University of Oregon
Erb Memorial Union
Eugene, Oregon

Structural and MEP
Package 3
Project Manual

100% CONSTRUCTION DOCUMENTS
Divisions 00-33

16 May 2014

SERA Project Number: 11045

REGISTERED ARCHITECT
DONALD D. EGGLESTON
PORTLAND, OREGON
STATE OF OREGON

SERA

SERA Architects, Inc.

338 NW 5TH AVE
PORTLAND, OREGON 97209
P. 503.445.7372
F. 503.445.7395
SERAPDX.COM

TABLE OF CONTENTS

DIVISION 00 PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 10 TABLE OF CONTENTS
00 31 00 AVAILABLE PROJECT INFORMATION

DIVISION 01 GENERAL REQUIREMENTS

01 10 00 SUMMARY
01 20 00 PRICE AND PAYMENT PROCEDURES
ARCHITECTURAL BULLETIN
01 26 13 REQUEST FOR INTERPRETATION
SERA RFI FORM
01 30 00 ADMINISTRATIVE REQUIREMENTS
01 32 16 CONSTRUCTION PROGRESS SCHEDULE
01 33 00 SUBMITTAL PROCEDURES
LEED MATERIAL TRACKING FORM
SERA ELECTRONIC MEDIA RELEASE
01 33 16 DELEGATED DESIGN PROCEDURES
01 35 15 LEED CERTIFICATION PROCEDURES
LEED CHECK LIST
01 40 00 QUALITY REQUIREMENTS
01 45 19 VAPOR EMISSION AND ALKALINITY TESTING
01 50 00 TEMPORARY FACILITIES AND CONTROLS
01 56 39 TEMPORARY TREE AND PLANT PROTECTION
01 57 13 TEMPORARY EROSION AND SEDIMENT CONTROL
01 60 00 PRODUCT REQUIREMENTS
SUBSTITUTION REQUEST FORM BEFORE BID
SUBSTITUTION REQUEST FORM AFTER BID
01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS
01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
CONSTRUCTION WASTE MANAGEMENT PLAN TRACKING FORM
01 78 00 CLOSEOUT SUBMITTALS
01 91 13 GENERAL COMMISSIONING REQUIREMENTS

DIVISION 03 CONCRETE

03 30 00 CAST-IN-PLACE CONCRETE
03 37 13 SHOTCRETE

DIVISION 05 METALS

05 12 00 STRUCTURAL STEEL FRAMING

TABLE OF CONTENTS

05 31 00 STEEL DECKING
05 40 00 COLD-FORMED METAL FRAMING
05 50 00 METAL FABRICATIONS

DIVISION 06 WOOD, PLASTICS AND COMPOSITES

06 10 00 ROUGH CARPENTRY
06 15 00 WOOD DECKING
06 16 53 MOISTURE RESISTANT GYPSUM SHEATHING
06 18 00 GLUE-LAMINATED CONSTRUCTION

DIVISION 22 PLUMBING

22 05 00 BASIC MATERIALS AND METHODS – PLUMBING
22 05 01 PLUMBING
22 11 23 PLUMBING EQUIPMENT
22 21 13 PLUMBING PIPING, VALVES, AND SPECIALTIES
22 21 23 PUMPOS AND SPECIALTIES

DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING

23 05 00 BASIC HVAC MATERIALS AND METHODS
23 31 13 AIR DISTRIBUTION

DIVISION 26 ELECTRICAL

26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

DIVISION 31 EARTHWORK

31 10 00 SITE CLEARING
31 20 00 EARTH MOVING
31 23 33 TRENCHING AND BACKFILL
31 25 00 EROSION CONTROL

DIVISION 33 UTILITIES

33 10 00 WATER UTILITIES
33 30 00 SANITARY SEWERAGE UTILITIES
33 39 13 SANITARY UTILITY SEWERAGE MANHOLES, FRAMES, AND COVERS
33 40 00 STORM DRAINAGE UTILITIES
33 49 13 STORM DRAINAGE MANHOLES, FRAMES, AND COVERS
33 51 00 NATURAL GAS DISTRIBUTION

END OF TABLE OF CONTENTS

AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Geotechnical Report: Entitled Geotechnical Investigation and Site Specific Hazard Study, dated August 16, 2013.
   1. Original copy is available for inspection at Owner's offices during normal business hours.
   2. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
   3. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.
   4. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

B. Hazardous Material Survey: Entitled Asbestos Survey Report, dated February, 2013.
   1. Original copy is available for inspection at Owner's offices during normal business hours.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SUMMARY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Summary of the Work.

B. Work by Owner.

C. Owner's occupancy.

D. Contractor's use of site and general limitations.

E. Definitions used throughout the Specification and Drawings.

F. Specification formats and conventions.

1.02 PROJECT

A. Project Name: Erb Memorial Union, Addition and Renovation.

B. Owner's Name: University of Oregon.

C. Package 3 consists of some site demolition and clearing, new structural and mechanical, electrical and plumbing construction elements of the Erb Memorial Union Addition.

D. The Project is registered with the US Green Building Council's LEED Green Building Rating System. The Owner's goal and the Contractor's responsibilities for LEED are summarized in Section 01 35 15 - LEED Certification Procedures. Contractor's LEED responsibilities are part of the Work. For the purposes of tracking LEED credits, please note the LEED project boundary and the LEED site boundary indicated on sheets G012 and G013 for your reference.

1.03 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in the Agreement.

B. Permit fee with the City of Eugene will be paid for by The University of Oregon.

1.04 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is shown on drawings and specified in Section 02 41 00.

1.05 WORK BY OWNER

A. Items noted FOIO (Furnished by Owner Installed by Owner) will be furnished and installed by Owner before Substantial Completion. Some items include:
   1. Furnishings.
   2. Small equipment.
   3. Artwork.

B. Owner will supply the following for installation by Contractor:
   1. Room numbering; See Appendix – Room Numbering Guide
   2. Specification of and providing of door hardware; OFCI.
   3. Exterior trash cans. Custom UO design and order, OFOI.
   4. Exterior benches; OFCI.
   5. Toilet dispenser accessories; OFCI.
   6. Exterior light poles, globes, lamps, and junction box; OFCI.
   7. Interior signage on small to medium projects only; OFOI.
   8. Exterior building marker signage; OFOI.
   9. Wall clocks; OFCI.
   10. Waste receptacles for all spaces; OFOI.
   11. Ash posts or smoking stations. OFOI; Custom UO fabrication.
   12. Walk off mats; OFOI.

C. Third party entities hired by the Owner may include, but are not limited to, the following:
   1. Cost estimator.
   2. Site survey.
   3. Certified arborist services.
   4. Special inspections and testing services (See Section 01 40 00).

5. Water and air balancing and testing services.
6. Commissioning services.
7. Energy analyst.
8. Geotechnical consultant.
9. Hazardous materials testing and monitoring.
10. Asbestos removal.

1.06 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.07 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. No Smoking Policy: Smoking is prohibited in Project Site.

C. Provide access to and from site as required by law and by Owner:
1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
2. Do not obstruct roadways, sidewalks, or other public ways without permit.
3. Unless written approval is obtained, construction must not obstruct private or public streets, driveways, pedestrian walkways, ADA routes, fire lanes, egress of occupied buildings, etc.
4. Coordinate construction detour routes for bikes, pedestrians, vehicles, etc. with FS Exterior Supervisor, PP, PM, and as needed DPS.

D. No disposal or recycling on university property outside construction area(s) unless approved by PM.

E. No burying of any demolition or construction materials on site.

F. No stockpiling of waste on-site beyond the period necessary for sorting and accumulation of practical quantities for transport off-site.

G. Description of Work times may be limited beyond requirements set by city codes.

H. In the event the Conractor encounters material that is believed to be hazardous, asbestos containing, coated with lead base paint, and/or oily debris the Contractor shall immediately stop work in the affected area and report the condition to the PM. At no time shall such material be disturbed, handled or disposed of by the Contractor. The Contractor will cooperate and work with the PM, EH&S, any Consultants, and abatement Contractors engaged by the Owner.

I. Protection of existing conditions:
1. Provide necessary measures required to fully protect existing conditions.
2. Restore permanent facilities used during construction to their specified and/or original condition.

J. When required, provide scaffolding erected by a certified erector following OSHA guidelines.

K. Reference Section 00 31 00 – Available Project Information, for information on known asbestos containing materials and locations to be provided protection to prevent disturbance.

1.08 DELEGATED DESIGN REQUIREMENTS

A. General requirements for Delegated Design components are specified in Section 01 33 16.

B. Specific design requirements are specified in Sections of Division 02 through 50.

C. Delegated design may sometimes also be referred to as "Design-Build." Both terms may be used interchangeably and have the same meaning.

1.09 DEFINITIONS

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

1. Basic Contract Definitions: Contact Documents, Work, Project, Drawings, Specifications, Project Manual, Owner, Contractor, Subcontractor, Architect, Contract Time, Day, Substantial Completion, Contract Sum (or GMP), Change Order.
2. Basic contract definitions that are not defined in the General Conditions shall have the same meaning as defined in AIA Document A201 – 1997.

B. "AHJ": Authority Having Jurisdiction as defined in AIA Document A201.

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

D. "Delegated Design": Professional design service or certification specifically required of the Contractor in the Specifications. Such work is subject to provisions of AIA Document A201 § 3.12.10. The terms "Delegated Design," and "Design-Build," mean the same thing and are used interchangeably.

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

F. "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."

G. "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.

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

I. "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, complete and ready for the intended use.

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

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

L. "Work": Project material "furnished" and "installed" complete and ready for the intended use.

1.10 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's MasterFormat 50-Division numbering system.

B. Sections in Division 01 govern the execution of the Work of all Sections in the Specifications and Drawings.

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Contract modification procedures.

C. Additional architectural service for extraordinary contract administration.

D. Procedures for preparation and submittal of application for final payment.

1.02 DEFINITIONS

A. Architectural Bulletin (AB): Architect's form issued by Architect indicating "Architect's Supplemental Instruction" or "Proposal Request" or "Construction Change Directive" or as a signature cover to Contractor initiated proposal.
   1. AB Form is enclosed at end of Section.

B. B. Architect's Supplemental Instruction (ASI): Minor change in Work directed by Architect.

C. Proposal Request (PR): A formal request from Architect to Contractor for change in Contract Sum and Time required to perform a proposed change in Work. Proposal Request is not a directive to perform the proposed change.

D. "Construction Change Directive" and "Change Order" have meanings defined in AIA Document A201.

E. Additional Contract Administration Services: Architectural service to enforce Contract Documents resulting from Contractor's failure to comply with requirements or Contractor's request for accelerated procedures.

1.03 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

B. Forms filled out by hand will not be accepted.

C. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization.

F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

G. Revise schedule to list approved Change Orders, with each Application For Payment.

H. See 1.4 Applications for Progress Payments for additional requirements.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Present required information in typewritten form.

E. Form: AIA G702 Application and Certificate for Payment and AIA G703 - Continuation Sheet including continuation sheets when required.

F. Procedures for preparation and submittal of applications for progress payments in addition to those stated in the General Conditions and General Requirements also include:
   1. LEED project submittal summary is to be included with each payment application before application can be processed. Additionally, one half of one percent from each payment

application will be allocated and held until released upon approval of the final LEED submittal.

2. One half of one percent from each payment application will be allocated and held until released upon approval of the final Operation and Maintenance Manual submittal. The Contractor shall submit a draft Operation and Maintenance Manual to the Architect upon 75 percent project completion.
3. One half of one percent from each payment application will be allocated and held until released upon approval of the final Record Document submittal.
4. One half of one percent from each payment application will be allocated and held until released upon approval of the final Commissioning submittal.
5. The above items, where applicable, will be listed as separate line items on the Contractor's schedule of values.

G. Changes in the work shall be initiated using the SERA Architectural Bulletin (AB) Form.

H. Additional contract administration services is an additional architectural service and will be billed to the Owner who will then back-charge the Contractor.

I. Execute certification by notarized signature of authorized officer.

J. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.

K. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

L. Submit three copies of each Application for Payment.

M. Include the following with the application:
1. Construction progress schedule, revised and current as specified in Section 01 30 00.
2. Current construction photographs specified in Section 01 30 00.
3. LEED submittals applicable to work for which application is being made; see Section 01 35 15.
4. Project Record Documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
   a. Alternative: Review Record Documents with Architect prior to submitting Application.
5. Preliminary Closeout Documents when specified in Section 01 78 00.
6. Affidavits attesting to off-site stored products.
7. Contractor payment requests must be accompanied by all wage certificates for the billing period.

N. Materials stored off site and included in the schedule of values for monthly payment application are to be stored in a bonded and secure facility. Copies of bill of sale for materials and certificate of insurance for material with Owner named as an insured are to be included with the payment application.

O. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

B. Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing supplemental instructions on Architectural BulletinForm.

C. Construction Change Directive: Architect may issue an AB, signed by Owner, instructing Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change.

D. Proposal Request: Architect may issue an AB which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 15 days.

E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 60 00. Contractor proposal will be processed in one of the following methods:
   1. Architect may reject Contractor proposal or may return it for modification.
   2. Architect may attach Contractor proposal to SERA AB, complete the AB appropriately, and distribute it for signatures.
   3. Architect may accept Contractor's form that has place for signatures, sign it and distribute to Owner for signature.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For pre-determined unit prices and quantities, the amount shall be based on the fixed unit prices.

G. Substantiation and Computation of Costs: Provide complete itemized cost information with substantiating backup for each item for evaluation as follows:
   1. Quantities of products, labor, and equipment.
   2. Taxes, insurance, and bonds.
   3. Overhead and profit on products and labor only. Overhead and profit is limited as follows:
      a.
      b. Upper tier contractor: 5%
   4. Justification for any change in Contract Time.
   5. Credit for deletions from Contract, similarly documented.
   6. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly enter changes in Project Record Documents.

1.06 EXTRAORDINARY CONTRACT ADMINISTRATION SERVICE

A. Owner-Architect Agreement identifies certain additional services for which Architect may receive additional compensation. Some of these services may result out of actions or non-actions by Contractor; these include, but are not limited to:
   1. Design services for modification resulting from substitution proposed by Contractor.
   2. Review of submittals after the first re-submittal.
   3. Review or response to unnecessary or frivolous RFI.
   4. Second notification and review of non-compliant work.
   5. Design services to correct or incorporate non-compliant work.
   6. Design or engineering specified as Contractor's responsibility; for example, for design-build component or for performance-specified work.
   7. Performing administrative work specified as Contractor's responsibility when Contractor refuses to perform after notification.
   8. Performing administrative work specified as Contractor's responsibility when requested to expedite the Work.

9. Providing extra construction administration services after the specified date of Substantial Completion or the specified date of Final Completion when delay is not caused by Owner.
10. Re-inspection for Substantial Completion or Final Completion.

B. Architect will issue Notice for Extraordinary Contract Administration Services to Owner and a copy to Contractor. Thereafter, Architect will record time and expense for each occurrence, or in the case of recurring occurrences, each type of occurrence.
   1. Architect will, at their discretion, invoice Owner monthly for additional services.
   2. Architect's fee schedule for additional services is included in Owner-Architect Agreement, and is available to Contractor upon request.

C. Owner reserves the right to charge the cost of Architect's extraordinary contract administration service plus 10% administration cost to Contractor in an AB.

1.07 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 70 00. Prior to any final payment(s) all required as-built and O&M documentation as listed in Section 01 70 00 must be received by Owner.
   2. Affidavit that payrolls and bills have been satisfied.
   3. Consent of Surety to make Final Payment.
   4. Certificate evidencing that Builder's Risk Insurance required after Substantial Completion will remain in force, and a written statement that Contractor knows of no reason that insurance will not be renewed for the required period until Final Payment.
   5. Prior to any final payment(s) all keys checked out to Contractor(s) and/or Consultant(s) must be returned to DPS and a receipt of return provided to PM by DPS.

END OF SECTION

Architectural Bulletin

SERA
ARCHITECTURE
URBAN DESIGN + PLANNING
INTERIOR DESIGN

Project Name
Project Number
Owner
Owner Contract No. (if any)

Bulletin No.
Date Issued
Contractor

Subject

The following instruction is hereby issued:

ARCHITECT'S SUPPLEMENTAL INSTRUCTION (complete **PART A** only)

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates the Contractors acknowledgement that there will be no change in the Contract Sum or Contract Time.

PROPOSAL REQUEST (complete **PART A** only)

Please submit an itemized quotation for changes to the Contract Sum and/or Contract Time incidental to the proposed modifications of the Contract Documents described below. DO NOT PROCEED WITH WORK UNTIL RECEIVING FURTHER WRITTEN INSTRUCTION This is not a change order, a construction change directive or a direction to proceed with the work described herein.

