. Pipe and Wire Depth:
   a. Pressure Supply Piping - 24 inches from top of pipe.
   b. PVC Sleevings - 18 inches from top of pipe.
   c. Non-pressure Piping (rotor) - 18 inches from top of pipe.
   d. Non-pressure Piping (pop-up) - 12 inches from top of pipe.
   e. Control Wiring/Communication Cable - Side of pressure main or at 18 inch depth if installed in a separate trench with no mainline piping.
   f. Drip Tubing - 12 inches from top of pipe.
   g. Emitter Tubing (Micro-tubing) - 8 inches from top of pipe.
3. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density of backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed first by jacking or boring, and pipe laid through sleeves. Observe same precautions as though pipe were installed in open trench.

4. Vibratory Plow - Non-pressure piping may be installed through use of vibratory plow method if consultant determines soil conditions are satisfactory for this method of installation. Vibratory plowing does not relieve installer of minimum pipe depths.

3.4 INSTALLATION

A. Locate other equipment as near as possible to locations designated. Consultant shall review deviations prior to installation.

B. PVC Piping - Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below 40°F. Place manual drain valves at low points and dead ends of pressure supply piping to insure complete drainage of system. When pipe installation is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform Work in accordance with good practices prevailing in piping trades.

1. Solvent Weld PVC Pipe - Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.

2. Gasketed End Pipes:

   a. Lay pipe and make pipe to fitting or pipe to pipe joint, following OR70 recommendations (Johns-Manville Guide for Installation of Ring-Tite Pipe), or pipe manufacturer's recommendations.

   b. Construct concrete thrust blocks behind all gasketed fittings, tees, bends, reducers, line valves, and caps in accordance with pipe manufacturer's recommendations. Contact Consultant prior to placing thrust blocks, for observation of thrust block excavation and initial placement. Thrust block bearing surface shall be calculated based on tables below. All bearing surfaces shall be undisturbed soil:

   THRUST BLOCK SIZING GUIDE:
   Thrust developed per 100 PSI pressure (lbs. force) for various fitting configurations.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Fitting 90 deg. Elbow</th>
<th>Fitting 45 deg. Elbow</th>
<th>Valves, Tees Dead Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1,000</td>
<td>600</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>1,800</td>
<td>1,100</td>
<td>1,300</td>
</tr>
<tr>
<td>6</td>
<td>4,000</td>
<td>2,300</td>
<td>4,900</td>
</tr>
</tbody>
</table>
Approximate bearing strength of typical soils.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Lbs/ft²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mulch, Peat, etc.</td>
<td>0</td>
</tr>
<tr>
<td>Soft Clay</td>
<td>500</td>
</tr>
<tr>
<td>Sand</td>
<td>1,000</td>
</tr>
<tr>
<td>Sand and Gravel</td>
<td>1,500</td>
</tr>
<tr>
<td>Sand and Gravel with Clay</td>
<td>2,000</td>
</tr>
<tr>
<td>Sand and Gravel Cemented with Clay</td>
<td>4,000</td>
</tr>
<tr>
<td>Hard Pan</td>
<td>5,000</td>
</tr>
</tbody>
</table>

Example Calculation: 6 inch 90 degree elbow in sand and gravel soil

Bearing Surface Area (square feet) = 4,000 lbs / 1,500 lbs/ ft² = 2.67 square feet
bearing surface area on undisturbed soil

C. Control Wiring:

1. Low Voltage Wiring:
   a. Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipe lines with such wires to be consistently located below and to one side of pipe, or in separate trenches.
   b. Bundle all 24 volt wires at 10 foot intervals and lay with pressure supply line pipe to one side of the trench.
   c. Provide an expansion loop at every pressure pipe angle fitting, every electric control valve location (in valve box), and every 500 feet. Form expansion loop by wrapping wire at least 8 times around a 3/4 inch pipe and withdrawing pipe.
   d. Make all splices and E.C.V. connections using Rain Bird Pentite connectors or similar dry splice method.
   e. Install all control wire splices not occurring at control valve in a separate splice valve box.
   f. Install one control wire for each control valve.
   g. Run two spare #14 AWG UFUL control wires and one common wire from controller pedestal to the end of each and every leg of mainline. Label spare wires at controller and wire stub box.

2. High Voltage Wiring for Automatic Controller:
   a. Provide 120 volt power connection to automatic controller.
   b. All electric work shall conform to local codes, ordinances, and authorities having jurisdiction. All high voltage electrical work shall be performed by licensed electrician.

D. Automatic Controller:

1. Install controller in accordance with manufacturer's instructions as detailed and where shown on Drawings.
2. Connect remote control valves to controller in numerical sequence as shown on Drawings.
3. Owner shall approve final location of controller prior to installation.
4. Each controller shall be a dedicated separate ground wire and grounding rod as detailed.
5. All above ground conduit shall be rigid galvanized with appropriate fittings. All below ground conduit shall be schedule 40 PVC.

E. Electric Control Valves - Install cross-handle four inches below finished grade where shown on Drawings as detailed. When grouped together, allow at least 12 inches between valve box sides. Install each remote control valve in a separate valve box. Install individual valve box flush with grade.

F. Quick Coupling Valves - Install quick couplers on swing-joint assemblies as indicated on construction details; plumb and flush to grade. Angled nipple relative to pressure supply line shall be no more than 45 degrees and no less than 10 degrees.

G. Drip Valve Assemblies - Install drip valve assembly as detailed.

H. Drip Emitters - Stake all surface emitters as detailed and staked with acceptable tubing stakes.

I. Drain Valves - Install one manual drain valve on pressure supply line directly downstream of backflow preventer as detailed. Provide a three cubic foot drainage sump for drain valve as detailed.

J. Valve Boxes:
   1. Install one valve box for each type of valve installed as detailed. Valve box extensions are not acceptable except for master valves and flow sensors. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted.
   2. Brand controller letter and station number on lid of each valve box. Letter and number size shall be no smaller than 1 inch and no greater in size than 1 1/2 inches. Depth of branding shall be no more than 1/8 inch into valve box lid.

K. Gate Valves - Install where shown on Drawings as detailed.

L. Sprinkler Heads - Install sprinkler heads where designated on Drawings or where staked. Set to finish as detailed. Spacing of heads shall not exceed the maximum indicated on Drawing unless re-staked as directed by Consultant. In no case shall the spacing exceed maximum recommended by manufacturer. Install heads on swing joints or riser assemblies as detailed. Adjust part circle heads for proper coverage. Adjust heads to correct height after sod is installed. Plant placement shall not interfere with intended sprinkler head coverage, piping, or other equipment. Consultant may request nozzle changes or adjustments without additional cost to the Owner.