CONSTRUCTION CHANGE DIRECTIVE (complete **PARTS A & B**)

You are hereby directed to make the following change(s) in this Contract. Track the costs of changes to the Contract as described in *proposed adjustments* (Part B) below.

PART A: DESCRIPTION OF WORK

X.1 (DISPOSITION) (Description – describe work scope in this space – text to be Title Case and not bold. Column to left, i.e. "disposition" to denote type of change using on the following works (or iterations), "**ADD**", "**DELETE**", "**CLARIFY**", or "**CHANGE**". Disposition text to be ALL CAPS and **bold**.)

ATTACHMENTS

Issued by: SERA Architects, Inc.

PART B: PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:

   Unit Price of $ per
   Lump Sum (increase) (decrease) of $
   As provided in Subparagraph 7.3.3 of AIA Document A201 1997 Edition
   As follows:

2. The Contract Time is proposed to:

   Remain unchanged
   Be adjusted with an (increase) (decrease) of days

REQUEST FOR INTERPRETATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes procedure for coordinating and submitting Request for Interpretation.

1.02 DEFINITIONS

A. RFI: Request from Contractor to Architect seeking interpretation or clarification of the Contract Documents.

1.03 RFI PROCEDURE

A. Review Contract Documents and Project Site in a thorough and timely manner so Architect will have sufficient time to respond to RFI prior to execution of subject construction.
   1. Claim for additional Time or Cost when RFI is answered within time limit specified in this Section will be rejected.

B. Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
   1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

C. When possible, request interpretation at next Progress Meeting. Record Architect’s response in meeting minutes.
   1. When response is not given during meeting, submit RFI in approved format.

1.04 SUBMITTALS

A. RFI Form: Electronic form furnished by Architect, numbered and signed by Contractor.
   1. Number each page of attachments with RFI number in lower right corner.
   2. Attachments shall be electronic files in Adobe Acrobat PDF format.
   3. Alternative RFI Form: Subject to Architect’s approval, Contractor software-generated form modified to match Architect’s form. Numbering and attachments as specified in this Section.

B. RFI Content: Include detailed, legible description of item needing interpretation and the following:
   1. Project name and number.
   2. Date.
   3. Name of Contractor.
   4. Name of Architect.
   5. RFI number, numbered sequentially. Add revision numbers as decimal and digit.
   6. RFI subject title, less than five words
   7. Initiator of question
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
   10. Field dimensions and conditions, as appropriate.
   11. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state anticipated impact in the RFI.
   12. Contractor's signature.
   13. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
      a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
   14. Single discipline per RFI: Architectural, Civil, Structural, Mechanical or Electrical
   15. Space for reply on same page, if possible.

C. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B or approved form. Include the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were dropped and not submitted.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.
   8. Identification of related Minor Change in the Work, Instrument of Change, Construction Change Directive, or Proposal Request, as appropriate.

1.05 ARCHITECT'S ACTION

A. Architect will review each RFI, determine action required, and return it. Allow 14 days for Architect's response for each RFI; and additional 7 days for consultant review. RFIs received after 1:00 p.m. will be considered as received the following working day.
   1. Failure to allow specified response time will not be cause for an extension of Contract Time or additional cost.
   2. Architect's goal will be to return RFI as quickly as possible. However, quick response is not guaranteed.
   3. The following RFIs are defined as frivolous and will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for information already indicated in the Contract Documents.
      d. Requests for information derived from activities assigned to Contractor in the Contract Documents.
      e. Requests for approval of adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect's actions on submittals.
      g. Incomplete RFIs or RFIs with numerous errors.
      h. Questions relating to construction means, methods, techniques, sequences, procedures or safety precautions. (These are Contractor’s responsibility exclusively.)
      i. Questions relating to construction schedule, coordination between trades, or division of work among subcontractors. (These are also Contractor’s responsibility exclusively.)
   4. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
   5. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Contract Modification Procedures.
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
      b. Do not proceed with this work until Change Order is executed.

B. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 5 days if Contractor disagrees with response.

C. Frivolous RFI: Architect may claim compensation for cost of Architect’s time and materials as a result of unnecessary or frivolous RFIs. Compensation will be assessed to Contractor in accordance with Section 01 20 00 - Price and Payment Procedures.

1.06 QUALITY ASSURANCE

A. Contractor shall strive to keep the number of RFIs to a minimum.
   1. Prior to submitting RFI, carefully study Contract Documents to assure that requested information is not already available. RFIs that request information available in the Contract Documents will be considered frivolous.

B. RFI is not a substitute for Shop Drawing. When multiple RFIs are submitted for related work, Architect may require a Shop Drawing.

C. RFI submitted by Fax is not acceptable.

END OF SECTION

SERA

ARCHITECTURE
URBAN DESIGN + PLANNING
INTERIOR DESIGN

Request for Interpretation

Project Name:
Project Number: **Request for Interpretation No.:**
Owner: **Date Issued:**
Attention: **Time:**
Owner Contract No. (if any): **Contractor:**

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgement that there will be no change in the Contract Sum or Contract Time.

Description:

Specification Section: _____ Paragraph: _____ Article: _____

Drawing Title: _____ Sheet #: _____ Reference: _____

Request:

Requested By: _____ Initiating Sub. (if app.): _____

Title: _____ Request Reply By: _____

Architect/Consultant Response:

Accepted: ☐ Accepted as Noted: ☐ Not Accepted: ☐

Response:

BY: _____ Date: _____

Attachments:

☒ Owner ☐ Consultant ☐ Contractor ☐ Other

☒ Architect ☐ Consultant ☐ Field ☐ Other

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ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project coordination.

B. Communication with Architect.

C. Coordination Drawings.

D. Pre-construction meeting.

E. Progress meetings.

F. Pre-installation meetings.

1.02 SUBMITTAL PROCEDURES

A. Specified in Section 01 33 00 - Submittal Procedures

1.03 SUBMITTALS

A. Construction Submittal Requirements:

B. PM shall receive a minimum of one stamped original of all submittals at the time of Consultant approval.

C. PM will provide the A/E and GC with a list of submittal items that require concurrent FS Maintenance & PM review and approval prior to official submittal acceptance. This list consists of, but is not limited to the following items:
   1. Variable Frequency Drives, VFD
   2. AHU and motor-mounts
   3. Transformers
   4. Building controls
   5. Soils
   6. Light Fixtures
   7. Backflow devices
   8. Fire Alarm systems
   9. Fire sprinkler components

D. Pre-Construction Meeting Submittals: Bonds, insurance, schedule of values, project personnel directory, subcontractor and supplier list, and other lists; specified in other Sections.

E. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
   1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

F. Minutes of meetings required in this Section.

G. Coordinated Ceiling Drawings: Submit within 60 days of Notice to Proceed. Submit 1 set of color plots or color copies on white bond paper. Transmit CADD files.
   1. Architect will review, stamp and return one copy with comments within 14 days after receipt. Procedure requirements for Shop Drawings in Section 01 33 00 apply.
   2. Architect's review is for compliance with design intent and does not relieve Contractor of coordination and performance requirements.
   3. Copy reviewed drawings and distribute to appropriate entities.

1.04 PROJECT COORDINATION

A. Coordinate construction operations specified in different Sections to ensure efficient and orderly installation of each part of the Work. Coordinate portions of work that depend on each other for proper installation, connection, and operation.

B. In the event of an inconsistency in the Drawings or between the Drawings and the Specifications, unless otherwise ordered in writing by the Architect, the Contractor shall provide the greater quantity and/or better quality of work.

C. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
   2. Sheet Size: At least 8-1/2 by 11 inches but no larger than Project Drawings.
   3. Media: CADD electronic "dwg" files unless other media is approved by Architect.

1.05 DIGITAL COMMUNICATION

A. Communication to Architect: High speed internet based digital, except Submittals specified in Section 01 33 00.
   1. Telephone communication is acceptable for initial or simple issues.
   2. Follow up telephone communication in writing.

B. Construction Office Equipment:
   1. High speed internet connection equipment and service.
      a. Email Attachment Capacity: Not less than 10 megabytes.
   2. Computer with internet connection and project management software:
      a. MicroSoft Office 2000 or newer with Word, Excel, and Outlook.
      b. Adobe Reader, current edition.
      c. Project scheduling software.
   3. Scanner, not less than 150 dpi.
   4. Copy machine not less than 400 dpi with capability for 11 x17 and color.
   5. Telephone with conference call capability
   6. Digital camera, 3.5 megapixel minimum.

C. Correspondence:
   1. correspondence by FAX is not acceptable unless specifically approved.
   2. Any information that is disseminated shall retain the original scale and aspect from the original as published by Architect.

1.06 COORDINATED CEILING DRAWINGS

A. Content and View: Two views, concealed conditions and visually exposed conditions, shown as reflected plans. Indicate actual size of components at scale sufficient to show no interference and adequate space for installation and maintenance of each component.
   1. Concealed Conditions View: Including, but not limited to: mechanical systems (plumbing, ductwork, HVAC Equipment, piping, controls, fire protection systems, etc.); electrical systems (wiring, raceway, conduit, cable trays, controls, fire and life safety systems, lighting, alarm devices, etc.); structural elements (beams, girders, etc); acoustical systems, ceiling equipment supports.
   2. Exposed Conditions View: Including, but not limited to: mechanical; electrical; structural elements as noted above; acoustical systems; lights – pendants, surface and recessed; exit signage; directional signage; conduit; grilles; diffusers; damper actuators; sprinkler

heads/type, speaker locations, access panels with sizes indicated, smoke detectors and alarm devices, and any other item or element that will be seen when looking at the ceiling.

B. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

C. Congested Areas: Provide more detailed plan and either vertical sections or 3-dimensional CADD model.

D. Media: CADD plans, sections, and models for color plotting; ".dwg" file format.

E. Show the following in different colors for each system: structure, HVAC, plumbing, piping, electrical, fire protection, other work.

F. Distribute Coordinated Ceiling Drawings among affected entities for review. Resolve conflicts and incorporate corrections into drawings prior to submitting to Architect.
   1. Work that is not included in Coordinated Ceiling Drawings shall be coordinated and installed without conflicts or defects, and without change in Time or Cost.

1.07 PRECONSTRUCTION MEETING

A. Owner/Architect will schedule meeting after Notice to proceed.

B. Meeting location shall be either on site at FS or conducted by the Lead Consultant with PM.

C. Attendance Required: Owner, Owner’s project manager, Architect and Contractor.

D. Agenda items at a minimum and/or applicable include the following; List is subject to addition as needed:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of complete list of Subcontractors, with contact information, list of products, schedule of values, submittal schedule, and construction progress schedule with any critical path work sequencing and long lead time materials.
   5. Designation of key personnel representing parties in Contract, Owner and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, RFIs, requests for applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Construction site access: pick-up, delivery, and parking; temporary facilities and controls, security, safety, and restrictions.
   8. Scheduling activities of Testing Agent.
   9. Progress cleaning.
   10. Anticipated building service or system interuptions, and impact to building operations/occupants.
   11. Owner occupancy, schedule, and activities requiring accommodation and/or coordination.
   12. Use of site, campus premises, and existing buildings.
   13. Office, work, and storage areas.
   14. All shut-off locations.
   15. Define plan to reduce impact to building users regarding application of finishes, paints, adhesives, etc.
   16. Utility mete removals or connections.
   17. Facilities EH&S items include but are not limited to the following:
      a. List of emergency contacts, and contact information.
      b. Process for accessing emergency assistance.
      c. Process for spills and clean-up.
      d. EH&S expectations regarding maintaining safe conditions for UO employees, students, visitors, construction workers, etc. including odors, egress, avoidance of fire alarms, etc.
      e. If applicable, EH&S expectations regarding compliance with erosion control permits.

E. Contractor shall record minutes and distribute copies within four (4) days after meeting to participants, with one original copy to Architect, Owner and those affected by decisions made.

1.08 CONSTRUCTION PROGRESS MEETING REQUIREMENTS

A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals.
   1. Architect may elect to attend by telephone conference call.

B. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, or Owner's representative, Architect/Engineer, as appropriate to agenda topics for each meeting. Architect shall attend in person or via conference call at Architect's discretion.

C. Meeting location shall be on site and conducted by the GC or CM.

D. Meeting minutes shall be by the GC or CM and distributed to attendees and to individuals requesting courtesy copies.
   1. Courtesy copies shall be provided to N&TS.

E. Agenda items at a minimum and/or applicable include the following; List is subject to addition as needed:
   1. Review minutes of previous meetings.
   2. Review of Work progress overall construction schedule progress and status.
   3. Field observations, problems, and decisions.
   4. Identification of problems impeding planned progress.
   5. Review of submittals schedule and status, RFIs and status, and proposal requests/change orders and status.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of construction progress schedule with 3 week detailed schedule of coming weeks' activities and needed shutdowns.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period with 3 week detailed schedule of coming weeks' activities and needed shutdowns.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Owner schedule and activities requiring accommodation and/or coordination.
   14. Site access & utilization and any changes due to construction or delivery activities.
   15. Work hours and notification of evening or weekend events needing notification to campus.
   16. Status of correction of deficient items.
   17. Pending changes.
   18. Payment request status.
   19. Other business relating to Work.

F. Contractor shall record minutes and distribute copies within four (4) days after meeting to participants, with one (1) original copy to Architect, Owner, and those affected by decisions made.

1.09 PRE-INSTALLATION MEETING

A. When required in individual specification sections, convene pre-installation meeting at Project site prior to commencing work of specific section.

B. Work undertaken or completed without convening a pre-installation meeting shall be subject to removal, inspection, testing, observation, etc at the Architect's discretion without additional compensation to Contractor in time or money. Work required as a result of removal, inspection, testing, observation, etc., even though determined to be satisfactory, shall be provided without additional compensation to the contractor in time or money.

C. Require attendance of parties directly affecting, or affected by, Work of specific section including the Architect, Owner, Design Engineer, manufacturer (representative and technical support) and key personnel of the installation team.

D. Notify Architect seven (7) days in advance of meeting date.

E. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.
   2. Review coordination with related work.

F. Record minutes and distribute copies within four (4) days after meeting to participants, with one original copy to Architect, Owner, and those affected by decisions made.

END OF SECTION

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

C. Short interval schedule.

1.02 REFERENCES

A. AGC (CPSM) - Construction Planning and Scheduling Manual; Associated General Contractors of America; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM, O'Brien, McGraw-Hill Book Company; 2006.

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit Preliminary Schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
   1. List Owner and other scheduled or projected building user activities and milestones coordinated within the construction activities schedule.
   2. List Owner Furnished Contractor Installed (OFCI) and Owner Furnished Owner Installed (OFOI) items, delivery dates, and completion dates.
   3. Required shutdowns must be requested by the Contractor to PM a minimum of two (2) weeks in advance.
   4. Notify PM for distribution of advanced notice to campus a minimum of forty eight (48) hours
   5. prior to start of disruptive work, including but not limited to vibration, noise, or odors that may occur wirhin occupied buildings or neighboring buildings.
   6. List commissioning activities and milestones.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed Baseline Schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.
   2. Include narrative report that identifies critical, near-critical and major activities in sufficient detail that explains their significance.

D. Within 10 days after joint review, submit Baseline Schedule.

E. Submit updated schedule with each Application for Payment.

F. Short Interval Schedule: Submit copies to attendees at each Progress Meeting.

1.04 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with 5 years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.05 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size (overall schedule): Maximum 22 x 17 inches or width required.

C. Diagram Format: Color. Printed copy and Adobe pdf.

D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 BASELINE SCHEDULE

A. Baseline (Construction Progress) Schedule is a continuation of the Preliminary Schedule that shows the entire, complete construction activity. Actual progress of the Work will be measured against the Baseline Schedule.

B. Revisions to the accepted Baseline Schedule are subject to review and approval.

3.03 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
   1. Include Pre-Installation Meetings.

B. Identify each item by specification section number.

C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

D. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, Products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
   1. Refer to Section 01 33 00 for more requirements.

E. Indicate delivery dates for owner-furnished products.

F. Provide legend for symbols and abbreviations used.

3.04 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. Listing of activities on the critical path.

3.05 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.06 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect including the effects of changes on schedules of separate contractors.

3.07 RECOVERY SCHEDULE

A. Prepare and submit Recovery Schedule and Narrative Report that demonstrates how lost time will be recovered when one of the following occurs:
   1. Project falls behind schedule more than 14 days.
   2. Project falls behind schedule more than 10% of remaining duration to Substantial Completion.

B. Submit Recovery Schedule within 7 days of falling behind schedule.

C. Recovery Schedule is subject to review and approval.

3.08 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

3.09 SHORT INTERVAL SCHEDULE

A. Description: Three week schedule of current and near-future construction activity.
   1. Duration: 3 weeks
   2. Time Increment: Day
   3. Bar chart with separate bar for each trade that is active at Site, sequentially organized, beginning with continuing activities.
   4. Indicate crew size for each activity.
   5. If activity differs from Baseline Schedule, compare Baseline to proposed activity as adjacent bars.

B. Format: Single letter size or ledger size sheet. Bond paper copy and Adobe.pdf.
   1. Hand drafted or computer generated schedule at Contractor's option.

C. Update schedule weekly.

END OF SECTION

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal control report and submittal procedure.
B. Proposed products list.
C. Product data.
D. Sustainable building data.
E. Shop drawings.
F. Samples.
G. Design data.
H. Test reports.
I. Certificates.
J. Manufacturer's instructions.
K. Manufacturer's field reports.
L. Construction photographs.

1.02 SUBMITTAL CONTROL REPORT

A. Prepare and maintain a separate material delivery log to monitor submittals required by the contract documents. Show:
   1. Work item number corresponding to the specification section and construction schedule.
   2. Contractor, subcontractor, sub-subcontractor or supplier responsible for each work item.
   3. Narrative description of the work item.
   4. Number of days required for preparation of the submittal.
   5. Date submittal due.
   6. Number of days allowed for approval.
   7. Date approval due.
   8. Number of days required to fabricate and deliver item to the Contractor.
   9. Date of delivery.
   10. Date item required to be installed, corresponding to the construction schedule.
B. Distribution:
   1. Distribution copies of reviewed schedule to: Architect, Owner’s Representative.
   2. Instruct recipients to report any inability to comply and provide detailed explanation with suggested remedies.

1.03 SUBMITTAL PROCEDURE

A. Construction Submittal Requirements:
   1. PM shall receive a minimum of one stamped original of all submittals at the time of Consultant approval.
   2. PM will provide the A/E and GC with a list of submittal items that require concurrent FS Maintenance & PM review and approval prior to official submittal acceptance. This list consists of, but is not limited to the following items:
      a. Variable Frequency Drives, VFD
      b. AHU and motor-mounts
      c. Transformers
      d. Building controls
      e. Soils
      f. Light Fixtures
      g. Backflow devices
      h. Fire Alarm systems
      i. Fire sprinkler components
B. Organize and submit complete information into separate submittals for each Specification Section listed in Table of Contents, except as follows:

1. Consolidated Division submittal for Sections in the following Divisions:
   a. Division 21, 22, and 23.
   b. Division 26, 27 and 28.
   c. Division 31, 32, and 33, except 1 separate consolidated submittal for Landscaping is acceptable.
2. Doors, door frames and door hardware: 1 consolidated submittal.
3. Exterior curtainwall, storefront and entrance systems: 1 consolidated submittal.
4. Exceptions must be approved by Architect.

C. Number submittals sequentially, followed by specification Section number.
   1. Revisions: Add "R-1" to submittal number; example "034- 08 51 13 R-1".

D. Transmittal or Cover Sheet: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
   1. Transmittal Form: Use CSI Form 12.1A.
   2. Incomplete transmittal form will be returned.

E. Contractor's Review: Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
   1. Review submittals prior to submission and provide stamp of approval signed or initialed by Contractor.
      a. Contractor’s review indicates that Contractor has thoroughly reviewed the submittal and certifies that it is complete, correct, in compliance with the Contract Documents, and suitable for the Project.
      b. Review represents that field measurements and field conditions have been considered and that the work submitted will perform as intended.
      c. Review of Shop Drawing represents that required coordination with other work has been performed and is indicated in Shop Drawing.
   2. Architect will not review submittals that do not include Contractor's signed review stamp, do not include required field conditions, or are not accurate.
   3. Include written description and graphic demarcation of deviations from requirements of Contract Documents.
   4. All work done prior to approval of submittals shall be at the Contractor’s risk.

F. Clearly indicate all options, colors, accessories, data, etc, provided for this Project.

G. Identify variations from Contract Documents. Identify product limitations which may be detrimental to successful performance of completed Work.

H. Allow space on submittals for Contractor and Architect review stamps.

I. Schedule submittals to expedite Project. Deliver submittals to Architect at SERA Architects Inc. Coordinate submission of related items.
   1. Deliver one additional copy each to Owner

J. For each submittal, allow 14 days excluding delivery time from and to Contractor.
   1. Allow additional 7 days for any one of the following submittals:
      a. Major building components or consolidated submittals.
      b. Review by Architect's consultant.
      c. Review by Commissioning Agent.

K. When revised for resubmission, identify changes made since previous submission.

L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

1.04 PRODUCT DATA

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

1. Provide product data whether specified or not specified in Section.
2. If information that must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
3. Mark each copy of each submittal to show which products and options are applicable.

B. Include the following information, as applicable:
1. Manufacturer's written recommendations.
2. Manufacturer's product specifications.
3. Manufacturer's installation instructions.
4. Standard color charts.
5. Manufacturer's catalog cuts.
6. Wiring diagrams showing factory-installed wiring.
7. Printed performance curves.
8. Operational range diagrams.
9. Mill reports.
10. Standard product operation and maintenance manuals.
11. Compliance with specified referenced standards.
12. Testing by recognized testing agency.
13. Application of testing agency labels and seals.
14. Notation of coordination requirements.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. Submit one electronic copy in PDF format.

F. Architect will return a reviewed electronic copy in PDF format.

1.05 SUSTAINABLE BUILDING DATA

A. Submit information applicable to Sustainable Building Requirements, LEED certification, and Environmental Responsibility.
1. Recycled content as applicable: Percent post consumer and percent post industrial, on Manufacturer's letterhead or published data certified by SCS.
2. Rapidly renewable materials as applicable: List percent of materials whose source is replaced or renewed within a 10 year period.
3. Local materials as applicable: List material amount, cost, source of manufacture and distance to site in miles, on Manufacturer's letterhead.
4. Locally harvested or extracted as applicable: List material amount, cost, source and distance to site in miles, on Manufacturer's letterhead.
5. Levels of Volatile Organic Compounds (VOC).
6. FSC Wood products as applicable: List FSC % (FSC Pure, FSC Mixed Credit, FSC Mixed (NN)%)
7. Verification of no added Urea-Formaldehyde in composite wood and agrifiber products used on the interior of the building.

1.06 SHOP DRAWINGS

A. Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on standard printed data or reproductions of the Contract Documents, unless submittal of Architect's CAD Drawings is permitted.
1. Provide Shop Drawings for work indicated in Sections and when needed to execute the Work.

B. Electronic copy of Architect's CADD drawings (floor plans, site plan and ceiling plans, only) will not be provided.

C. Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

1. Dimensions.
2. Three dimensional axonometric views of flashings, pans and sheet metal details.
3. Identification of products.
4. Fabrication and installation drawings.
5. Roughing-in and setting diagrams.
6. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
7. manufacturing instructions.
8. Templates and patterns.
9. Schedules.
10. Design calculations.
11. Compliance with specified standards.
12. Notation of coordination requirements.
13. Notation of dimensions established by field measurement.
14. Relationship to adjoining construction clearly indicated.
15. Seal and signature of professional engineer if specified.
16. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

D. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. Submit copies or transparencies as follows:
1. 8.5 by 11 inch or 11 by 17 inch size: Submit 4 copies on bond paper.
2. Larger than 11 by 17 inches: Submit 4 copies on bond paper.
3. Submit 1 additional copy for Architect's consultant's review.

1.07 SAMPLES

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

B. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

C. Identification: Attach label on unexposed side of Samples that includes the following:
1. Generic description of Sample.
2. Product name and name of manufacturer.
3. Sample source.
4. Number and title of appropriate Specification Section.

D. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
1. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
2. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

E. Samples for Initial Selection: Submit 2 manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

F. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
1. Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned.

2. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
3. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

G. Finishes, products and/or materials noted as custom, hand worked, etc shall be submitted to Architect for review and approval prior to fabrication/installation. Allow for minor revisions to sample in terms of finish, fabrication, installation and/or sequencing.

H. Field Samples: Large size samples and assembled samples that shall be submitted at the Project Site are specified in individual Sections.

1.08 DESIGN DATA

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

B. Submit for Architect’s information.
1. Architect's review is limited to assessing conformance with design concept expressed in Contract Documents.

C. Refer to Section 01 33 16 - Delegated Design Procedures.

1.09 TEST REPORTS

A. Submit for Architect's knowledge.

B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect.

1.11 QUALIFICATION DATA

A. When specified in individual specification sections or requested by Architect, submit qualifications for manufacturer, installer, or subcontractor.

B. Data may include previous experience, list of previous similar projects, references, proof of training, and approval by manufacturer or warrantor.

1.12 SAMPLE WARRANTY

A. When warranty is specified in a Section, submit sample of specified warranty with initial product submittal.

B. Final warranty submittal is specified in Section 01 78 00 - Closeout Submittals.

1.13 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect for delivery to Owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.14 MANUFACTURER'S FIELD REPORTS

A. Submit reports for Architect's benefit as contract administrator or for Owner.

B. Submit report in duplicate within 30 days of observation to Architect for information.

C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.15 CONSTRUCTION PHOTOGRAPHS

A. Photographic Documentation Requirements by Contractor:
   1. This requirement may be waived at Owner discretion.
   2. Monthly, an 8”x10” printed photograph. On the front of the photograph identify the project name, location where photograph was taken, and month/date/year.
   3. At project start before demolition, a photo record of the project site, surrounding and adjacent structures and conditions.
   4. At final completion, final color photo documentation; date stamped on the back of the photo.
   5. With closeout documentation submittal a complete digital set of all construction photographs shall be included.

B. Provide photographs of site and construction throughout progress of Work including those required for LEED credits SSp1 and EQc3.1.

C. Each month submit photographs with Application for Payment.

D. Photographs: Digital camera, 3.5 mega pixel minimum.

E. Take one (1) site photograph from same direction indicating relative progress of the Work.

F. Deliver digital copies to Owner on approved media (CD, DVD) with project record documents. Catalog and index files in chronological sequence; include word processor table of contents.

END OF SECTION

Electronic Media Agreement

SERA

ARCHITECTURE
URBAN DESIGN + PLANNING
INTERIOR DESIGN

THIS AGREEMENT is entered into effective [*insert date]* by and between [*insert party's company name*] ("Recipient") and SERA Architects, Inc. ("SERA") with respect to the [*insert project name*] ("Project") located at [*insert location*].

The Recipient has requested that SERA provide to the Recipient certain drawings, specifications or other documents for the Project in electronic form ("Electronic Form Documents"). SERA agrees to do so, subject to the terms and conditions of this Agreement.

The Recipient recognizes that the Electronic Form Documents may be revised by others without the knowledge or consent of SERA and, when plotted, may result in variances or corrupt other files of the user.

The Recipient agrees not to use the Electronic Form Documents for any purpose or project other than the Project.

The Recipient acknowledges that the Electronic Form Documents are the property of SERA or its consultants and are subject to the copyrights and other reserved rights of those parties. The Electronic Form Documents may be write-protected by SERA such that no data can be manipulated by the Recipient or third parties. SERA may provide to the Recipient only a working copy of Electronic Form Documents which have all indices of SERA, its consultants, and their respective ownership, professional names, and involvement in the Project removed from the electronic display.

Any use of or changes to the Electronic Form Documents shall be at the sole risk of the user, and without liability, risk or legal exposure to SERA or its consultants. The Recipient and any other person or entity using the Electronic Form Documents agrees to release and, to the fullest extent permitted by law, indemnify, hold harmless and defend SERA, its consultants, and their respective partners, shareholders, agents and employees from and against any and all claims, demands, losses, expenses, damages, penalties and liabilities of any kind, including without limitation attorneys' and expert witnesses' fees, arising out of or relating in any way to any such use of or changes to the Electronic Form Documents.

Under no circumstances shall SERA's transfer of the Electronic Form Documents to the Recipient be deemed a sale by SERA or its consultants. SERA and its consultants make no warranties, either expressed or implied, with respect to the Electronic Form Documents, including but not limited to warranties of merchantability or of fitness for any particular purpose.

The Recipient agrees, as a condition of providing the Electronic Form Documents to any contractor, design professional or other person or entity, to require such third party to agree in writing to the terms and conditions of this Agreement.

By electronically accessing the Electronic Form Documents, the Recipient accepts and is bound to the terms and conditions of this Agreement.

RECIPIENT:
Company:_____

Signature:_____

Printed Name:_____

Title:_____

Date:_____

SERA:
SERA Architects, Inc.

Signature:_____

Printed Name:_____

Title: Principal

Date:_____

SERA **LEED® Material Tracking Form**

PROJECT NAME: _____

PROJECT NUMBER: _____

This form serves as a preliminary checklist for evaluating building products and materials and their contribution to and compliance with various LEED-NC credits.
Refer to the LEED-NC Reference Guide for additional requirements and detailed descriptions for each credit.
Always provide the product cutsheet or a signed statement from the manufacturer to authenticate each claim noted in the table below.

A COMPLETED FORM MUST ACCOMPANY EACH SUBMITTAL (ONE PER SPECIFICATION SECTION)

1. Do NOT leave blank cells in a row - if an item is not applicable, mark as **"n/a"**.
2. NOTE: if a product has multiple components, each component must be listed individually with the following information:
   - its percentage of the product by weight. Provide documentation.
   - its distance between source location and project site (see "location" below). If within 500 miles of project site, provide documentation.

SUBCONTRACTOR INFORMATION

COMPANY NAME: _____

CONTACT NAME: _____

ADDRESS: _____

PHONE NUMBER: _____

FAX NUMBER: _____

			COST	LOCATION			CONTENT											
SPEC SECTION	**PRODUCT / MATERIAL**	**QUANTITY** (SF/LF/GAL)	**TOTAL MATERIAL COST** (excludes labor & equipment)	**PERCENTAGE OF EXTRACTED/HARVESTED AND MANUFACTURED/ASSEMBLED** (%)	**DISTANCE BETWEEN MANUFACTUER AND PROJECT SITE** (mi)	**DISTANCE BETWEEN SOURCE OF RAW MATERIALS AND PROJECT SITE** (mi)	**PRE-CONSUMER/ POST INDUSTRIAL RECYCLED** (%)	**POST-CONSUMER RECYCLED** (%)	**RAPIDLY RENEWABLE** (%)	**NEW WOOD** (%)	**FSC CERTIFIED WOOD** (%) Attach vendor's and manufacturer's chain-of-custody certificate number.	**RECYCLED WOOD** (%)	**VOC CONTENT** (g/l) minus water*	**Green Label Plus, FlorScore** (yes/no) (if "YES", provide #)	**ALL WOOD & AGRIFIBER PRODUCTS** (yes/no) NO ADDED UREA-FORMALDEHYDE	**SOLAR REFLECTANCE INDEX** (yes/no) Site Hardscape - 29 min Roof (slope): ≤2:12 - 78 min; ≥2:12 - 29 min	**SALVAGED MATERIAL** (yes/no) (if "YES", provide replacement cost)

*** At a minimum, VOC Content is monitored for the following interior products using the accompanying standards listed below:**
ADHESIVES/SEALANTS: South Coast Air Quality Management District (SCAQMD), Rule #1168 (01/07/05). **AEROSOL ADHESIVES**: Green Seal Standard GS-36 (10/19/00).
PAINTS/COATINGS/PRIMERS: Green Seal Standard GS-11 (05/20/93). **ANTI-CORROSIVE PAINTS**: Green Seal Standard GS-03 (01/07/97). **WOOD COATINGS/SEALERS/STAINS**: SCAQMD Rule #1113 (01/01/04)
CARPETS: Carpet and Rug Institute (CRI), Green Label Plus Program. **CARPET CUSHION/PAD**: CRI, Green Label Program. **CARPET & PAD ADHESIVE**: SCAQMD Rule #1168 (01/07/05).

DELEGATED DESIGN PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Summary of Delegated Design portion of Work.
   2. Permitting for Delegated Design portion of Work.
   3. Delegated Design submittals.

B. Coordinate and assume full responsibility for design, engineering, submittals, fabrication, transportation, and installation of this work.