M. Backflow Preventer – Not Required.

N. Backfilling - Do not begin backfilling operations until required system tests have been completed. Backfill shall not be done in freezing weather except with review by Consultant.
Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by Consultant.

1. Materials - Excavated material is generally considered satisfactory for backfill purposes. Backfill material shall be free of rubbish, vegetable matter, frozen materials, and stones larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfill shall be hauled away. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction, and final grade requirements.

2. Do not leave trenches open for a period of more than 48 hours. Open excavations shall be protected in accordance with OSHA regulations.

3. Compact backfill to 90% maximum density, determined in accordance with ASTM D155-7 utilizing the following methods:
   a. Mechanical tamping.
   b. Puddling or ponding and/or jetting is prohibited within 20'-0" of building or foundation walls.

O. Piping Under Paving:

1. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.

2. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer 6" below pipe and 6" above pipe).

3. Compact backfill material in 6" lifts at 90% maximum density determined in accordance with ASTM D155-7 using manual or mechanical tamping devices.

4. Set in place, cap, and pressure test all piping under paving, in presence of Owner prior to backfilling and paving operations.

5. Piping under existing walks or concrete pavement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/or concrete is necessary, it shall be done and replaced at not cost to Owner. Obtain permission to cut or break walks and/or concrete from Owner.

P. Water Supply and Point of Connection - Water supply shall be extended as shown from water supply lines.

3.05 FIELD QUALITY CONTROL

A. Flushing - After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthest valves. Cap risers after flushing.

B. Testing - Conduct tests in presence of Consultant. Arrange for presence of Consultant 48 hours in advance of testing. Supply force pump and all other test equipment.

1. After backfilling, and installation of all control valves, fill pressure supply line with water, and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.
2. Leakage, Pressure Loss - Test is acceptable if no loss of pressure is evident during the test period.
3. Leaks - Detect and repair leaks.
4. Retest system until test pressure can be maintained for duration of test.
5. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.

C. Walk-Through for Substantial Completion:
1. Arrange for Consultant's presence 48 hours in advance of walk-through.
2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
3. Operate each zone in its entirety for Consultant at time of walk-through and additionally, open all valve boxes if directed.
4. Generate a list of items to be corrected prior to Final Completion.
5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.
6. During walk-through, expose all drip emitters under operations for observation by Consultant to demonstrate that they are performing and installed as designed, prior to placing of all mulch material. Schedule separate walk-through if necessary.
7. Supply Consultant with prints of irrigation as-builts prior to scheduling substantial completion walk-through.

D. Walk-Through for Final Completion:
1. Arrange for Consultant's presence 48 hours in advance of walk-through.
2. Show evidence to Consultant that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
3. Operate each zone, in its entirety for Consultant at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by Consultant shall be reworked to complete satisfaction of Consultant.
5. If after request to Consultant for walk-through for Final Completion of irrigation system, Consultant finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by Consultant to conduct and document further walk-throughs as deemed necessary to insure compliance with Contract Documents.

3.06 ADJUSTING

A. Upon completion of installation, "fine-tune" entire system by regulating valves, adjusting patterns and break-up arms, and setting pressure reducing valves at pro-per and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible. Heads of same type shall be operating at same pressure +/- 7%.

B. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by Consultant, contractor shall make such adjustments
prior to Final Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling.

C. All sprinkler heads shall be set perpendicular to finish grade unless otherwise noted on Construction Plans or directed by Consultant.

D. Areas that do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.

3.07 CLEANING

A. Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at no additional cost to Owner, all trash or debris generated by installation of irrigation system.

END OF SECTION 32 84 00
SECTION 32 91 13 - SOIL PREPARATION

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Ripping
2. Fertilizer
3. Soil Conditioner
4. Fine Grading

B. Related Sections:

1. SECTION 32 84 00 – Irrigation System
2. SECTION 32 92 23 – Bluegrass Sodding
3. SECTION 32 93 00 - Trees, Plants and Ground Covers
4. SECTION 32 94 00 – Landscape, General

1.02 SUBMITTALS

A. Quality Control Submittals: Certificates - State, federal and other inspection certificates shall accompany invoice for materials showing source or origin. Submit to Owner prior to acceptance of material.

1.03 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 01.

B. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to state law, bearing name and warranty of producer.

C. Notify Owner of delivery schedule in advance so material can be inspected upon arrival at project site. Immediately remove unacceptable material from project site.

1.04 PROJECT/SITE CONDITIONS

A. General: Do not perform work when climate and existing site conditions will not provide satisfactory results.

B. Vehicular accessibility on site shall be as directed by University of Colorado PTS. Repair damage to prepared ground and surface caused by vehicular movement during work under this section to original condition at no additional cost to the Owner. Coordinate access with the University of Colorado Project Manager.
PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil: Remove existing top 12” of soil from site. Replace soil with 12” of new approved top soil in all proposed landscape areas including landscape beds.

B. Soil Conditioner: A-1 Organics Pro Gro II Organic Compost or approved equal to be sued for all areas requiring soil amendment. Alternates to be approved by the Campus Landscape Architect.

C. First Application Fertilizer to all landscape areas: Apply Richlawn 5-3-2 or approved equal at a rate of 1lb of Nitrogen/1000 sq. Ft. tilled to a depth of 6”.

PART 3 – EXECUTION

3.01 EXAMINATION

A. General: Verify that existing site conditions are as specified and indicated before beginning work under this Section.

1. Grades: Inspect to verify rough grading is within ± 0.1 foot of grades indicated and specified.
2. Damaged Earth: Inspect to verify that earth rendered unfit to receive planting due to concrete, water, mortar, limewater or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Campus Landscape Architect.
3. Contractor shall provide smooth finish grade free of roots, depressions and irregularities.

B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Owner.

C. Acceptance: Beginning of installation means acceptance of existing conditions by installer.

3.02 PREPARATION

A. Protection:

1. Contractor shall locate sewer, water, irrigation, gas, electric, phone and other pipelines, conduits or utilities prior to commencing work.
2. Contractor shall be responsible for proper repair to landscape, utilities, walls, pavements and other existing site improvements damaged by operations under this section.
3. Contractor shall use caution when grading around existing trees as per specification Section 32 01 90.