C. Delegated Design portions include the following:
   1. Temporary shoring and supports for excavation, concrete, walls and other construction.
   2. Section 03 30 00 - Concrete mix design.
   3. Section 03 37 17 - Shotcrete; For shoring.
   4. Section 03 45 00 - Architectural Precast Concrete
   5. Section 05 50 00 - Metal Fabrications, for fabricated railings.
   6. Section 05 51 00 - Metal Stairs.
   7. Section 05 73 00 - Decorative Metal Railings
   8. Section 06 17 53 - Shop-Fabricated Wood Trusses; Plate-connected wood trusses.
   9. Section 07 42 13 - Metal Wall Panels; for furring system and panel attachment to structure.
   10. Section 07 62 00 - Sheet Metal Flashing and Trim;
   11. Section 07 81 00 - Applied Fireproofing.
   12. Section 07 84 00 - Firestopping
   13. Section 08 43 13 - Aluminum Storefronts.
   14. Section 08 44 13 - Glazed Aluminum Curtain Walls.
   15. Section 08 46 13 - Aluminum Window Wall
   16. Section 08 53 13 - Vinyl Windows
   17. Section 08 63 00 - Metal Framed Skylights
   18. Section 08 80 00 - Glazing, for glass strength.
   19. Section 09 21 16 - Gypsum Board Assemblies; For non-structural metal-framed interior partitions, gypsum board ceiling suspension systems and perimeter requirements, and seismic bracing.
   20. Section 09 51 00 - Acoustical Ceilings,for ceiling suspension systems.
   21. Section 11 24 23 - Fall protection.
   22. Section 14 20 10 - Passenger Elevators, including supports for rails, sills and hoisting beams in Division 05. Elevators submittal through normal process, permit costs included for state inspection, and AHJ.
   23. Division 21 - Fire suppression system.
   24. Divisions 21, 22 and 23 - seismic restraint of systems.
   25. Divisions 26, 27 and 28 - seismic restraint of systems.
   26. Division 28.- Fire detection and alarms.
   27. Section 32 80 00 - Irrigation Systems.
   28. See structural notes for other delegated design items.

1.02 DEFINITIONS

A. Delegated Design: Professional design service or certification specifically required of the Contractor in the Specifications.

B. AHJ: Authorities Having Jurisdiction, defined in Section 01 10 00 and AIA Document A201.

1.03 PERFORMANCE REQUIREMENTS

A. Comply with Regulations.

B. Provide complete, operational systems that perform their intended use.

C. Engineer Delegated Design portions for gravity, lateral and seismic loads.
   1. Load criteria is indicated in Structural Drawings. If not indicated, request criteria.

2. Indicate reactions to structure.
3. Provide services of a qualified professional engineer licensed in the Project jurisdiction.

D. Calculate and complete energy forms required by AHJ.

E. Execute the design intent as indicated in Project Drawings and Specifications.

F. Obtain Permits and inspections and pay fees required by AHJ.

1.04 OWNER'S RESPONSIBILITIES

A. The Owner will not pay for progress delays, additional Work, additional products, restocking, or re-working required by Contractor's failure to coordinate Delegated Design work with other Project work.

1.05 SUBMITTALS

A. Preliminary Design: Submit to Architect drawings and product data that describe Contractor’s design prior to performing engineering calculations and Shop Drawings.
1. Architect will evaluate proposed design and comment on conformance with intent of Contract Documents.
2. Preliminary review is for aesthetic and general function concerns and will not constitute approval of engineering.
3. Purpose of this submittal is to avoid engineering and detailing an unacceptable proposal.

B. Permit Review: Submit Delegated Design documents to AHJ for review and approval.
1. When AHJ requires review by Architect or Architect’s consultant, allow 10 days for Architect’s review. Submit documents to Architect and pick-up documents when review is complete. Make corrections noted by Architect.
2. Obtain permits prior to executing work component.
3. Comply with AHJ requirements.
4. Execute corrections to Delegated Design work required by AHJ at no cost to Owner and prior to Substantial Completion.
   a. Notify Architect of changes required by AHJ as soon as they are known.
5. Include design criteria, design assumptions, structural calculations, fabrication and construction details, required clearances, and interface requirements.
   a. Delegated Design drawings are in addition to Shop Drawings.
6. Affix Design Professional's seal for State License on Submittals.

C. Engineer’s qualifications.

D. Product Data, Shop Drawings and Samples: Comply with requirements in Section 01 33 00 for each product of Delegated Design portion of work. Product submittals are in addition to submittals for permit and design data.

1.06 QUALITY ASSURANCE

A. Documentation: Comply with the following:
1. Uniform Drawing System, NCS/UDS published by National Institute of Building Sciences.
2. Minimum text size: 1/8 inch
3. Legible when microfilmed
4. Other requirements of AHJ

B. Design requirements specific to Delegated Design portions are indicated in Drawings and in Sections that specify the component.

C. Engineer’s Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

D. Pre-Submittal Meeting: Contractor shall meet with Architect, Consultant, and Delegated Designer to discuss requirements of work-portion, submittals, scheduling and sequencing.

1.07 SCHEDULING

A. Schedule design process and submittals required for Delegated Design portions to fit within Construction Schedule.

B. Allow adequate time for AHJ review. Contact AHJ for time estimate and coordination of schedule.

C. If Architect's approval of Shop Drawings is required prior to application for permit, schedule and sequence Shop Drawing review prior to review of permit submittal. Allow time specified in Section 01 33 00.

END OF SECTION

LEED CERTIFICATION PROCEDURES

PART 1 GENERAL

1.01 PROJECT GOALS

A. This project has been designed to achieve the LEED-NC Gold (minimum 60 points) rating, as defined in the LEED(r) Green Building Rating System for New Construction and Major Renovations, 2009 Edition.

B. Contractor is not responsible for the application for LEED certification, nor for determination of methods of achieving LEED credits unless specifically so indicated.

C. Many of the LEED credits can be achieved only through careful design of the project.which is not the responsibility of the Contractor. However, certain credits relate to the products and procedures used for construction. The full cooperation of the Contractor and subcontractors is essential to achieving the LEED goal.

D. Contractor shall familiarize themselves with the relevant requirements and provide the necessary information and instruction to subcontractors and installers.

E. This Section includes a summary of requirements and procedures intended to achieve LEED credits.
   1. Some credits are marked PREREQUISITE; these must be achieved regardless of the level of certification; many are dependent on proper performance by Contractor and subcontractors.
   2. Some credits involve quantifying percentages by weight and cost; these require careful recordkeeping and reporting by the Contractor.
   3. See www.usgbc.org for more information.

F. LEED Reporting: Credits are achieved after properly executed reports are accepted by USGBC. This Section identifies the LEED Credits for which Contractor shall execute LEED Credit Reports.

G. Abbreviations and Symbols:
   1. USGBC: United States Green Building Council.
   2. LEED: Leadership in Energy and Environmental Design, a registered trade mark of USGBC.
   3. LEED Form: USGBC form that is executed by the responsible party identified in LEED Checklist or this Section. LEED Forms are executed via internet at http://leedonline.com.
   4. NC: New Construction (or major renovation).
   5. CI: Commercial Interiors.
   6. SS: Sustainable Site.
   7. WE: Water Efficiency.
   8. EA: Energy and Atmosphere.
   9. MR: Materials and Resources.
   10. EQ: Indoor Environmental Quality.
   11. ID: Innovation and Design process. ID credits are identified as "ID 1.#" because they cannot be verified and numbered until all applicable information is available.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Achieving some LEED Prerequisites are entirely Contractor's responsibility. They are:
   1. SS Prerequisite 1, Erosion and sedimentation control plan during construction, Section 01 57 13.
   2. EA Prerequisite 3, Assure zero use of CFC's, prohibited in Section 01 60 00 and Division 23.

B. Achieving some LEED Credits are entirely Contractor's responsibility. They are:
   1. MR 2.1 and M2.2, Construction waste management. Specific requirements are specified in Section 01 74 19.
   2. IEQ 3.1 and IEQ 3.2, Construction indoor air quality management plan during construction and before occupancy. Requirements are specified in Section 01 57 21.

3. IEQ 4.1, IEQ 4.2, IEQ 4.3, and IEQ 4.4, Low-emitting materials. Contractor shall assure that products used in this Project comply with requirements. Specific requirements are summarized in Section 01 60 00.

C. Some LEED Credits require Contractor's assistance to select products that comply with LEED requirements. These credits include:
1. EA 4, Montreal Protocol Early Compliance. Assure zero use of CFC's, HCFC's and Halon.
2. MR 3.1 and MR 3.2, Resource re-use. Re-use and document existing materials. These credits are not being sought but it should be tracked for future use in project sustainability metrics.
3. MR 4.1 and MR 4.2, Recycled content. Select products with highest recycled content.
4. MR 5.1 and MR 5.2, Regional Materials. Select products that are extracted and manufactured within Project region.
5. MR 7, Certified wood. Select wood products made from certified wood.
6. ID 1.#, Exemplary performance for MR 2, MR 3, MR 4, MR 5, MR 6, MR 7, or EQ 4.

D. Contractor shall assist Owner to achieve as many LEED Credits as possible; see LEED scorecard, following this Section, for performance requirements.

E. Anticipated Credits: Contractor shall comply with Contract Documents and LEED requirements for credits reviewed during the design phase and designated "Anticipated" by USGBC.
1. Substitutions: Contractor shall assure that substitute products or methods for work in Anticipated credits comply with LEED requirements.

1.03 SUBMITTALS TO USGBC

A. Credits are awarded when properly executed and documented LEED forms are submitted and accepted by USGBC. When supporting documentation is ready, the responsible party shall execute the appropriate LEED Form, sign the form, save the form, upload the documentation, and respond to USGBC comments or requests until the credit is awarded. Some Work of this total Project may lie outside the LEED Project boundry (see sheet G012) and must not be included in the tracking and submittal forms going to USGBC.
1. Upload LEED Form and required support documents to LEED Online via internet at http://leedonline.usgbc.org.
2. Owner's LEED consultant will initiate review of LEED credits by USGBC upon receiving completed documentation for all credits from responsible parties.
3. USGBC review staff will require clarification for LEED credits where documentation is incomplete, unclear or incorrect.
4. Owner's LEED Consultant will inform responsible party to respond to USGBC comments or requests until the credit is awarded.

B. Contractor shall upload to LEED Online the completed LEED Forms and support documentation for the following credits:
1. SS Prerequisite 1, Construction Activity Pollution:
   a. LEED Form.
   b. Erosion and sedimentation control plan.
   c. Drawings documenting erosion and sedimentation control measures.
2. MR 2, Construction Waste Management:
   a. LEED Form.
   b. Documentation of waste hauling certificates for commingled waste.
   c. Construction Waste Management Plan. Specific requirements are specified in Section 01 74 19.
3. MR 3, Materials Reuse: These credits are not being sought but it should be tracked for future use in project sustainability metrics.
   a. LEED Form.
   b. BDC calculator
   c. Documentation for materials contributing towards achievement of this credit.
4. MR 4, Recycled Content:
   a. LEED Form.

b. BDC Calculator
c. Documentation for all materials contributing towards achievement of this credit.
d. Assembly Calculations as required.

5. MR 5, Regional Materials:
   a. LEED Form
   b. BDC Calculator
   c. Documentation for all materials contributing towards achievement of this credit.
   d. Assembly Calculations as required.
6. MR 7, Certified Wood:
   a. LEED Form.
   b. BDC Calculator.
   c. Chain-of-Custody certificates for all wood products contributing towards achievement of this credit.
   d. Assembly Calculations as required
7. EQ 3.1, Construction IAQ Management - During Construction:
   a. LEED Form.
   b. Construction IAQ Management Plan. Specific requirements are specified in Section 01 57 21.
   c. Narrative and photographs demonstrating compliance with Construction IAQ Management Plan.
   d. If the HVAC system is run during construction, cut sheets or manufacturers data on filtration media installed during construction.
8. EQ 3.2, Construction IAQ Management - Before Occupancy:
   a. LEED Form.
   b. Indoor Air Quality testing report if Indoor Air Quality testing was performed for credit compliance.
   c. Narrative describing the specific flush out procedures of IAQ testing process.
   d. Specific requirements for IAQ testing and building flush out procedures are specified in section 01 57 21.
9. EQ 4.1, Low-Emitting Materials - Adhesives and Sealants:
   a. LEED Form
   b. List adhesives and sealants installed inside the weather resistive barrier including the manufacturer, VOC content and quantity used.
10. EQ 4.2, Low-Emitting Materials - Paints and Coatings:
    a. LEED Form.
    b. List of all paints and coatings installed inside the weather resistive barrier including the manufacturer, VOC content and quantity used.
11. EQ 4.3, Low-Emitting Materials - Carpet Systems:
    a. LEED Form.
    b. List of carpet products, cushions and adhesives installed in the building, and confirmation that all comply with the CRI Green Label Plus testing program.
12. EQ 4.4, Low-Emitting Materials - Composite Wood, Agrifiber Products, and Laminating Adhesives:
    a. LEED Form.
    b. List of composite wood and agrifiber product installed inside the weather resistive barrier and confirmation that each product does not contain added urea-formaldehyde.
    c. List laminating adhesives for both shop and field use, and confirmation that each product does not contain urea-formaldehyde.

C. In the event that a credit is audited during the review by USGBC, submit information requested.

1.04 RELEVANT SECTIONS

A. Section 01 33 00 - Submittal Procedures: for procedures and submittal cover sheet that is required with each submittal.

B. Section 01 57 13 - Temporary Erosion and Sediment Control.

C. Section 01 57 21 - Indoor Air Quality Controls:
   1. Testing of ventilation; EQ Credit 2.
   2. Contractor's IAQ management plan and construction procedures; EQ Credit 3.1.
   3. Building flush out or air contaminant testing; EQ Credit 3.2.

D. Section 01 60 00 - Product Requirements: includes LEED credit requirements for products.

E. Section 01 74 19 - Construction Waste Management and Disposal specifies requirements for construction waste management credits.

F. Section 01 91 13 - General Commissioning Requirements, and commissioning Sections in other Divisions.

G. Individual Sections of Divisions 02 through 10 include specific submittal requirements and product requirements.

1.05 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. LEED Submittal/Report: For each product with the notation "show quantity on LEED submittal or report," submit a report with the following information:
   1. Submit with each Application for Payment; update the Report each period with latest period shown separately:
   2. Identify each product with:
      a. Name and manufacturer.
      b. Location of manufacturer and source of materials.
      c. Specification Section number.
      d. Applicable Credit(s).
      e. Net weight per unit.
      f. Quantity installed.
      g. Material cost per unit.
      h. Total material cost.
      i. Other information specified for specific item.
   3. Attach evidence of compliance from either the manufacturer or an independent agency.

1.06 INFORMATION SOURCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE); 1791 Tullie Circle, NE, Atlanta, GA 30329. Tel: (404) 636-8400. Fax: (404) 321-5478. www.ashrae.org.

B. Bay Area Air Quality Management District (BAAQMD); 939 Ellis Street, San Francisco, California 94109. Tel: (415) 771-6000. www.baaqmd.gov.

C. Carpet and Rug Institute (CRI) Green Label Testing Program; Tel: (800) 882-8846. www.carpet-rug.com.

D. Center for Resource Solutions (CRS); Presidio Building, 49 P.O. Box 29512, San Francisco, CA 94129. Tel: (415) 561-2100. Fax: (415) 561-2105. www.resource-solutions.org or www.green-e.org.

E. Green Seal; 1001 Connecticut Avenue, NW, Suite 827, Washington, DC 20036-5525. Tel: (202) 872-6400. Fax: (202) 872-4324. www.greenseal.org.

F. South Coast Air Quality Management District (SCAQMD); 21865 E. Copley Drive, Diamond Bar, CA 91765. Tel: (909) 396-2000. www.aqmd.gov.

G. U.S. Green Building Council (USGBC); 1015 18th Street, NW, Suite 805, Washington, DC 20036. Tel: (202) 82-USGBC or (202) 828-7422. Fax: (202) 828-5110. www.usgbc.org.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

UNIVERSITY OF OREGON

UO EMU Renovation

LEED-NC® 2009 Scorecard

Project Phase Schematic Design
Last Updated 15 May 2014

titles highlighted are possible changes

CHAMPION		
SA	SERA Architects	BH Balzhiser & Hubbard
GL	Glumac	LCL Lease Crutcher Lewis
CM	Cameron McCarthy	UO Univ. of Oregon
IN	Interface	

TOTAL
55
21
14
22

Tracking towards LEED Gold (C + P = 76)
Certified 40-49 / Silver 50-59 / Gold 60-79 / Platinum 80+

CHAMPION		C	P	U	N	max		Sustainable Sites (26 Possible Points)	STRATEGY	CRITICAL QUESTIONS
		22	1	0	3	26				
LCL/BHE	c	✓					P 1	**Construction Activity Pollution Prevention**	ESC Plan	
UO	d	1				1	C 1	**Site Selection**	Existing Site	
UO	d	5				5	C 2	**Development Density & Community Connectivity**	Connected to 10 community services	
SA/LCL	d	1				1	C 3	**Brownfield Redevelopment***	n/a	
UO	d	6				6	C 4.1	**Alternative Transportation,** Public Transportation Access	2 or more bus lines 1 or more stops within 1/4 mile	
SA	d	1				1	C 4.2	**Alternative Transportation,** Bicycle Storage & Changing Roor	Campus credit, offiste showers are 272 yds away	found 2 existing showers
SA/UO	d	3				3	C 4.3	**Alternative Transportation,** Fuel-Efficient Vehicles	Campus credit, offsite LeV/FeV parking can be used	
SA	d	2				2	C 4.4	**Alternative Transportation,** Parking Capacity	Campus credit, offsite parking can be used	
CM	c				1	1	C 5.1	**Site Development,** Protect or Restore Habitat*	n/a	
CM	d	1				1	C 5.2	**Site Development,** Maximize Open Space	Campus credit, open space equal to bldg footprint	
BH	d				1	1	C 6.1	**Stormwater Design,** Quantity Control	poor infiltration conditions	
BH	d		1			1	C 6.2	**Stormwater Design,** Quality Control	mostly vegetative systems, mechanical where veg. not feasible	
SA/CM	c	1				1	C 7.1	**Heat Island Effect,** Non-Roof	SRI>29 hardscape areas	
SA	d	1				1	C 7.2	**Heat Island Effect,** Roof	SRI>78 roof for at least 50% roof area	
SA/GL	d				1	1	C 8	**Light Pollution Reduction**	Night sky compliance ext. lighting	

		2	4	2	2	10		Water Efficiency (10 Possible Points)		
SA/GL	d	✓					P 1	**Water Use Reduction,** 20% Reduction	Efficient indoor plumbing fixtures	
CM	d		2			2	C 1.1	**Water Efficient Landscaping,** Reduce by 50%	Efficient irrigation system	
CM	d			2		2	C 1.2	**Water Efficient Landscaping,** No Potable Use or No Irrigation	n/a	
SA/GL	d				2	2	C 2	**Innovative Wastewater Technologies***	n/a	
SA/GL	d	2				2	C 3.1	**Water Use Reduction,** 30% Reduction	Efficient plumbing fixtures	
SA/GL	d		1			1	C 3.2	**Water Use Reduction,** 35% Reduction	n/a	
SA/GL	d		1			1	C 3.3	**Water Use Reduction,** 40% Reduction	n/a	

		17	4	9	5	35		Energy and Atmosphere (35 Possible Points)		
UO	c	✓					P 1	**Fundamental Commissioning**	CxA - TBD	
IN/GL/SA	d	✓					P 2	**Minimum Energy Performance,** 10% N or 5% E	exceed ASHRAE 90.1-2007 std	
GL	d	✓					P 3	**Fundamental Refrigerant Management**	no CFC refrigerant	
IN/GL/SA	d	2				2	C 1.2	**Optimize Energy Performance,** 14% N or 10% E	Efficient M/E/P systems	
IN/GL/SA	d	2				2	C 1.4	**Optimize Energy Performance,** 18% N or 14% E	Efficient M/E/P systems	
IN/GL/SA	d	2				2	C 1.6	**Optimize Energy Performance,** 22% N or 18% E	Efficient M/E/P systems	
IN/GL/SA	d	2				2	C 1.8	**Optimize Energy Performance,** 26% N or 22% E	Efficient M/E/P systems	
IN/GL/SA	d	2				2	C 1.10	**Optimize Energy Performance,** 30% N or 26% E	Efficient M/E/P systems	
IN/GL/SA	d	2				2	C 1.12	**Optimize Energy Performance,** 34% N or 30% E	n/a	
IN/GL/SA	d		2			2	C 1.14	**Optimize Energy Performance,** 38% N or 34% E	n/a	
IN/GL/SA	d			2		2	C 1.16	**Optimize Energy Performance,** 42% N or 38% E	n/a	
GL/SA	d			2		2	C 1.18	**Optimize Energy Performance,** 46% N or 42% E	n/a	
IN/GL/SA	d			1		1	C 1.19	**Optimize Energy Performance,** 48% N or 44% E	n/a	
GL/SA/IN	d			2		2	C 2.1	**On-Site Renewable Energy,** 3%	n/a	
GL/SA/IN	d				2	2	C 2.2	**On-Site Renewable Energy,** 7%	n/a	
GL/SA/IN	d				2	2	C 2.3	**On-Site Renewable Energy,** 11%	n/a	
GL/SA/IN	d				1	1	C 2.3	**On-Site Renewable Energy,** 13%	n/a	
UO	c	2				2	C 3	**Enhanced Commissioning**	CxA - TBD	
GL	d	2				2	C 4	**Enhanced Refrigerant Management**	no CFC refrigerant w/GWP <100	
GL/UO	c	1	2			3	C 5	**Measurement & Verification**	Data Sharing Only	UO: research!
UO	c			2		2	C 6	**Green Power**	n/a	UO: research!

		C	P	U	N	max	STRATEGY	CRITICAL QUESTIONS
		2	5	1	6	14		
SA	d	✓					Campus credit, centralized storage can be used	
SA	c				1	1	n/a	
SA	c				1	1	n/a	
SA	c				1	1	n/a	
SA	c				1	1	n/a	
LCL	c	1				1	CWM plan + diversion	
LCL	c		1			1	CWM plan + diversion	
LCL/ SA	c			1		1	Existing bldg material reuse and repurpose	
LCL/ SA	c				1	1	n/a	
LCL/ SA	c	1				1	Div 3-10, 31 32 specs	
LCL/ SA	c		1			1	Div 3-10, 31 32 specs	
LCL/ SA	c		1			1	Div 3-10, 31 32 specs	
LCL/ SA	c		1			1	Div 3-10, 31 32 specs	wood struct?
LCL/ SA	c				1	1	n/a	
LCL/ SA	c		1			1	n/a	verify upon delivery

		9	2	2	2	15		
GL	d	✓					ASHRAE 62.1-2007 std compliance	
UO/SA	d	✓					No smoking policy + signage	
GL	d	1				1		
GL	d	1				1	>30% min. ventilation reqs. per ASHRAE 62.1 :	vs. energy perf?
LCL	c	1				1	IAQ plan	
LCL	c	1				1	building flush	
LCL/ SA	c	1				1	No or Low VOC products	
LCL/ SA	c	1				1	No or Low VOC products	
LCL/ SA	c	1				1	GLP or FloorScore or CA 01350 compliance	
LCL/ SA	c	1				1	NAUF wood products	
SA/GL	d	1				1	MERV 13 filters, Entryway systems, Ded. Exhaust	
SA/GL	d			1		1	Indiv. controllable lighting systems for 90% spaces	
UO	d				1	1	Indiv. controllable systems for 50% spaces	
GL	d		1			1	ASHRAE 55-2004 compliance	
UO	d		1			1	Thermal comfort survey	
SA	d				1	1	access to daylight	
SA	d			1		1	access to exterior views	approve costs for larger relites

		2	4	0	0	6		
CM	d	1				1	Double open space area	
	c		1			1	document treatment of parking lot runoff	confirm amounts and methods
UO	d		1			1	Double transit ridership	needs research
SA/UO	c		1			1	Signage/ bldg tour/ education	user engagement & OMSD
UO/SA	c		1			1	Green Operations	see LISB
SA	c	1				1	Several LEED AP on project team	

		1	1	0	4	5	
SA/LCL	d	1				1	n/a
CM	d				1	1	n/a
SA/GL	d				1	1	n/a
LCL/SA	c				1	1	

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Quality assurance submittals.

C. Mock-up.

D. Control of installation.

E. Tolerances.

F. Testing and inspection services.

G. Manufacturers' field services.

1.02 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008.

B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2011c.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2012.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

E. ASTM E329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2011.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2009.

1.03 DEFINITIONS

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

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

C. Mock-Up: Full-size, physical assemblies that are constructed on-site. Mock-ups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.
   1. Approved mock-ups establish the standard by which the Work will be judged.

D. Laboratory Mock-up: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

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

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of 10 previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 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 Contract Documents, unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on the Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. When copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
   2. When copies of standards are needed for any reason, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.
   1. ADAAG or ADAAmericans with Disabilities Act
   2. CFRCode of Federal Regulations
   3. DODDepartment of Defense Military Specifications and Standards
   4. FSFederal Specification
   5. MILSPECMilitary Specification and Standards
   6. UFASUniform Federal Accessibility Standards

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

1.05 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.06 SUBMITTALS

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

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.
14. Distribution: Contractor, Architect, Engineer of Record, Authority Having Jurisdition, Owner (verify), and Construction Manager (when appropriate).

B. Deficiencies Report: Attach a separate list of deficiencies identified in previous reports that have not been corrected and successfully retested.
   1. Submit a final report certifying the status of all deficiencies, signed and stamped. Submit report directly to Authority having jurisdiction (when required) and copy to others.

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

D. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

1.07 TESTING AND INSPECTION AGENCIES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.
   1. Owner's testing agent will perform "special inspections" required by Regulations.

B. Contractor shall employ and pay for services of an independent testing agency to perform other testing and inspection specified as Contractor's responsibility or required by Contractor for quality control.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 543, ASTM C 1021, ASTM C 1077, and ASTM C 1093.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory: Authorized to operate in the State in which the Project is located.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.
   1. Design anchorage and attachments to resist seismic forces when required by Regulations.

3.02 MOCK-UP

A. Before installing portions of the Work requiring mockups, build mock-up for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mock-up in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mock-up will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mock-up before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of mock-up.
   5. Maintain mock-up during construction in an undisturbed condition as a standard for judging the completed Work.

B. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

C. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

D. Accepted mock-up shall be a comparison standard for the remaining Work.

E. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.
   1. Deconstruct and recycle mock-up that is not incorporated in Work.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
a. To provide access to Work to be tested/inspected.
b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
c. To facilitate tests/inspections.
d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
1. Observer subject to approval of Architect.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

VAPOR EMISSION AND ALKALINITY TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Measuring moisture vapor emission of new concrete floors.
   1. Calcium Chloride (CaCl2) Test.
   2. In-situ Relative Humidity Test.

B. Measuring alkalinity (pH) of new concrete floors.

1.02 RELATED SECTIONS

A. Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Section 01 40 00 - Quality Requirements for quality assurance, laboratory responsibilities and laboratory reports.

C. Section 01 50 00 - Temporary Facilities and Controls: Temporary heating, cooling and ventilating.

D. Section 03 30 00 - Cast-In-Place Concrete; for substrate to be tested.

1.03 REFERENCES

A. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

B. ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.04 PERFORMANCE REQUIREMENTS

A. Provide suitable concrete floor substrate for application of finish floor systems that will meet finish floor manufacturer's installation requirements.

B. Moisture vapor emission testing:
   1. Moisture dome testing (calcium chloride test):
      a. Moisture vapor test results to achieve three pounds per 1,000 square feet of concrete floor surface per 24 hours, or as allowed by flooring (or adhesive) manufacturer, when tested in conformance with ASTM F 1859.
   2. In-situ relative humidity test:
      a. In-situ relative humidity test results to achieve relative humidity reading of no greater than 75 percent or as allowed by flooring (or adhesive) manufacturer, when tested in conformance with ASTM F 2170.

C. Concrete slab surface pH testing:
   1. Alkalinity testing with probe or pH testing paper to achieve an alkalinity pH no more than 7 and no greater than 9 or as allowed by flooring (or adhesive) manufacturer when tested in conformance with ASTM F 710.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product data for all testing materials proposed for Work of this Section.

B. Letter of Verification of Environmental Conditions as below.

C. Test Reports: Submit moisture vapor emission and alkalinity test reports in accordance with requirements of Section 01 30 00.

1.06 ENVIRONMENTAL CONDITIONS

A. Prior to testing for moisture vapor emissions rate, space shall be enclosed, fully weather-tight, wet work shall be complete and normally dry, work above ceilings finished. The test site shall be at the same temperature and humidity expected during normal use.

B. Building Temperature: Minimum 65 degrees F. Maximum 85 degrees F.

C. Interior Relative Humidity: Minimum 40 percent. Maximum 60 percent.

D. Maintain specified environmental conditions not less than 72 hours prior to conducting tests and throughout duration of the tests.

1.07 QUALITY CONTROL

A. Testing shall be conducted not less than 120 days after date of last pour of concrete slab to be tested.

B. Quantity of Tests Required:
   1. Not less than 3 test are required for the first 1,000 square feet plus one test per each additional 1,000 square feet or fraction thereof.

PART 2 PRODUCTS

2.01 MOISTURE VAPOR EMISSION TESTING

A. Moisture Dome Testing: Conform to requirements of ASTM F 1869.
   1. Anhydrous Calcium Chloride ($CaCl_2$) Test Kits: Kits shall contain a plastic spherical dome with a factory installed silicone gasket, weight ring, airtight foil bag of calcium chloride (approximately 30 grams), and a plastic dish with snap-top lid and label.
      a. This test requires use of a gram-weight scale with a gradation of 1/10th (0.1) gram.
   2. Approved Manufacturers:
      a. Vaprecision Testing Systems, www.vaportest.com.
      b. Other manufacturers: Comply with Section 01 60 00 - Product Requirements.

B. In-situ Relative Humidity Testing is required to be performed by an independent testing laboratory using relative humidity moisture meter kits and sensors conforming to requirements of ASTM F 2170.

2.02 CONCRETE SLAB SURFACE PH TESTING

A. pH Tester with a surface probe.

B. pH Test Kits: Kits shall contain pH paper, pH pencil and pH color chart for comparison.

PART 3 EXECUTION

3.01 PREPARATION

A. General:
   1. Prior to testing, verify that environmental conditions have been met.
   2. Heating ventilating and air conditioning system is operating or temporary heat, cooling and ventilating system is operating.
   3. Lay Out Test Area: Measure the space to be tested. Layout the test sites in a rectangular, quasi rectangular or a cross-diagonal grid. Come in 5 feet from any exterior wall and place test kits at even intervals. Complete the grid. Record the location of each test site on a Record Drawing.

B. Moisture Dome Testing:
   1. Surface Preparation:
      a. For each test area, expose a surface area of 20 inches square.
      b. Grind or sand the concrete surface. Test area shall be clean and free of all foreign substances; including curing compounds, sealers, paint, oil, resins, parting compounds, floor leveling compounds, dirt, etc.
   2. After surface preparation is complete and prior to testing, allow space to remain undisturbed for 24 hours.

C. In-situ Relative Humidity Test:
   1. Drill 5/8 inch diameter test site holes to a depth equal to 40 percent of the slab's thickness for slabs on grade and 20 percent for elevated slabs.

3.02 TESTING

A. Using a vacuum, remove any dust or dirt from concrete surface where moisture dome test kit is to be placed or in the case of an insitu relative humidity test clean debris from hole then insert plastic sleeve and cap sleeve.. Do not use solvents or water to clean the concrete.

B. Moisture Dome Testing: Perform in accordance with requirements of ASTM F 1869.

1. Install moisture vapor emission test kits according to manufacturer's published instructions.
2. Test results are sensitive to testing procedures. Take care to follow manufacturer's instructions.
3. Allow test kits to remain in place undisturbed for 60 to 72 hours.

C. In-situ Relative Humidity Test: Perform testing in accordance with requirements of ASTM F 2170.
1. Allow probe sensor at each test site 72 hours equilibration time prior to reading relative humidity levels.
2. After equilibration, take a probe into the sleeve and obtain relative humidity level readings from the bottom of the hole.
3. Testing density is required to equal 3 tests in the first 1,000 square feet, with one additional test per each additional 1,000 square feet of concrete slab surface.
4. Once satisfactory relative humidity testing results are achieved, patch testing site holes prior to application of finish flooring.

D. Alkalinity Testing Using pH Tester:
1. Conduct test adjacent each location of test for moisture vapor emission.
2. With the concrete already clean, pour approximately 2 tablespoons of distilled water onto surface of concrete.
3. Allow distilled water to stand for approximately 3 minutes. While waiting, lightly stir water to help it absorb any of the salts.
4. Place tip of surface probe into the distilled water solution to obtain results.

E. Alkalinity Testing Using pH Paper:
1. Conduct test adjacent each location of test for moisture vapor emission.
2. With the concrete already clean, pour approximately 2 tablespoons of distilled water onto surface of concrete.
3. Allow distilled water to stand for approximately 3 minutes. While waiting, lightly stir water to help it absorb any of the salts.
4. After the allotted time, place a pH paper into the distilled water solution and then compare the color changes in the paper with the pH chart to obtain results.