B. Weed Control: Remove weeds by removing top 12” of existing soil. Do not remove soil within tree/plant protection zones. Take care to insure that removal of soil and weeds is done in a fashion as not to contaminate surrounding soil with existing weed/weed seed. Use of herbicide in any form must be approved in writing with the Campus Landscape Architect.
C. Surface Grade: Remove weeds, debris, clods and rocks larger than 1/2". Dispose of accumulated debris at direction of Campus Landscape Architect.

D. Runoff: Take measures and furnish equipment and labor necessary to control the flow, drainage, and accumulation of water. Insure that all water will run off the grades.

E. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind deposited material on the site throughout duration of work.

3.03 INSTALLATION

A. Soil Amendment:
   1. Evenly distribute Pro Gro II and Richlawn 5-3-2 to landscape areas at the following rates:
      a. Pro Gro II will be applied at a rate of 4 cu. Yds. Per 1,000 sq.ft to all sod and seed areas.
      b. Richlawn 5-3-2 will be applied at a rate of 1 lb nitrogen/ 1000 sq.ft to all sod and seed areas
   2. After applying soil conditioner and fertilizer, thoroughly till area to depth of 6" minimum by plowing, harrowing, or disking until soil is well pulverized and thoroughly mixed.

B. Fine Grading in all Landscape Areas:
   1. Do fine grading for areas prior to planting.
   2. For ground surface areas surrounding buildings to be landscaped, maintain required positive drainage away from buildings.
   3. Establish finish grades to within 0.04 foot of grades indicated.
      a. Sod areas: Allow 1.25" for sod.
   4. Noxious weeds or parts thereof shall not be present in the surface grade prior to landscaping.
   5. Prior to acceptance of grades, hand rake to smooth, even surface free of debris, clods, rocks, and vegetable matter greater than 1/2".

3.04 NOTIFICATION AND INSPECTION

A. Inspection: Provide notice to Campus Landscape Architect and Owner requesting inspection at least 7 days prior to anticipated date of completion.

B. Deficiencies: Campus Landscape Architect will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Campus Landscape Architect for final inspection.
3.05 CLEANING

A. General: Remove debris and excess materials from site. Clean out drainage inlet structures. Clean paved and finished surfaces soiled as a result of work under this Section, in accordance with direction given by Campus Landscape Architect.

3.06 PROTECTION

A. General: Provide and install barriers as required and as directed by Campus Landscape Architect to protect completed areas against damage from pedestrian and vehicular traffic until acceptance by Owner. Contractor is not responsible for malicious destruction caused by others.

END OF SECTION 32 91 13
SECTION 32 92 23 - BLUEGRASS SODDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fertilizer.
2. Sod.

B. Related Sections:

1. Section 32 84 00 Irrigation System
2. Section 32 92 13 Soil Preparation

1.02 REFERENCES


1.03 SUBMITTALS

A. Quality Control Submittals: Certificates - State, Federal and other inspection certificates shall accompany the invoice for materials showing source or origin. Submit to Campus Landscape Architect prior to acceptance of material.

B. Contract Closeout Submittals: Warranty - At completion of work, furnish written warranty to Owner based upon requirements as specified.

1.04 QUALITY ASSURANCE

A. Source Quality Control:

1. Sod Materials: Supplier must be a member of Rocky Mountain Sod Growers Association. Sod will be subject to inspection and acceptance. Campus Landscape Architect reserves the right to reject at any time or place prior to acceptance, any work and sod which in the Campus Landscape Architect's opinion fails to meet these specification requirements.
2. Inspection: Primarily for quality; However, other requirements are not waived even though visual inspection results in acceptance. Notify Campus Landscape Architect of intended sod farm prior to cutting for inspection. Inspection at growth site shall not preclude the right of rejection at project site.
3. Promptly remove rejected sod from site.
4. Inspection will be made periodically during sodding, at completion and at end of warranty period by Campus Landscape Architect.
B. Sod Standards:

1. General: Healthy, thick turf having undergone a program of regular fertilization, mowing and weed control; free of objectionable weeds; uniform in green color, leaf texture and density; healthy, vigorous root system; inspected and found free of disease, nematodes, pests and pest larvae by the entomologist of the State Department of Agriculture.
2. Each piece of Sod: Sandy-loam soil base that will not break, crumble or tear during sod installation.
3. Thickness: 1.25" thick, excluding top growth and thatch.
4. Thatch: Not to exceed 1/4" uncompressed.
5. Size: Cut in strips 18" wide no more than 24 hours prior to delivery.
6. All Sod supplied will be comprised of the same turf cultivars. Product must be cut continuously from the same turf field or from a separate field that was seeded with the same cultivars and same percentages of cultivars as original product. During all phases of grow in, establishment phase and warranty phases, color should be even after proper fertilization. Turf must be of even color without addition of specialized nutrient products. If discoloration is evident and it is believed different cultivars of sod were used, contractor bares all responsibility for providing proof that turf is of the same cultivar, including but not limited to: genetic testing done at a location of the Campus Landscape Architects choosing. All costs associated with material testing will be the responsibility of the landscape contractor. If it is determined that turf is of different cultivars landscape contractor is solely responsible for all removal and replacement costs. All repairs will be done at a time determined by the Campus Landscape Architect.

1.05 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section Division 1.

B. Sod: Deliver on pallets properly loaded on vehicles and with root system protected from exposure to sun, wind, and heat in accordance with standard practice and labeled with botanical and common name of each grass species in accordance with Federal Seed Act.

1. Protect from dehydration, contamination and heating at all times. Keep stored sod moist and under shade or covered with moistened burlap.
2. Do not drop sod rolls from carts, trucks or pallets.
3. Do not deliver more sod than can be installed within 24 hours.
4. Do not stack sod more than 2 feet deep.
5. Remove all netting or other stabilizing material prior to installation.

C. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, warranty and conformance to state law.

1. Material shall be inspected upon arrival at job site.
2. Immediately remove unacceptable material from job site.
1.06 PROJECT/SITE CONDITIONS

A. Existing Conditions:
   1. Import and place any fill material required to adjust the fine grade to meet drainage requirements or to match hard surface fine grades.
   2. Vehicular accessibility on site shall be as directed by Campus Landscape Architect. Repair damage to prepared grounds and surfaces caused by vehicular movement during work under this section to original condition at no additional cost to Owner.

B. Environmental Requirements:
   1. Landscape may be installed between the dates of April 1-October 1. Variation from these dates requires written authorization from Campus Landscape Architect, and may require extended warranty.
   2. Do not install sod on saturated or frozen soil.