F. Record data and results and submit in accordance with Section 01 30 00.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

I. Field offices.

1.02 TEMPORARY AND CONSTRUCTION UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Existing facilities may not be used.

C. New permanent facilities may be used.

D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

E. All shut-off locations are to be documented for emergency purposes prior to pre-construction meeting.

F. Documentation of locations is to be distributed to PM, Facilities Zone Supervisor, DPS, EH&S, and any others determined by individual projects.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.09 SECURITY AND ACCESS TO CONSTRUCTION SITES

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. DPS and PM are to be consulted to determine strategies to be implemented.

C. UO Fire Marshal and EH&S consultation regarding egress routes from the project site and adjacent buildings to be provided and maintained at all times.

D. ADA routes must be provided and maintained at all times from the site & adjacent buildings.

E. Parking within site fencing is controlled and managed by the GC.

F. If the project does not have site fencing then parking is restricted by issued parking permits through DPS in designated locations only. Parking permits are requested of DPS by the PM.

1.10 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.11 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on Drawings.

B. Erect on site at location indicated.

C. No other signs are allowed without Owner permission except those required by law.

D. Only two types of signs fixed to construction fencing are allowed:

E. One sign to identify the project, project purpose, project rendering and design team.

F. One sign to list the general and sub-contractors.

1.13 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Protection of existing trees from damage.

B. DEFINITIONS
   1. Designated Trees: As indicated on Drawings.
   2. Critical Root Zone (CRZ): The CRZ for trees 4 inches in caliper or smaller shall be an area with a radius at least 5 feet from the trunk. The CRZ for trees over 4 inches in caliper shall be an area with a radius of at least 1 foot 6 inches from the trunk for every 1 inch of caliper size.
   3. Zone of Protection: CRZ and as indicated on Drawings.

C. POSTING
   1. When directed, post Designated Trees with Notice sign provided by Owner's Representative. Attach sign to tree with twine or staples, no nails. Maintain and protect the Notice sign until completion of construction. Obtain approval of Owner's Representative prior to removal of sign.

D. NOTICE
   1. Notify all workers, including subcontractors, of the requirements to protect Designated Trees using Notice provided.

E. PROTECTIVE FENCING
   1. Install protective fencing around Designated Trees and where shown on Drawings prior to commencement of any work. Fencing to be a minimum 6 foot chain link, with fence posts securely anchored. Maintain during construction. Adjustments to fence locations are to be approved by the Owner's Representative prior to performing any work within the Zone of Protection.

F. CONSTRUCTION FENCING
   1. No construction activities are permitted within the protective fencing without prior approval of the Owner’s Representative.
   2. Prior to removal of Construction Fencing perform a mandatory meeting for the remaining exterior trades to ensure tree protection measures are met.

G. ZONE OF PROTECTION
   1. No storage, stockpiling, parking, etc. is permitted within the Zone of Protection.
   2. Post notices on fencing listing prohibited activities without prior apporval. Notice to remain in place until authorization is granted by the Owner's Representative.
   3. Submit requests to work within the Zone of Protection to Owner's Representative.
   4. The following activities are prohibited in the Zone of Protection without written approval from the Owner's Representative:
      a. Removal or moving protective fencing
      b. Parking and driving of vehicles
      c. Storing equipment or materials
      d. Excavations
      e. Flooding and cleanup of equipment, tools, etc.
      f. Operation of equipment
      g. Staging of materials
      h. Trenching
      i. stockpiling
      j. Altering drainage

H. TRENCHING AND EXCAVATION
   1. All trenching and excavation within the Zone of Protection is to be performed with the use of an air spade or by hand. Obtain Owner’s Representative approval of trenching and excavation locations and methods prior to performing any work.

I. ROOT PRUNING

1. Prune roots encountered during construction with an approved root-pruning device. Make clean, vertical cuts. Do not leave split or frayed ends. Obtain Owner's Representative approval prior to cutting roots larger than 1 inch in diameter. Backfill exposed roots with specified Planting Soil as soon as practical.

J. TREE CANOPY PRUNING
1. Prune canopies of Designated Trees impacted by construction only upon approval of Owner's Representative. All canopy pruning must be performed by a certified arborist. Canopy pruning must be approved in advance by consulting arborist hired by Owner.

K. MULCH
1. Provide four (4) inch deep mulch within CRZ and/or Zone of Protection as directed.

L. WATERING
1. Water trees if required by Owner's Representative. Watering will be required if it is judged that root removal is necessary for construction and threatens the survival of the tree. Use a slow drip or soaker hose to provide one-inch water per week until completion of construction.

M. PROHIBITED ACTIVITIES
1. Cutting of roots larger than 1 1/2 inch diameter or larger without approval.
2. Damaging tree bark, branches.
3. Removal of protective fencing or notice posted on trees prior to approval of Owner's Representative.
4. Activities prohibited within the Zone of Protection (without prior approval) are, but not limited to: construction, operation of machinery, storage of materials, paving, grading, cutting, filling, travel within, dumping, disposal of liquids, and parking of vehicles or equipment.

N. DAMAGE
1. Actual tree damage such as trunk scoring and broken limbs or damaged roots inside the Zone of Protection will be assessed according to the percentage of loss of tree value. Percentage of tree value will be determined by the Owner's Representative. Tree value will be determined from "Evaluation of Landscape Trees, Shrubs, and Other Landscape Plants" by International Society of Arboriculture.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Performance bond.

E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 REFERENCE STANDARDS

A. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus; 2007.

B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2009).

C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2011.

D. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2008.

E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.

F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002 (Reapproved 2009).

G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition.

1.03 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2003 Construction General Permit (CGP), whether the project is required by law to comply or not.

B. Also comply with all more stringent requirements of State of Oregon Erosion and Sedimentation Control Manual.

C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
   1. Obtain and pay for permits and provide security required by authority having jurisdiction.
   2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.

E. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.

F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
1. Control movement of sediment and soil from temporary stockpiles of soil.
2. Prevent development of ruts due to equipment and vehicular traffic.
3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
1. Prevent windblown soil from leaving the project site.
2. Prevent tracking of mud onto public roads outside site.
3. Prevent mud and sediment from flowing onto sidewalks and pavements.
4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

L. Open Water: Prevent standing water that could become stagnant.

M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:
1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
2. Include:
   a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
   b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
   c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
   d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
   e. Other information required by law.
   f. Format required by law is acceptable, provided any additional information specified is also included.
3. Obtain the approval of the Plan by authorities having jurisdiction.
4. Obtain the approval of the Plan by Owner.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

E. LEED Prerequisite SS 1: Document construction activity pollution prevention. Comply with Section 01 35 15.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:
   1. Erosion control matting or netting.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Bales: Air dry, rectangular straw bales.
   1. Cross Section: 14 by 18 inches, minimum.
   2. Bindings: Wire or string, around long dimension.

D. Bale Stakes: One of the following, minimum 3 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
   2. Wood, 2 by 2 inches in cross section.

E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
   1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
   2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491.
   3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355 after 500 hours exposure.
   4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632.
   5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632.
   6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D4533.
   7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

F. Silt Fence Posts: One of the following, minimum 5 feet long:
   1. Hardwood, 2 by 2 inches in cross section.

G. Gravel: See Section 32 11 23 for aggregate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.
   1. Width: As required; 20 feet, minimum.
   2. Length: 50 feet, minimum.
   3. Provide at each construction entrance from public right-of-way.

4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.
1. Provide linear sediment barriers:
   a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
2. Space sediment barriers with the following maximum slope length upslope from barrier:
   a. Slope of Less Than 2 Percent: 100 feet..
   b. Slope Between 2 and 5 Percent: 75 feet.
   c. Slope Between 5 and 10 Percent: 50 feet.
   d. Slope Between 10 and 20 Percent: 25 feet.
   e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

G. Soil Stockpiles: Protect using one of the following measures:
1. Cover with polyethylene film, secured by placing soil on outer edges.
2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

A. Traffic-Bearing Aggregate Surface:
1. Excavate minimum of 6 inches.
2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:
1. Store and handle fabric in accordance with ASTM D4873.
2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
5. Install with top of fabric at nominal height and embedment as specified.
6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
7. Fasten fabric to wood posts using one of the following:
   a. Four 3/4 inch diameter, 1 inch long, 14 gage nails.
   b. Five 17-gage staples with 3/4 inch wide crown and 1/2 inch legs.
8. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

C. Straw Bale Rows:
   1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
   2. Install bales so that bindings are not in contact with the ground.
   3. Embed bales at least 4 inches in the ground.
   4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
   5. Fill gaps between ends of bales with loose straw wedged tightly.
   6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Temporary Seeding:
   1. When hydraulic seeder is used, seedbed preparation is not required.
   2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
   3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
   4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
   5. Incorporate fertilizer into soil before seeding.
   6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep deep.
   7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
   8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:
   1. Promptly replace fabric that deteriorates unless need for fence has passed.
   2. Remove silt deposits that exceed one-third of the height of the fence.
   3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:
   1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
   2. Remove silt deposits that exceed one-half of the height of the bales.
   3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations and procedures.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 DEFINITIONS

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

B. 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.

C. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or reused from other projects are not considered new products.

D. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

E. Substitutions: Contractor proposed changes in products, materials, equipment, or methods of construction different from those required by the Contract Documents.

F. VOC: Volatile organic compound, carbon compounds that participate in atmospheric photochemical reactions and vaporize at normal room temperature. Measure as grams per liter, less water.

G. Bidding/ Negotiating Period: The period within the project schedule where the Contractor receives bids or pricing from subcontracts or prepares their own bid to establish a contract value with the Owner.

H. Award of Contract: The formal acceptance of the terms of the negotiation by the Contractor.

I. Notice to Proceed: A document that establishes the date work is authorized to commence. It may also include the number of calendar days or date of substantial completion.

1.03 SUBMITTALS

A. Submittal procedure for Product Data, Shop Drawings, Samples, and Certificates is specified in Section 01 33 00 - Submittal Procedure.

B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Notice to Proceed.
   2. For products specified only by reference standards, list applicable reference standards.

C. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Request for Substitution: Submit approved form with supporting information to CM/GC. Comply with "Substitution Procedures" Article in this Section.
   1. Requests During Bidding/ Negotiating period: CSI Form 1.5C or current CSI Northwest Region Form.

2. Requests after Bidding/Negotiating period: CSI Form 13.1A.
3. Submit original request forms in quantity required distribution. Original must be signed by person authorized to certify the substitution request form. Architect may request proof of authorization.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Construction deliveries shall be made at the project jobsite to the attention of the Contractor; not FS receiving.

B. Products and materials shall be protected from damage, weather, vandalism, etc. prior to installation. Replacement and replacement cost will be the responsibility of the Contractor.

1.06 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
   3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

C. Reused Products: Reused products include materials and equipment salvaged and refurbished as specified.
   1. Protect, repair and prepare for installation items indicated as "reinstall" or "salvage for reinstallation'.
   2. Replace items that are damaged beyond repair during demolition or construction.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Provide commercial grade products as a minimum; residential grade products are unacceptable.

C. Do not use products having any of the following characteristics:
   1. Made using or containing CFC's or HCFC's.
   2. Made of wood from newly cut old growth timber.

D. Where all other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured within 500 miles of the project.
   2. Are made with rapidly renewable material.
   3. Contain more recycled material.
   4. Use sustainably harvested wood over non-sustainably harvested wood.
   5. Do not contain urea formaldehyde.
   6. Contain fewer VOCs.
   7. Are Green Label Plus carpet, cushion or adhesive.
   8. Have longer documented life span under normal use.
   9. Result in less construction waste.

E. Products with Rapidly Renewable Material Content:
   1. Definition: Materials made from plants that are typically harvested within 10 years or less after planting.
   2. Overall Project Requirement: Provide materials amounting to a minimum of 2.5 percent of the total value of all materials and products used on the project.
   3. Specific Product Categories: Provide renewable material content as specified elsewhere.
   4. Calculations: Where information about renewable material content is required to be submitted and an item is not made completely of rapidly renewable material, calculate content by dividing the renewable material content by weight by the total weight of the item.
   5. Submittals: State unit cost, renewable material content percentage, quantity installed, total material cost, and total renewable material value; attach evidence of contents from either manufacturer or an independent agency.

F. Products with Recycled Content:
   1. Overall Project Requirement: Provide products with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial recycled content constitutes at least 20 percent of the total value of all products installed from CSI Masterformat 2004 Divisions 3 - 10, 31 60 00, 32 10 00, 32 30 00, and 32 90 00 only. This excludes mechanical, electrical, and plumbing components, and equipment.
      a. This provision is applicable to LEED Credit MR 4; show quantity and calculations on LEED report.
   2. Specific Product Categories: Provide recycled content as specified elsewhere.
   3. Calculations: Where information about recycled content is required to be submitted:
      a. Determine percentage of post-consumer and post-industrial content separately, using the guidelines contained in 16 CFR 260.7(e).
      b. Previously used, reused, refurbished, and salvaged products are not considered recycled.
      c. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
      d. Determine percentage of recycled content of any item by dividing the weight of recycled content in the item by the total weight of all material in the item.
      e. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.
   4. Submittals: State unit cost, post-consumer and post-industrial content percentages, quantity installed, total material cost, and total recycled content value; attach evidence of contents from either manufacturer or an independent agency.

G. Certified Wood - Sustainably Harvested Wood:
   1. Definition: Wood-based materials include but are not limited to structural framing, dimension lumber, flooring, wood doors, finishes, and furnishings that are permanently installed in the project. Wood and wood-based products not permanently installed in the project are not included in the definition.
   2. Overall Project Requirement: Provide a minimum of 50 percent of all wood-based materials made of sustainably harvested wood.

a. This provision is applicable to LEED Credit MR 6/7; show quantity on LEED report and submit certificates.

3. Specific Wood-Based Fabrications: Fabricate of sustainably harvested wood when so specified elsewhere.
4. Certification: Provide wood certified or labeled by an organization accredited by one of the following:
   a. The Forest Stewardship Council, The Principles for Natural Forest Management; for Canada visit http://www.fsccanada.org, for the USA visit http://www.fscus.org.
5. Submittals: State unit cost of each wood-based item, quantity installed, quantity certified as sustainably harvested, total wood-based material cost, and total sustainably harvested value; provide letter of certification signed by supplier of each item, indicating compliance with the specified requirements and identifying the certifying organization.
   a. Provide chain-of-custody documentation:
   b. Include the certifying organization's certification numbers for each certified product, itemized on a line-item basis.
   c. Attach copies of invoices bearing the certifying organization's certification numbers.
   d. Provide Assembly calculations as required.

H. Urea-Formaldehyde Prohibition:
1. Overall Project Requirement: Provide composite wood and agrifiber products having no added urea-formaldehyde resins. Laminating adhesives used to fabricate both on-site and shop-applied composite wood and agrifiber assemblies shall not contain urea formaldehyde resin.
   a. This provision is applicable to LEED Credit EQ 4.4; submit LEED Prohibited Content Installer Certification Forms.
   b. Require each installer to certify compliance and submit product data showing product content.
2. Specific Product Categories: Comply with limitations specified elsewhere.

I. Adhesives and Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168, and Green Seal Standard for Commercial Adhesives GS-36.
1. This provision is applicable to LEED Credit EQ 4.1.
   a. Require each installer to certify compliance and submit product data showing product content.
2. Specific Product Categories: VOC in grams/Liter shall not exceed:
   a. Indoor Carpet Adhesive: 50.
   b. Carpet Pad Adhesive: 50.
   c. Wood Flooring Adhesive:100.
   d. Rubber Flooring Adhesive:60.
   e. Subfloor Adhesive:50.
   f. Ceramic Tile Adhesive:65.
   g. VCT and Asphalt Adhesive:50.
   h. Gypsum Board Adhesive:50.
   i. Resilient Base Adhesive:50.
   j. Multipurpose Construction Adhesive: 70.
   k. Structural Glazing Adhesive:100.
3. Specialty Applications: VOC in grams/Liter shall not exceed:
   a. PVC Welding:510.
   b. CPVC Welding:490.
   c. ABS Welding:325.
   d. Plastic Cement Welding:250.
   e. Adhesive Primer for Plastic:550.
   f. Contact Adhesive:80.
   g. Special Purpose Contact Adhesive:250.
   h. Structural Wood Member Adhesive:140

i. Sheet Applied Rubber Lining Operations: 850.
j. Top and Trim Adhesive:250.