1.07 WARRANTY

A. Sod: Warrant sod for a period of one year from date of Substantial Completion to be in a healthy, vigorous growing condition.
   1. During the original warranty period, replace at once sod areas that die due to natural causes, etc., or which in Campus Landscape Architect's opinions are unhealthy.
   2. Replacement will not be required in any season definitely unfavorable for sodding.
   3. Install replacements as originally specified and warranted.

1.08 MAINTENANCE

A. General: The maintenance period shall begin immediately after each area is sodded and continue until final acceptance of entire project. During this time, be responsible for watering, mowing, spraying, weeding, aerating, fertilizing, and all related work as necessary to ensure that sodded areas are in a vigorous growing condition. Furnish all supervision, labor, material and equipment to maintain turf areas.

B. Materials: Conform to specification or otherwise acceptable to Owner.

C. Watering: Water sod sufficiently to moisten subsoil in a manner not to cause erosion, damage, or overwater to a point which firmness of subsoil is compromised must prevent excessive water usage during initial watering to prevent any changes to the grade of the install. Water shall be free of substances harmful to plant growth. Be responsible for furnishing water from underground sprinkler system, quick couplers or other source.

D. Fertilizing: If work has not received final acceptance within 45 days after initial fertilizer application to sodded areas, repeat fertilizer application to maintain optimal sod vigor.

E. Mowing and Trimming:
   1. Mow and trim around trees (keeping mulch in saucers and beds), walls, fences, etc., maintaining turf at 2½ -2 3/4" height. Do not remove more than 33% of grass leaf in single mowing. Remove grass clippings from pavement areas.
F. Resodding: Resod spots larger than 1 sq. ft. not having healthy, uniform stand of grass.

G. Weed Control: As required, using selective herbicides approved by Owner, following current university policies.

H. Insect and Disease Control: As required, using insecticides and fungicides approved by Owner, following current university policies.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sod: Sod to be provided by a member of the Rocky Mountain Sod Growers Association and have an average N.T.E.P test result of 6.0 or higher in the Color, Vigor, and Density class. The mix should have at least three cultivars of Kentucky bluegrass each with the same N.T.E.P scores as stated above. Submit proposed blend to the Campus Landscape Architect for review and approval prior to application.

B. Water: Free of substances harmful to plant growth. Be responsible for furnishing water from underground sprinkler system, quick couplers or other source.

C. Fertilizer: Inorganic mixture with following chemical composition:

1. First Application: Under Section 32 92 13, 2.1 B.

PART 3 – EXECUTION

3.01 EXAMINATION

A. General-Verify that existing site conditions are as specified and indicated before beginning work under this section.

1. Layout: Verify layout of sodded areas as indicated prior to starting operations.
2. Grades: Verify that grades are within 0.04 ft. of grades indicated and specified.

B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Campus Landscape Architect.

C. Beginning of installation means acceptance of existing conditions by Contractor.

3.02 PREPARATION

A. Protection:
1. Pay for repairs made by contractors designated by Owner & Campus Landscape Architect.
2. Identify prepared sod areas requiring protection and erect barriers for proper protection and traffic control.
3. All areas related to the project are subject to landscape repairs including areas outside of the construction work limit fencing including but not limited to: landscape damage from irrigation shut downs required by the project in areas outside limits of
construction fence, all damage related to traffic pattern changes that are caused by fencing or construction operation and other damage caused by the contractor or subcontractors will be the responsibility of the contractor.

B. Sodding Areas: Remove weeds, debris and rocks larger than 1/4” which may hinder sodding. Dispose of accumulated debris off site while taking care to prevent weed seed contamination during removal.

C. Adjustment: Adjust irrigation heads to proper watering height according to depth of sod material but lower than compacted blade height to enable lawn mowers to cut grass freely without damage to the sprinkler system.

D. Fine Grading: Perform as required to maintain positive drainage, prevent ponding and direct runoff into catch basins, drainage structures, etc., and as required to provide smooth well contoured surface prior to proceeding. Tolerance: ± 0.04 foot. All areas will be inspected by Campus Landscape Architect prior to installation of sod.

3.03 FERTILIZING

A. First Application to newly sodded areas: Under Section 31 92 13 2.1B.

3.04 SODDING

A. Sodding:

1. Sod shipped with netting or other extraneous materials shall not be allowed. Remove all netting or other material prior to placement.
2. Soil on which sod is laid: Slightly moist.
3. Lay with longest dimension parallel to contours and in continuous rows.
4. Tightly butt ends and sides of sod together. Stagger and compact vertical joints between sod strips by rolling so sod will be incorporated with the ground surface, insure that joints between adjacent pieces.

B. Rolling: When soil and sod are moist, roll sod lightly as soon as possible after it is laid. Delay rolling until just before the second watering.

C. Topsoil: Add along exposed edges to match adjacent grade. Feather topsoil out approximately 1 foot from edge of sod. Transition to existing sod will be smooth.

D. Drainage: Assure finished areas of sod are such that positive drainage of storm and irrigation water will occur and ponding of water will be minimized.

3.05 REPAIR OF EXISTING SOD AREAS DISTURBED BY RENOVATION

A. Repair existing sod areas disturbed by renovation work (utilities, paving, etc.), as indicated, in accordance with specifications of this section.

3.06 NOTIFICATION OF INSPECTION

A. Notification: Give notice requesting inspection by Campus Landscape Architect at least seven (7) days prior to the anticipated date of completion. All sod must be alive and healthy in order to be considered complete.
B. Deficiencies: If deficiencies exist, Campus Landscape Architect shall specify such deficiencies to the Contractor who shall make satisfactory adjustments and will again notify the Campus Landscape Architect for final inspection.

3.07 CLEANING

A. Cleaning: Remove pallets, unused sod, and other debris from site. Clean paved and finished surfaces soiled as a result of work under this Section in accordance with directions given by Campus Landscape Architect. Clean out drainage inlet structures.

3.08 PROTECTION

A. General: Provide and install barriers as required and as directed by Campus Landscape Architect to protect sodded areas against damage from pedestrian and vehicular traffic until acceptance by Owner. Contractor is not responsible for malicious destruction of sodding caused by others.

END OF SECTION 32 92 23
SECTION 32 93 00 - TREES, PLANTS AND GROUND COVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Trees.
   2. Plants and shrubs.
   4. Non-plant materials required to complete installation of planting.

B. Related Sections:
   1. Section 32 84 00 Irrigation System
   2. Section 32 94 00 Landscape General
   3. Section 32 92 13 Soil Preparation

1.02 REFERENCES

A. Standards:
   1. Plants shall be first class representatives of the specified species or variety, in healthy
      condition with normal well developed branch and root systems, free of objectionable
      features, and shall conform to requirements as follows:
      a. USDA Standards for Nursery Stock.
      b. AAN Standardized Specifications.
      c. American Joint Committee on Horticulture (AJCH) (plant names shall meet
         standards of AJCH).
      d. American National Standard Institute (ANSI) (nursery stock shall meet ANSI
         standard specifications).

1.03 SUBMITTALS

A. Certificates of Inspection for Materials: State, Federal, or other inspection certificates shall
   accompany invoice for materials showing source or origin.

B. Plant List:
   1. Submit list of plants. Refer to Section 01 33 00.
   2. Indicate which plants have special watering requirements.

C. Maintenance Instructions:
   1. At completion of work, furnish three copies of written maintenance instructions to
      Owner for maintenance and care of installed plants through a full growing season.
   2. Maintenance shall be the responsibility of Landscaping Subcontractor for one year
      after final acceptance of project.
3. The Owner shall be notified 14 days in advance of the date that maintenance operations will be discontinued.

1.04 QUALITY ASSURANCE

A. Inspection and Approval: The Owner reserves the right to reject, at any time or place prior to final acceptance, of the installation, any materials and plants which in the Owner's opinion fails to meet specified standards requirements.

B. Inspection of plants is primarily for quality, size, and variety; however, other requirements are not waived even though visual inspection results in approval.

C. Plants may be inspected where growing, but inspection at place of growth shall not preclude the right of rejection at site.

D. Rejected plants and other materials shall be promptly removed from site.

1.05 DELIVERY, STORAGE AND HANDLING

A. Fertilizer: Deliver to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to Local, State and Federal law.

B. Protection:

1. Plants shall be containerized with limbs bound, properly pruned and prepared for shipping.
2. Root system shall be kept moist and plants shall be protected from adverse conditions.

C. Identification:

1. Each plant shall be identified by means of grower's label affixed to plant.
2. Grower's label shall give data necessary to indicate conformance to specifications.
3. Use durable waterproof labels with water resistant ink which will remain legible for at least 60 days.

1.06 SITE CONDITIONS

A. Repair of lawn watering system, other underground pipe, electrical wiring, concrete walkways, sodded areas or other appurtenances damaged by operations under this Section at no additional cost to the Owner.

1.07 PLANT WARRANTY

A. For a period of one (1) full growing season after Final Acceptance of Landscape work and at no additional cost to the Owner, the Contractor shall replace any trees, shrubs or ground cover that are dead, or that are, in the opinion of the Owner, in unhealthy, or unsightly condition, or that have lost their natural shape due to dead branches or excessive pruning of dead branches.
B. Replacement of planting shall be in accordance with the original specifications and its cost shall be included.

PART 2 – PRODUCTS

2.01 PLANT MATERIAL
   A. Plant List: Refer to "Schedule" provided in construction drawings.
   B. Size: Minimum acceptable sizes of plants measured before pruning with branches in normal position.
   C. Source:
      1. Hardiness Zones: Shrubs grown in Hardiness Zones 2, 3, 4, and 5 only will be accepted. Hardiness Zones are defined in U.S. Department of Agriculture publications.
      2. Nursery Grown: Plants shall be nursery grown. The term "nursery grown" may include gathered native plants and imported plants that have been growing in a nursery for a minimum of one growing season.

2.02 BACKFILL MATERIAL
   A. Planting mix shall be existing topsoil blended 50%/50% with A1 Premium 3 Organic Compost
   B. Topsoils:
      1. Use topsoils stockpiled on site, free from toxic substances, sticks, debris, vegetation and stones over 1" (2.5cm) in maximum dimension.
      2. In the event that no suitable topsoil exists after site clearing, the Contractor shall provide adequate topsoil at no additional cost.

2.03 TREE WRAPPING MATERIALS
   A. First quality 4" wide Bituminous impregnated tape, corrugated or crepe paper, brown in color, specifically manufactured for tree wrapping and having qualities to resist insect infestation.

2.04 STAKING AND GUYING MATERIAL
   A. Stakes shall be standard wood 8' high stakes.
   B. Protective loops will be nylon, of a composition durable enough to last two years.
PART 3 – EXECUTION

3.1 INSTALLATION

A. Positioning: Shrubs and trees shall be placed in position prior to planting, for final acceptance to location by the Owner or Landscape Consultant.

B. Placing Plants:
   1. All landscaping shall be installed in accord with good horticultural practice or region, in a manner designed to encourage quick establishment and healthy growth.
   2. Trees should be planted so the top of the root ball is four (4) inches above surrounding grade.

C. Excavation of Planting Pit:
   1. After preparation of soil, the plant pit, centered on the location stake, shall be excavated in a cylindrical shape with vertical sides and flat or saucer shaped bottom. Sides of the plant pit shall be scarified. Diameter of plant pit will be at least twice the spread of ball or container.
   2. Contractor shall hand dig all planting pits adjacent to utilities. If utilities are damaged, repairs shall be made at no additional cost to Owner.

D. Root Care:
   1. Do not remove protective wrapping of root ball or bare roots until plant is positioned accurately in planting pit. When positioned, remove wire mesh and burlap prior to backfilling.
   2. Score root balls of containerized shrubs just prior to planting.

E. Pruning and Watering: Plant material shall be pruned only to remove dead, injured or lower branches.

F. Guying and Staking:
   1. Guy and stake in accordance with the standard detail in the Drawings.
   2. Stakes and guying shall be repaired as needed upon notification from the Owner during warranty period.
   3. Contractor shall remove all staking and guying material after two years from date of Final Acceptance.

G. Tree Mulch Ring: Provide an 8 foot diameter mulch ring around each newly planted tree.

3.02 PRE-EMERGENT HERBICIDE

A. Applied as per manufacturer's recommendations, at Owner’s approval.

3.03 MULCHING

A. Organic Mulch: Mulch planting saucers, beds, tree mulch ring and areas within two days after planting.
3.04 PRUNING

A. New Plant Material: Prune minimum necessary to remove injured twigs and branches, deadwood and suckers.

3.05 PLANT MAINTENANCE AND ACCEPTANCE

A. Maintenance period shall begin immediately after plant material is installed until final acceptance of landscape work.