4. Substrate Specific Applications: VOC in grams/Liter shall not exceed:
   a. Metal to Metal:30.
   b. Plastic Foams:50.
   c. Porous Material (except wood)50.
   d. Wood30.
   e. Fiberglass80.
5. Sealants: VOC in grams/Liter shall not exceed:
   a. Architectural250.
   b. Roof300.
   c. Roadway250.
   d. Single Ply Roof Membrane450.
   e. Other250.
6. Primers for Sealants: VOC in grams/Liter shall not exceed:
   a. Architectural Non Porous250.
   b. Architectural Porous775.
   c. Other750.
7. Aerosol Adhesives: Percent VOC by weight shall not exceed:
   a. General Purpose Mist Spray:65%.
   b. General Purpose Web Spray:55%.
   c. Special Purpose (all types):70%.

J. Interior Paints and Coatings: Provide only products having lower volatile organic compound (VOC) content than required by Green Seal Standards GS-11 and GC-03, SCAQMB Rule 1113, in grams/Liter as follows:
   1. This provision is applicable to LEED Credit EQ 4.2.
      a. Require each installer to certify compliance and submit product data showing product content.
   2. VOC in grams/Liter shall not exceed the following for each product:
      a. Non-flat opaque products:150.
      b. Flat opaque products: 50.
      c. Anti-corrosive paint:250.
      d. Floor coating:100.
      e. Clear varnish: 350.
      f. Sanding sealer: 275.
      g. sealer:250.
      h. Other sealers:200.
      i. Stains:250.
      j. Lacquer:Not allowed.
   3. Comply with other requirements of GS-11 (component limitations, scrubbability, hiding power, washability).

K. Carpet, Carpet Tile, Carpet Cushion and Adhesives: Provide only products having lower volatile organic compound (VOC) content than required by Carpet and Rug Institute Green Label Plus Testing Program Limits, Emission Factor Limit in mg/sq.. m. x hour as follows:
   1. Total Carpet or Carpet Tile VOC: 0.50
      a. 4-Phenylcyclohexene: 0.05
      b. Formaldehyde: 0.05
      c. Styrene: 0.40
      d. Green Label Plus testing for Acetaldehyde, Benzene, Caprolactam, 2-Ethylhexanoic Acid, Formaldehyde, 1-Methyl-2-Pyrrolidinone, Naphthalene, Nonanal, Octanal, 4-Phenylcyclohexene, Styrene, Toluene, and Vinyl Acetate.
   2. Total Adhesive VOC: 10.00
      a. Formaldehyde: 0.05
      b. 2-Ethyl-1-Hexanol: 3.00

3. Total Cushion VOC: 1.00
   a. 4-Phenylcyclohexene: 0.05
   b. Formaldehyde: 0.05
   c. BHT (butylated hydroxytoluene):0.30
4. This provision is applicable to LEED Credit EQ 4.3. Require each installer to certify compliance and submit product data showing product content.

L. Provide interchangeable components of the same manufacture for components being replaced.

M. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

N. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.

E. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with provisions in "Product Substitutions" Article for proposal of product.

F. Visual Selection Specification: Selection of products for color, pattern, density, or texture will be by Architect from Manufacturer's full range, unless indicated otherwise.
   1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
   2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.04 MAINTENANCE MATERIALS

A. Furnish maintenance/overstock/extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Specific construction overstock requirements are stated in each section as applicable.

C. Overstock goods shall be from the same manufacturer, lot and/or run as the material installed.

D. Provide complete written inventory of overstock goods in Excel format indicating product type, model number, installed location(s), name of supplier, quantity supplied, and storage location. Inventory shall be confirmed prior to issuance of Substantial Completion.

E. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Substitutions may be considered during construction when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
   1. Note any departures from the Contract Documents or changes in previously reviewed submittals which were not commented upon in the initial review of information.

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Where "visual matching" is not possible, paragraph 2.3E.
   6. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
   7. Will reimburse the Architect for changes to the building design, including engineering design, detailing and additional Construction Administration services as a result of the proposed substitution.

E. Conditions for Substitution after Bidding/ Negotiating Period: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
   1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   2. Requested substitution does not require revisions to the Contract Documents.
   3. Requested substitution is consistent with the Contract Documents and will produce indicated results including warranty, maintenance service or source replacement of parts.
   4. Requested substitution will not adversely affect Contractor's Construction Schedule or the work of other trades.
   5. Requested substitution will not require changing specifications or affect the Owner's activities.
   6. Requested substitution has received necessary approvals of authorities having jurisdiction.
   7. Requested substitution is compatible with other portions of the Work.
   8. Requested substitution has been coordinated with other portions of the Work.
   9. The Contractor agrees to reschedule activities around the required redesign time needed without changing Substantial Completion date and reimburse Architect for changes to the building design, including design, detailing and additional Construction Administration services as a result of the proposed substitution.

F. Substitutions will not be considered when they are indicated or implied on Shop Drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
   1. Submit proposed substitution 14 days prior to submittal.

G. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. Requests during Procurement (Bidding): Specified in Procurement Documents.
   4. Requests after Bidding/ Negotiating Period: Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-FURNISHED PRODUCTS (CONTRACTOR INSTALLED)

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in a manner to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

L. Installed products and materials shall be protected from damage, weather, vandalism, etc. prior to Final Completion. Replacement and replacement cost will be Contractor's responsibility.

END OF SECTION

Advancement of Construction Technology

The Construction Specifications Institute
Northwest Region

SUBSTITUTION REQUEST

TO: _____

PROJECT: _____

SPECIFIED ITEM: _____

Section	Page	Paragraph	Description

PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request. Applicable data is clearly identified.

Attached data also includes description of changes to Contract Documents the proposed substitution requires for its proper installation.

Undersigned certifies following items, unless modified by attachments, are correct:

1. Proposed substitution does not affect dimensions shown on drawings.
2. Undersigned will pay for changes to building design, including engineering design, detailing, and construction costs caused by proposed substitution.
3. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
4. Maintenance and service parts are available locally or are readily obtainable for proposed substitution.

Undersigned further certifies the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Undersigned agrees, if this page is reproduced, the terms and conditions for substitutions found in Bidding Documents apply to this proposed substitution.

Submitted by:

Name (printed or typed)

Signature

Firm Name

Address

City, State, Zip

Date

Telephone Fax

General Contractor (if after award of Contract)

For use by A/E

- Approved
- Approved as Noted
- Not Approved
- Received Too Late

By _____
Date _____
Remarks _____

1995 Edition

List of Attachments:

Advancement of Construction Technology

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Stage)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: □ New product □ 1-4 years old □ 5-10 years old □ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

□ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: □ No □ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____($_____).

Proposed substitution changes Contract Time: □ No □ Yes [Add] [Deduct]_____days.

Supporting Data Attached: □ Drawings □ Product Data □ Samples □ Tests □ Reports □_____

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SUBSTITUTION REQUEST

(After the Bidding/Negotiating Stage - Continued)

The Undersigned certifies:
• Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
• Same warranty will be furnished for proposed substitution as for specified product.
• Same maintenance service and source of replacement parts, as applicable, is available.
• Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
• Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
• Proposed substitution does not affect dimensions and functional clearances.
• Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
• Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E's REVIEW AND ACTION

□ Substitution approved – Make submittals in accordance with Specifications Section 01 60 00 Product Requirements.
□ Substitution approved as noted – Make submittals in accordance with Specification Section 01 60 00 Product Requirements.
□ Substitution rejected – Use specified materials.
□ Substitution Request received too late – Use specified materials.

Signed by: _____ Date: _____

Additional Comments: □ Contractor □ Subcontractor □ Supplier □ Manufacturer □A/E □ _____

_____

_____

_____

_____

_____

_____

_____

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Cutting and patching.

C. Laying out the work.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

G. Closeout procedures, except payment procedures.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Cutting and Patching: If not shown in Documents, submitt an RFI in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

C. Substantial Completion Documents: Statement that Project is substantially complete and list of incomplete items (Punch List).
   1. 1 copy.
   2. Other items listed under Substantial Completion in Part 3.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.03 QUALIFICATIONS

A. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate to be kept on file in Contractor's office.

1.04 PROJECT CONDITIONS

A. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

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

C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property, as required by Authority Having Jurisdiction (AHJ).

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations, as required by Authority Having Jurisdiction (AHJ).

E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

F. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

C. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
   1. Do not overcut at corners of masonry, concrete, metals and similar rigid materials.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

K. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

L. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

3.06 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

E. Daily Cleaning Requirements:
   1. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.
   2. After cutting and boring, contractor is required to clean the space of all debris, water and concrete.
   3. Keep the premises free from accumulation of debris.
   4. Remove all debris, equipment, surplus materials and leave the premises in a neat and orderly condition at the completion of the work day.
   5. Clean all walks, streets, etc. affected by the work.

3.07 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.08 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.09 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
   1. Training & demonstration session of overview for all trades and response groups.
   2. In depth training and demonstration session for maintenance, technician, and service personnel. shall be to a maintenance technician, and/or service levels for all systems.
   3. Required hours will be listed in following standards.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.10 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.

B. Use cleaning materials that are nonhazardous and will not damage the Work.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

J. See also Divisions 31 and 32 for landscape restoration requirements.

K. Special cleaning for specific work may be noted in following sections of this document.

L. Comply with manufacturer's instructions for cleaning of all system components, equipment, and materials installed into the project.

M. Prior to the time the Contractor requests Substantial Completion Inspection:
   1. Remove labels that are not required as permanent labels.
   2. Clean exposed hard-surfaced finishes including glass, metals, stone, concrete, painted surfaces, plastics, tile, wood, special coatings, and similar surfaces, to a dirt free condition, free of dust, stains, films, and similar noticeable distracting substances.
   3. Clean concrete floors in non-occupied spaces.
   4. Clean lighting fixtures and lamps of all dust and debris.
   5. Remove crates, cartons, and other flammable waste materials or trash from work areas. Building(s) shall be turned over free of concealed garbage, trash, and rodent infestation. If any of the preceding is revealed, or odors from them occur, they shall be removed by the Contractor at Contractor's expense.
   6. Restore all surrounding property to its original condition.
   7. Elevator shafts, electric closets, pipe, and duct shafts, chases, furred spaces, and similar spaces which are generally unfurnished, shall be cleaned and left free from rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt, and dust.
   8. Rubbish and debris shall be lowered by way of chutes, hoists, or lowered in receptacles. Under no circumstances shall any rubbish or waste be dropped or thrown from one level to another within or outside the building(s).
   9. No marking, soiling, or other defacing of finished surfaces. In the event that finished surfaces become defaced, all costs for cleaning and restoring such surfaces to their originally intended condition shall be the responsibility and cost of the Contractor.
   10. Remove debris from and clean tops of all equipment, AHU, lights, etc. This includes mechanical rooms.

N. Prior to Contractor request of Final Acceptance Inspection:
   1. Clean transparent materials, including mirrors and window or door glass, to a polished condition, removing substances that are noticeable as vision-obscuring materials.
   2. Turn the work over in immaculate condition inside and outside including the premises.
   3. Clean all work on the premises including walks, drives, curbs, paving, fences, grounds, and walls. Slick surfaces shall be left with a clear shine. Cleanup shall include removal of smudges, marks, stains, fingerprints, soil, dirt, paint, dust, lint, labels, discolorations, and other foreign materials.
   4. Clean all finished surfaces on interior and exterior of project including floors, walls, ceilings, windows, glass, doors, fixtures, hardware, and equipment.
   5. Clean and apply finish (including 'Anchor' wax) to all floors as recommended by the manufacturer.
   6. Wash exterior glass using a window-cleaning contractor specializing in such work.
   7. Remove temporary buildings and structures, fences, scaffolding, surplus materials, and rubbish of every kind from the site of the work. Repair these areas to be compatible with the surrounding finished conditions.
   8. Clean tops of all equipment, AHU, lights, etc. This includes mechanical rooms.
   9. Construction Waste Management, see Section 01 74 19.

3.12 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect.

B. Notify Architect when work is considered ready for Substantial Completion.

C. Substantial Completion: Submit written statement that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   a. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
   b. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   c. Include the following information at the top of each page: Project name; Date; Name of Architect; Name of Contractor; Page number.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction digital photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Certificate of Substantial Completion: On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Re-inspection is Extraordinary Contract Administration Service, Section 01 20 00.
   3. Results of completed inspection will form the basis of requirement for Final Completion.

E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

F. Notify Architect when work is ready for Final Completion.
   1. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   3. Submit pest-control final inspection report and warranty.
   4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
   5. Submit demonstration and training videotapes.

G. Final Completion: On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will certify a final Certificate for Payment after inspection or will notify Contractor of work that must be completed or corrected before certificate will be issued.

H. Complete items of work determined by Architect's final inspection.
   1. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Re-inspection is Extraordinary Contract Administration Service, Section 01 20 00.

END OF SECTION

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Salvage and Recycling Requirements: Our goal is to salvage and recycle as much non-hazardous demolition and construction waste as possible including any demolition and/or construction waste.

C. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

D. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood: May be used as blocking or furring.
   5. Land clearing debris, including brush, branches, logs, and stumps: See Section 31 10 00 for use options.
   6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
   7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
   8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
   9. Asphalt paving: May be recycled into paving for project.
   10. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   11. Glass.
   12. Gypsum drywall and plaster.
   13. Plastic buckets.
   14. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs. See http://www.carpetrecovery.org to help you divert carpet from a landfill.
   15. Asphalt roofing shingles.
   16. Paint.
   17. Plastic sheeting.
   18. Rigid foam insulation.
   19. Windows, doors, and door hardware.
   20. Plumbing fixtures.
   21. Mechanical and electrical equipment.
   22. Fluorescent lamps (light bulbs).
   23. Acoustical ceiling tile and panels.

F. Owner requires that 75 percent, by weight, of potential landfill trash/waste is diverted by recycling or salvage.

G. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

H. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

I. The following sources may be useful in developing the Waste Management Plan:
   1. Metro's Construction Industry Recycling Toolkit, www.metro-region.org/toolkit.

2. State DEQ Commercial Waste Reduction Clearinghouse, at www.deq.state.or.us/wmc/cwrc.

J. Methods of trash/waste disposal that are not acceptable are:
1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.
5. Incineration, either on- or off-site.

K. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 50 00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 60 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

E. Section 31 10 00 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Material Recovery Facility: Waste sorting facility where commingled materials are accepted and recovered for recycling or salvage.

E. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

F. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

G. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

H. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

I. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

J. Return: To give back reusable items or unused products to vendors for credit.

K. Reuse: To reuse a construction waste material in some manner on the project site.

L. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

M. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

N. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

O. Toxic: Poisonous to humans either immediately or after a long period of exposure.

P. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

Q. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Recycling Plan: Prior to preparation of the Waste Management Plan, submit the recycling plan to the PM and Architect for approval.

C. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

D. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
   4. Identified Diversion Goals (%)
   5. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   6. Materials Handling Procedures and Protocols: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   7. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
   8. Identify parties responsible for implementing the plan.

E. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
      e. 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.
   4. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.

b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
f. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste in weight generated by the Work.
g. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices. Include documentation for back-charge fees (if any) for improperly segregated waste.

5. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards.
   c. Include weight tickets as evidence of quantity.
6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

F. LEED Credit MR 2: Plan and documentation for Construction Waste Management. Comply with Section 01 35 15.

G. Donation Record Keeping: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether or not the organization is tax exempt.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
      c. Recycling bins at worker lunch area.

2. Label containers and areas with durable, weather-resistant signs. Use clear simple language. Use multiple languages spoken at Project Site.
3. Provide containers as required.
4. Provide adequate space for pick-up and delivery and convenience to subcontractors.
5. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
6. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
7. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
8. Comply with project requirements for controlling dust and dirt, environmental protection, and noise control.

F. Alternative to Site Separation: Material Recovery Facility that provides specified documentation is acceptable in lieu of source-separated recycling facilities.

G. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

H. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

I. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

J. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SERA

L E E D® Construction Waste Management Plan

PROJECT NAME: _____

PROJECT NUMBER: _____

Reporting Period F R O M : _____ T O : _____

This form serves as a preliminary document to track the construction waste management process.
Fill in an individual row and note diversion/disposal method used for each material type.

1. REUSE 2. SALVAGE 3. RECYCLE 4. LANDFILL	MATERIAL DESCRIPTION			NAME OF HAULER & DESTINATION			QUANTITY	UNITS CHOOSE ONE: (tons OR cy)

TOTAL CONSTRUCTION WASTE DIVERTED:		
TOTAL CONSTRUCTION WASTE SENT TO LANDFILL:		
TOTAL OF ALL CONSTRUCTION WASTE:		
PERCENTAGE OF CONSTRUCTION WASTE DIVERTED FROM LANDFILL:		%

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Manuals.
   1. Preliminary Operation and Maintenance Manual at partial completion.