B. Maintenance shall include watering, weeding, cultivating, mulching removal of dead branches, restoring plants to proper grade or upright position and other necessary operations.

END OF SECTION 32 93 00
SECTION 32 94 00 - LANDSCAPE, GENERAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Landscaping general requirements.
   2. Landscaping accessories.

B. Related Sections:
   1. Section 32 01 90 – Tree and Plant Protection
   2. Section 32 84 00 – Irrigation System
   3. Section 32 92 23 – Soil Preparation
   4. Section 32 92 23 – Bluegrass Sodding
   5. Section 32 93 00 – Trees, Plants and Ground Covers
   6. Section 32 96 43 – Transplanting

1.02 REFERENCES

A. Uniform Federal Accessibility Standards (UFAS).

B. University of Colorado (UCB), Boulder Campus Office of Facilities Planning:
   1. Campus Master Plan
   2. Campus District Micro Master Plans (when applicable)
   3. Williams Village Master Site Development Plan and Design Guidelines (when applicable).
   4. Research Park Master Site Development Plan and Design Guidelines (when applicable).

1.03 DEFINITIONS

A. The terms listed below have been used in this section and throughout the UCB Standards. Definitions are provided for each.

1. Landscape: Every single item on the campus floor except buildings occupied by people, materials storage, or equipment.
2. Operations: The series of actions taken to establish procedures and various controls that keep the campus functioning at a high level of efficiency. These include: planning, scheduling, budgeting, coordinating, supervising, improving, and maintaining the campus landscape.
3. Maintenance: The constant and continuing upkeep of campus facilities and plant material.
4. Development: The physical evolvement of the campus landscape through the enhancement of existing facilities and the creation of new facilities where none existed before.
5. Facilities: The physical objects that are built, installed, or established that serve a particular purpose in the campus landscape, such as buildings, walks, streets, parking
lots, benches, lighting, and all other manmade items in the campus landscape but not plant material.


1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. Materials List:

1. Plant material including source and location.
2. Mulches; organic rocks.
3. Amendments.
4. Accessories including edging, stake-guy system.

C. Plant and Material Certifications:

1. Certificates of inspection as required by government authorities.
2. Manufacturer’s or vendor’s certified analysis for soil amendments and fertilizer materials.
3. Label data substantiating that plants, trees, shrubs and planting materials comply with specified requirements.

D. Planting Schedule: Proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reason for delays.

E. Maintenance Instructions: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

1.05 QUALITY ASSURANCE

A. Pre-Planting Inspection

1. The Owner and Landscape Consultant will inspect all trees at the nursery before planting commences.
2. All plant fertilizers, backfill mixes, mulches and soil amendments will be accepted by the Owner prior to planting operations.

B. Planting Inspections

1. The Owner or Landscape Consultant will inspect the staked location of all trees prior to planting.
2. The Owner or Landscape Consultant will inspect the staked locations of container stock prior to planting. Contractor to report any variance of quantity on unit price contracts.
C. Pre-Maintenance Inspection: The Owner or Landscape Consultant will inspect site at the completion of all planting operations.

D. Final Inspection: Final acceptance of the Owner and Landscape Consultant will not be given until all deficiencies are corrected.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packaged Material: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

1.07 JOB CONDITIONS

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Campus Landscape Architect before planting.

PART 2 – PRODUCTS

2.01 ON SITE TOPSOIL

A. On-Site Topsoil- Topsoil limits shall be the top six (6) inches of soil within the limits of the area to be disturbed by the Contractor. Remove and stockpile sufficient topsoil to allow replacement on all planted surfaces to a minimum depth of six (6) inches after natural settlement. A minimum depth of twelve (12) inches after natural settlement is required in areas of road removal. The Contractor shall protect placed topsoil from undue compaction for the duration of construction.

2.02 IMPORTED TOPSOIL

A. Provide 6" new topsoil that is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2 inches in any direction, and other extraneous or toxic matter harmful to plant growth to all landscape areas.

1. Obtain topsoil from local sources or from areas having similar soil characteristics to those found at project site. Obtain topsoil only from naturally well drained sites where topsoil occurs in depth of no less than 4 inches. Do not obtain from bogs or marshes.

2.03 SOIL AMENDMENTS AND FERTILIZERS

A. Submit specific product analysis for approval.

B. Compost: A1-Premium 3 Organic Compost
C. Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs, or plants.

2.04 LANDSCAPE MATERIALS

A. Soil Separator Fabric:
   1. 4 oz. per square yard polypropylene fabric, water permeable, and unaffected by U.V. light, freezing and thawing.
   2. Approved substitute fabrics.
   3. Provide at all planting beds and crusher fines areas.

B. Pre-Emergent Herbicide:
   1. Apply beneath all mulch layers and soil separator fabric. Apply at manufacturer's specified rate. Comply with EPA requirements regarding application and use of product.
   2. Submit manufacturer's data for approval.

C. Landscape Edging
   2. Install per manufacturer's instructions.

D. Bark Mulch:
   1. Western Red Cedar Mulch

E. Rock Mulch: The following type, size, and color. Applied over specified filtration fabric. All rock mulch shall be clean and washed.
   1. Size: 3/4"
   2. Color: Colorado Red (match existing)
   3. Applied to 4" depth

F. Crusher Fines: The following type, size, and color. Applied over specified filtration fabric.
   1. Color: Red to match existing
   2. Applied to 4" depth

G. Anti-Desiccant: Emulsion type, film forming agent designed to permit transpiration, but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

H. Wrapping: tree-wrap tape not less than 4 inches wide, designed to prevent borer damage and winter freezing.
I. Stakes and Guys: Provide standard wood stakes. Provide wire ties and guys of 2-strand, twisted, pliable galvanized iron wire, not lighter than 12 gauge with zinc coated turnbuckles. Provide manufactured fabric tree strap with metal grommet to protect tree trunks from damage by wires.

PART 3 EXECUTION

3.01 PREPARATION

A. Contractor shall coordinate irrigation and planting work such that installed irrigation equipment shall not cause adjustment of planting locations contrary to the plans. If irrigation equipment is installed in locations obstructing the intended locations of the plantings, the irrigation equipment shall be relocated.

B. Lay out individual tree and shrub locations and areas for multiple plantings, Stake locations and outline areas and secure Campus Landscape Architect’s or Owner’s acceptance before start of work. Make minor adjustments as may be required.

C. All landscape areas disturbed by construction operations shall be topsoiled, soil prepared and landscaped by the Contractor.

D. After receiving approval of staked locations, and prior to digging, the Contractor shall request and verify locations of all utilities within the planting area.

END OF SECTION 32 94 00
SECTION 32 96 43 - TRANSPLANTING

PART 1 - GENERAL

1.01 SUMMARY

The extent of transplanting work is shown on the Drawings and consists of transplanting trees in accordance with the Construction Documents and accepted standard horticultural practices at the designated locations.

1.02 RELATED WORK

A. Related Documents: Construction Documents, General and Special Conditions of the Contract apply to work of this section.

1.03 QUALITY ASSURANCE

A. Contractor Qualifications: Install work using skilled persons, proficient in the trades required, in a neat, orderly and responsible manner with recognized standards of workmanship.

B. Reference Standards:


1.04 SUBMITTALS

A. Materials List: Submit a list of all equipment to be used in transplanting trees to Owner within 14 calendar days after receipt of Notice to Proceed.

B. Product Certification: Submit manufacturer’s data for soil additives to Owner not less than 14 days prior to scheduled delivery of these materials.

C. Maintenance Instruction: Submit detailed maintenance instructions for the care of transplanted material.

1.05 SITE CONDITIONS

A. Protection: Determine location of all underground utilities prior to transplanting work. Avoid damage to utility lines by hand excavating in close proximity to lines.

B. Sequencing: Coordinate transplanting with other work to ensure that damage will not occur. Install plants after final grades are established and prior to seeding.

C. Environmental Conditions: Contractor shall inspect planting areas to verify soils, drainage, and compaction. Start of planting work constitutes acceptance of these conditions.

D. Timing: Transplanting season is that period when plants are in a dormant condition and can be moved. Dormant means that coniferous material is without new candle growth. Transplanting
done in periods not considered dormant transplanting season shall require approval by the Campus Landscape Architect.

1.06 GUARANTEE

Guarantee all plantings until Date of Final Completion against death except for death resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond the Contractor's control.

PART 2 - PRODUCTS

2.01 PLANTS

A. Plant material to be transplanted as indicated on the Drawings. Contractor shall visit the site to determine the general range of plant material to be transplanted. Plants to be transplanted shall be those that are flagged on the project site or as directed in the field by the Owner or Landscape Consultant.

2.02 BACKFILL

Backfill material for all plantings shall be excavated soil from plant pit.

2.03 WATER

Water shall be supplied and paid for by Contractor. Use of on-site water shall be coordinated with Owner.

2.04 GUYS, STAKES AND WRAPPING

A. Guys: Provide 14 gauge wires.

B. Stakes: Provide 6’-6” long metal t-bar posts, with bottom anchor plate intact.

C. Straps: Provide 24” long, 3” wide nylon straps with metal grommets at each end.

2.05 MULCH

Wood Mulch: Washington Red Cedar Mulch.

2.06 SOIL ADDITIVE

PART 3 - EXECUTION

3.01 PREPARATION

A. Soil Preparation: Prepare soils as specified prior to planting.

B. Layout and Staking: Owner will flag trees to be transplanted and stake locations for all transplanted tree locations.

3.02 PLANTING

A. Anti-desiccant: Prior to transplanting all coniferous trees shall be sprayed with an approved anti-desiccant.

B. Pruning: Prune, thin and shape plants in accordance with standard horticultural practice and to retain natural character. Remove all dead or injured branches. Avoid damage to leaders. Root pruning shall be done as soon as possible at the beginning of the project. The root system shall be kept moist and plants shall be protected from adverse conditions due to climate and transporting from the time of digging to transplanting.

C. Mechanical Spade Planting: Transplant trees with mechanical tree spade transplanter. The following table represents minimum diameter of spade machine equipment to be used for transplanting plants based upon caliper size. The table also represent the minimum diameter of root balls for machine transplanted material.

<table>
<thead>
<tr>
<th>Caliper</th>
<th>Minimum Spade Machine Size (based on root ball width)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; – 3&quot;</td>
<td>44&quot;</td>
</tr>
<tr>
<td>3&quot; – 6&quot;</td>
<td>65&quot;</td>
</tr>
<tr>
<td>6&quot; – 9&quot;</td>
<td>80&quot;</td>
</tr>
<tr>
<td>9&quot; – 12&quot;</td>
<td>90&quot;+</td>
</tr>
</tbody>
</table>

D. Each tree shall be transported to the new site using the same spade with which it was dug, or several trees may be spade dug and transported in a pod trailer manufactured specifically for this purpose. Trees shall not be removed from spade or transported in haul truck. The Contractor shall give the Owner one week notice prior to transplanting trees.

E. Planting Pits: Planting pits for machine dug trees shall have the same dimension as the machine ball being placed. Before a tree is placed in a planting pit, the pit shall be filled half full of water and allowed to drain. Once the tree is placed, voids in the pit shall be filled with clean suitable backfill and tamped. If unsuitable soil is encountered in the panting pits, the Contractor shall dispose of said material and back fill with suitable material.

F. Soil Additives: add specified soil additives to backfill of transplanted trees as per manufacturer’s recommendations. Additive shall be applied at a rate of 5% of backfill material.

G. Watering, Guying and Staking: After the tree is planted, a basin shall be built to hold at least 30 gallons of water. For each inch of trunk diameter greater than 3 inches, the basin capacity shall be increased by 10 gallons. The depth of saucer shall not be below the top of the root system of the tree. The basin shall be filled with water three times and allowed to stand each time until empty before refilling. Saucers shall be covered with a 4-inch thick layer of wood mulch.
H. Guy and stake plants immediately after backfilling as shown on Drawings. Set stakes vertically and avoid penetrating root ball. Guys to tree trunk shall be connected to straps to prevent injury to tree trunks.

I. Transplant Sites: fill all holes with spoils, compact, and seed or sod.

3.03 MULCHING

A. Mulch: Place evenly over all areas and at the depth shown on the plans. Place wood mulch in all tree saucers in seeded areas at the depth indicated on the Drawings.

3.04 CLEANUP AND PROTECTION

During transplanting work, store materials and equipment in area approved by the Owner. Keep pavements clean and work areas in an orderly condition. Protect planting work and materials from damage due to landscape and other Contractor operations or trespassers. Maintain protection until completion of work.

END OF SECTION 32 96 43
SECTION 33 11 16 - BURIED CHILLED WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 1 Specifications, apply to this Section.

1.2 SUMMARY
   A. This Section includes chilled water distribution piping and related components outside the
      building.

1.3 DEFINITIONS
   A. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS
   A. Shop Drawings: Indicate piping system schematic and connection requirements.
   B. Product Data: Provide manufacturers catalog literature with capacity, weight and
      characteristics and connection requirements.
   C. Manufacturer’s Installation Instructions: Indicate hoisting and setting requirements, starting
      procedures, special procedures, assembly and installation of components.

1.5 INFORMATIONAL SUBMITTALS
   A. Coordination Drawings: For piping and specialties including relation to other services in
      same area, drawn to scale. Show piping and specialty sizes and valves, meter and
      specialty locations, and elevations.
   B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For water valves and specialties to include in
      emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE
   A. Permits: Obtain tap permit from the University of Colorado at Boulder Utility Engineer.
   B. Materials and workmanship shall conform to the latest issue of all industry standards,
      publications, or regulations referenced in this section and with the following references as
      applicable. Materials shall be new and free from defects.
   C. Conform to ASME B31-9 – Building Services Piping.
D. Conform to ASME A13.1 – Scheme for identification of Piping Systems.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Restrained Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and Flex-Ring spigot end to provide flexible joint restraint against thrust due to internal water pressure or external forces, Grade 60/42/10, pressure class 250, cement lining in accordance with AWWA C104, and an outside asphaltic coating.
   1. Push-on-Joint, Ductile-Iron Fittings: Grade 70/50/05 AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

B. Flanges: ASME 16.1, Class 250, cast iron.

2.2 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. Pipe shall be manufactured from a PE 3608 resin conform to ASTM D 2737. Dimension Ratio 9 (DR) with a Working Pressure Rating (WPR) of 200 psig.
B. Fittings: Butt or electro-fusion fittings shall conform to manufacturing standard ASTM D 3261 and F 1055.

C. Flanged and Mechanical Joint Adapters shall conform to manufacturing standard ASTM D 3261.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.4 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:
   1. Standards: ASTM A 674 or AWWA C105.
   2. Form: Sheet or tube.
   3. Material: High-density, cross-laminated PE film of 0.004-inch minimum thickness.

2.5 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   3. Basis of Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
      c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary
      d. Crane Co.; Crane Valve Group; Stockham Div.
      e. East Jordan Iron Works, Inc.
      f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa)
      g. McWane, Inc.; Kennedy Valve Div.
      h. McWane, Inc.; M & H Valve Company Div.
      i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
      j. Mueller Co.; Water Products Div.
      k. Nibco Inc.
      l. U.S. Pipe and Foundry Company
   4. Non-rising-Stem, Resilient-Seated Gate Valves:
      a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
         1) Standard: AWWA C509.
         2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

5. Non-rising-Stem, High-Pressure, Resilient-Seated Gate Valves:
   a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

   1) Standard: AWWA C509.
   2) Minimum Pressure Rating: 250 psig.
   3) End Connections: Push on or mechanical joint.
   4) Interior Coating: Complying with AWWA C550.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

   1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.7 BUTTERFLY VALVES

A. AWWA Butterfly Valves:

   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   3. Basis of Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings][Insert manufacturer's name; product name or designation] or a comparable product by one of the following:

      a. DeZURIK/Copes-Vulcan; a unit of SPX Corporation
      b. Milliken Valve Company
      c. Mosser Valve; a division of Olson Technologies, Inc.
      d. Mueller Co.; Water Products Div.
      e. Pratt, Henry Company
      f. Val-Matic Valve & Manufacturing Corp.

   4. Description: Rubber seated.

      a. Standard: AWWA C504
      b. Body: Cast or ductile iron
      c. Body Type: Wafer or flanged
      d. Pressure Rating: 150 psig
2.8 IDENTIFICATION

A. Underground Type Plastic Line Marker:

1. Manufacturer’s standard permanent, continuous-printed plastic tape with metallic core, intended for direct-burial service; not less than 6 inches wide x 4 mills thick. Provide green tape with black printing reading:

“CAUTION CHILLED WATER LINE BURIED BELOW”.

2. Provide identification markers of one of the following:

   a. Allen Systems, Inc.
   b. Emed Co., Inc.
   c. Seton Name Plate Corp.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Underground chilled water service piping NPS 4 to NPS 30 shall be the following:

   1. Ductile-iron, restrained push-on-joint pipe; ductile-iron, restrained push-on-joint fittings; and gasketed joints.
   2. Bid Alternate: Provide pricing as a bid alternate for PVC Pipe in lieu of Ductile-iron

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

   1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, non-rising-stem, high-pressure, resilient-seated gate valves with valve box.
   2. Underground Valves, NPS 3 and Larger: AWWA, cast or ductile-iron, butterfly valves with valve box.
3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Division 31 for piping system common requirements.

3.5 PIPING INSTALLATION

A. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

B. Bury piping with depth of cover over top at least 36 inches and according to the following:

1. Under Driveways: With at least 36 inches cover over top.
2. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

C. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

D. Extend buried chilled water piping and connect to building chilled water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate chilled water piping at building wall until building chilled water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material.

E. Install underground piping with self-restrained joints at horizontal and vertical changes in direction.

3.6 JOINT CONSTRUCTION

A. See Division Section 31 for basic piping joint construction.

B. Make pipe joints according to the following:


3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Locking mechanical joints.
2. Set-screw mechanical retainer glands.
3. Bolted flanged joints.
4. Pipe clamps and tie rods.
B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

3.9 CONNECTIONS

A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect buried chilled water piping to interior chilled water piping.

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at 200 psi for two hours. Testing procedure shall be per pipe manufacturer's recommendations.

C. Prepare reports of testing activities.

3.11 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31.

B. Valves Identification:

1. Identify all valves, in main and branch piping located inside the tunnel. Use tags secured with brass "S" hooks or brass chains.

2. Stamp tags with a unique prefix to identify system to which applied, followed by a number (Example: CHS-1, CHS-2, etc.). In general, prefix shall match system abbreviations used on drawings where applicable. Numbering system shall be approved by Owner's Representative.
3. Provide a typewritten list of valves including: valve identification number, location, function, normal position, service, and area served. Mount list as specified and directed. Include additional copy in operation and maintenance manuals.

C. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Tags may be used on small diameter piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and “T”, at each side of penetration of structure or enclosure, and at each obstruction.

3.12 VALVE CHART AND SCHEDULE:

A. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.

3.13 CLEANING

A. Clean and disinfect chilled water piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
   a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
   b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
   c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 33 11 16