C. Warranties (and Bonds) Manual.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit one copy of preliminary manual before 75% of Work is complete. Include table of contents, outline contents of each section, and at least one typical finish section complete, and one equipment section complete. Architect will review preliminary and return one copy with comments.
   2. Applications for payment equal to and greater than 75% will not be certified until preliminary manual is submitted.
   3. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   4. Submit 1 copy of completed documents 15 days prior to Substantial Completion. This copy will be reviewed and returned, with Architect comments. Revise content of all document sets as required prior to final submission.
   5. Submit two sets of revised final documents in final form within 10 days after request for final payment or request for final inspection, whichever is first.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. Items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

1. Review current information with Architect prior to each Application for Payment. This is a condition for payment. See Section 01200

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Field changes of dimension and detail.
   4. Details not on original Contract drawings.

G. Commissioning Closeout Documentation: Provide commissioning closeout documentation and/or verification not included in the O&M manuals or as-built documentation.
   1. This information is intended to be a consolidation of documentation and verification for the project commissioning and closeout process.
   2. Include documentation of training of FS personnel regarding operation of particular systems. Such documentation shall include identification of parties receiving training and date(s) of training.

H. General Contractor As-Built document requirements / deliverables at project closeout: With all the following listed items, give particular attention to concealed products and portions of the work that are not clearly identified in the original submittal or cannot otherwise be readily discerned at a later date by direct observation.
   1. Original permit set of documents with sign off of inspections. Contractor should make copies of these sign offs for their records.
   2. 1 complete full-size, reproducible drawing sets on bond paper.
   3. 1 complete set of as-built specifications.
   4. 1 complete reproducible CD of as-built drawings and specifications in ‘pdf’ file format.
   5. 1 complete full-size reproducible drawing & specification set of Contractor’s red-lines on bond paper.
   6. Complete digital set of all construction photographs by Contractor.

3.02 OPERATION AND MAINTENANCE DATA - GENERAL

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.

2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

D. Provide servicing and lubrication schedule, and list of lubricants required.

E. Include manufacturer's printed operation and maintenance instructions.

F. Include sequence of operation by controls manufacturer.

G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

H. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLING OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
1. Multiple Volumes: Divide O & M information logically following CSI MasterFormat when more than one binder is necessary.
2. Subtitle binders by Volume Number and CSI sub group title or CSI division title as appropriate.

D. Cover: Identify each binder with printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify Subtitle appropriate for subject matter of contents, Month and Year of Substantial Completion.

E. Table of Contents: Project name on each page; list products and systems included in Volume, indexed by CSI Section number.

F. Information Page: Project name; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; date of substantial completion.

G. Index of Products: Table that can be sorted by word processor or spreadsheet; printed and digital formats; include product information under the following column headings:
1. Product Name
2. Manufacturer
3. Model number
4. O&M Volume Number
5. Section Number

H. Arrange content by systems under Section numbers and sequence of Table of Contents of this Project Manual.

I. Provide tabbed dividers for each separate product or system, with Specification Section number and product name.
1. Product Summary: On divider page or a separate first page indicate Specification Section number and title, product or system name, manufacturer, model, major components, supplier and installer information.

J. Text: Manufacturer's printed or typewritten information on 20 pound paper.

K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

L. Elevator Operation and Maintenance Manual: Submit an additional copy of information for elevator in a separate manual, formatted similar to primary manual. This Manual will be kept in Elevator Machine Room.
   1. When Project includes more than one Elevator Machine Room, provide separate manuals with information for elevators served by that machine room.

M. Operation and Maintenance Manuals:
   1. 2 complete physical hard copies of ALL listed items.
   2. 1 complete reproducible CD of ALL listed items in 'pdf' file format.
   3. ALL part numbers of manufacturers and suppliers.
   4. Total quantities installed under the contract.
   5. Manufacturer and supplier names and addresses.
   6. Complete manufacturer's serial number(s) or other identity symbol(s).
   7. Parts lists that clearly identify every part in the item of equipment with the proper manufacturer's name, part nomenclature and number, local source, and list price.
   8. Draw-downs of all finish paint used.
   9. Recommended Spare Parts:
      a. Furnish a list of recommended spare parts for each equipment item that will be needed to support that item of equipment for a 12-month period.
      b. The quantities of spare parts recommended shall be based upon the quantity of like equipment items installed under the contract.
      c. Storage shelf life of part, in months, if the part has a limited life.
      d. Recommended quantity of part(s) to inventory and support the installed quantity of equipment in which the part appears for a period of 12 months.
      e. Name, address, and phone number of the nearest supplier for the part.
   10. Normal Operating Instructions: Provide sufficient information that will permit a journeyman mechanic to adjust, startup, operate, and shutdown the equipment. Special startup precautions and other action items required before the equipment is put into service must be noted.
   11. Emergency Operating Procedures: Detail description of the sequence of action to be taken in the event of a malfunction, either to permit a short period of continued operation or an emergency shutdown to prevent further damage to the unit and to the system.
   12. Preventative Maintenance: Detail information to cover routine and special inspection requirements, including field adjustments, inspections for wear, adjustment changes, packing wear, lubrication points, frequency and specific lubrication type required, cleaning of the unit, type of solvent to use, and other measures applicable.
   13. Calibration: Detailed data on what to calibrate, how to calibrate, when to calibrate, and procedures to enable checking the equipment for reliability; provide indications and data for test equipment, special tools and the location of test points. n. Scale and Corrosion Control: Detailed information for prevention and removal of scale and corrosion.
   14. Trouble Shooting Procedures: Detailed information and procedures for detecting and isolating malfunctions; provide detailed information concerning probable causes and applicable remedies.
   15. Removal and Installation Instructions: Detailed information concerning the logical sequence of steps required to remove and install the item including instructions for the use of special tools and equipment.
   16. Disassembly and Assembly Instructions: Detailed illustrations and text to show the logical procedure and provide the instructions necessary to disassemble and assemble the unit properly. The text shall include all checks and special precautions and list the use of special tools and equipment required to perform the assembly or disassembly.
   17. Repair Instructions: Detailed repair procedures to bring the equipment up to the required operating standard including instruction for examining equipment and parts for needed

repairs and adjustments, and tests or inspections required to determine whether old parts may be reused or must be replaced.

18. System Drawings: Detailed drawings, where applicable, that clearly show wiring diagrams, control diagrams, system schematics, pneumatic and fluid flow diagrams, etc., which pertain to the unit function. Drawings are required to show modifications to another manufacturer's standard unit which is incorporated into the assembly or packaged unit.
    a. The Contractor shall provide diagrammatic drawings for each installed system, which shall show the placement of the system in relation to the building, and the physical location of each item or equipment installed within the system. Each installed item of equipment shown on the drawing will be identified by the equipment item model and/or serial/part number.
19. Special Tools and Test Equipment: Furnish a detailed list of the special tools and test equipment needed to perform repair and maintenance for each equipment item. The list shall contain the special tool and test equipment part number, size, quantity, price, manufacturer's name and address, and local supplier's name and address.
20. Warranties and Guarantees: Within each tabbed section of the O&M, include an executed copy of the specified warranty/guarantee covering the particular system, equipment item, or material.
    a. This is to include both the manufacturer's warranty and the installing contractor's guarantee for workmanship and system operation. This copy of the particular warranty/guarantee is in addition to the original signed copies that are to be bound together separately.
    b. Provide a separate binder containing all original project warranties and guarantees.
21. Field records on excavations, foundations, underground construction, wells, and similar work; if not already included in as-built drawings / documentation.
22. Accurate survey showing locations and elevations of underground lines, including invert elevations of drainage piping; if not already included in as-built drawings / ocumentation.
23. Surveys establishing lines and levels of buildings; if not already included in as-built drawings / documentation.
24. Load and/or performance testing.
25. Final inspection and deficiency corrections.
26. Prior to date of substantial completion the Architect and PM shall determine which (if any) samples or mock-ups are to be transmitted to the PM for record purposes.
27. With all the above listed items, give particular attention to concealed products and portions of the work that are not clearly identified in the original submittal or cannot otherwise be readily discerned at a later date by direct observation.

3.06 WARRANTIES AND BONDS MANUAL

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
    1. Always provide, at a minimum, the responsible Subcontractor's, supplier's and manufacturer's standard product warranty unless noted otherwise in the individual specification sections.
    2. All listed manufacturers and all listed installers through the act of submitting a bid are confirming obligatory responsibility for providing an equal quantity and equal quality warranty to the design basis warranties listed, unless individual specification sections note otherwise.
    3. Minimum warranty for all material and workmanship, building envelope and penetration components excluded per above noted ORS, for a minimum of 1-year after date of substantial completion OR for the extended period of time determined by manufacturer's guarantee.
    4. Extended warranties may be required for specific items as noted in the following document.

5. Correct immediately any failure caused by poor material or workmanship during warranty period; within 72 hours of notice.
6. If the PM or FS personnel are required to proceed with repairs, the responsible party of the warranty will be billed for costs and damages when failing to comply.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
1. Do not include "And Bonds" when Project does not include bonds.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.07 MAINTENANCE MATERIALS

A. Closeout delivery of any and all closeout and/or overstock items to the PM requires formal transmittals for project records; including O&M manuals, extra materials, custom finish knives, etc.

B. See Section 01 60 00 for additional requirements.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

C. The Commissioning Authority is employed by Owner.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Plumbing Systems:

C. HVAC System, including:

D. Special Ventilation:

E. Electrical Systems:

F. Electronic Safety and Security:

G. Communications:

H. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

I. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Section 01 57 21.

1.03 RELATED REQUIREMENTS

A. Section 01 57 21 - Indoor Air Quality Controls: Precautions and procedures; smoking room testing; building flush-out.

B. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

1.04 REFERENCE STANDARDS

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2003 preferred.
   5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

C. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
   1. Manufacturer's product data, cut sheets, and shop drawings.
   2. Manufacturer's installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Fan and pump curves.
   5. Factory test reports.
   6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.

3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Contractor may independently perform startup inspections and/or tests, at his option.
   6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
   7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
   1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in the Contract Documents.

2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
1. Some test procedures are included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
2. Examples of Functional Testing:
   a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).

b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:

1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Barometric Pressure: 0.1 inch of Hg (.
7. Flow Rate, Air: 10 percent of design.
8. Flow Rate, Water: 4 percent of design.
9. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.
   8. Acoustical isolation floating slabs.
   9. Architectural Concrete Mock-ups for the following
      a. Retaining walls.
      b. Slabs.
      c. Interior ramp.
      d. Cast concrete against existing walls.
      e. Cast concrete in Hearth Area
   10. Site concrete: seat walls, retaining walls, accent paving.

B. This Section specifies architectural cast-in place concrete for locations indicated, and all materials, procedures, and requirements specified in Section 03 30 00 Cast-in-Place Concrete shall fully apply to cast-in-place architectural concrete, except as otherwise specified.

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following, subject to compliance with requirements:
   1. Blended hydraulic cement.
   2. Fly ash and other pozzolans.
   3. Ground granulated blast-furnace slag.
   4. Silica fume.

B. Formwork Surface Finish Class: For Maximum tolerance limits see Article 3.01, Paragraph C and subparagraphs.
   1. Class A: Cast-In-Place Architectural Concrete Surfaces; permanently exposed to public view that require excellent appearance at close range. Meet description under 1.04 Quality Requirements for Cast-In-Place Architectural Concrete. Mockup panel required.
   2. Class B: Surfaces exposed to public view that do not require the excellent appearance of Class A. Mockup panel required.
   3. Class C: Surfaces not exposed to view and for all surfaces not covered by Class A, B, or D finish.
   4. Class D: Surfaces where roughness and irregularities are not objectionable.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.
   2. Include substantiating test data to show compliance with ACI 318 Chapter 5.

C. LEED Submittals: Complete LEED Project Submittal Form, Section 01 33 00, for the following Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.
   1. Credit MR 2: Waste Material Tracking Form, Section 01 74 19.
   2. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.

3. Credit MR 5: (Regional) Straight-line distance to Manufacturer and distance to material extraction for each product. If greater than 500 miles, report “> 500”. Product cost data.
4. Credit EQ 4.1, 4.2, 4.3: Manufacturers' product data for adhesives, sealants, paints and coatings including printed statement of VOC content

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. The steel reinforcement detailer shall generate all shop drawing bending and installation details from the structural and architectural drawings and specifications. The use of reproductions or photocopies of the contract drawings shall not be permitted.
   1. Provide details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include special reinforcement required for openings through concrete structures.
   2. Shop drawing re-submittals shall clearly identify all revisions to previous submittals.
      a. Heavy ink clouded outlines (revision clouds) shall be drawn around revised areas of individual sheets.
      b. Architect/Engineer will not review information outside of revision clouds on resubmitted drawings.

E. Formwork Shop Drawings: Prepared by or under the supervision of a structural engineer licensed in the State of Oregon detailing fabrication, assembly, and support of formwork.
   1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
   2. Indicate location and provide product data for each type of form tie product indicated.
   3. Provide form tie layout in exposed to view concrete showing aesthetically symetrical, horizontally and vertically.aligned, and evenly spaced horizontally and vertically meeting structural resistance requirements for plastic concrete loads without deformation exceeding specified formwork surface class.

F. Waterstop Shop Drawings: PDF format showing locations and types per manufacturer’s recommendations.

G. Samples: For waterstops and vapor retarder.

H. Welding certificates.

I. Qualification Data: For Installer, manufacturer, and testing agency.
   1. Qualification Data: For firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

J. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Waterstops.
   7. Curing compounds.
   8. Floor and slab treatments.
   9. Bonding agents.
   10. Adhesives.
   11. Vapor barriers.
   12. Semirigid joint filler.
   13. Joint-filler strips.
   14. Repair materials.

K. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

L. Minutes of preinstallation conference.

M. Construction Joint Layout: Indicate proposed construction joints required to construct the structure. Location of construction joints is subject to approval by the Engineer.

N. Vapor barrier manufacturer's technical representative reports.

1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301, ACI 117 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and supervisor who is an ACI-certified Concrete Flatwork Technician.

E. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM 94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities.

F. For slabs-on-grade required to include an under-slab vapor barrier, provide a vapor barrier from a firm experienced in manufacturing vapor barriers and conforming to the requirements specified herein. Do not proceed with placement unless manufacturer's technical representative is present for vapor barrier installation and for every day of concrete slab placement.

G. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.

H. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant located within a 500 mile radius, obtain aggregate from one source, and obtain approved admixtures through one source.

I. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 30 00 - Administrative Requirements.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixes.
      c. Ready mix concrete manufacturer.
      d. Concrete subcontractor.
      e. Steel reinforcement subcontractor when applicable.
      f. Under-slab vapor barrier
      g. Under-slab vapor barrier manufacturer's technical representative, for slabs on grade.
   2. Review procedures and special conditions and details for field quality control of vapor barrier placement.

3. Review and hold product shop drawing tolerances for related work that will interface with the Work of this section.
4. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

K. Manufacturer's Technical Representative:
1. Visit site not less than three times, and more if required to review vapor barrier placement and installatiion procedures and concrete placement over vapor barrier.
   a. Pre-installation meeting.
   b. Duration of membrane installation for observation of completed membrane installation.
   c. After installation of reinforcing, when applicable, and during placement of concrete
2. Document site visits in writing with copy to Architect.

L. Cast-In-Place Architectural Concrete:
1. Installer Qualifications: A qualified contractor who has specialized in installing cast-in-place architectural concrete similar in material, design, and extent to that indicated for this Project, and capable of casting in place architectural concrete with finish as exists at Wieden and Kennedy, Portland, as an example of concrete finish expectation for this Project.
2. Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment to achieve indicated quality expectations.
3. ACI Standards: Comply with ACI 303.1, "Specification for Cast-in-Place Architectural Concrete"; ACI 301, "Specification for Structural Concrete"; and ACI 117, "Specifications for Tolerances for Concrete Construction and Materials," unless more stringent provisions are indicated.
4. Mockups (Sample Panels): Before casting architectural concrete, produce a minimum of three (3) sets of full-scale sample panels, cast vertically, approximately 48 by 48 by 6 inches minimum, to demonstrate the expected range of finish, color, joint types, patching, sacking, and texture variations.
5. Preinstallation Conference: Conduct conference at Project site two weeks prior to beginning architectural concrete placement. Include installer, suppliers and factory representative for all products proposed for use in the placement procedures.

1.05 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship for each exposed to view formed surface finish class. See Section 01 43 39.

C. Construct concrete mock-up panels for new architectectural concrete placements indicated on the drawings, incorporating all components specified, and mock up panels shall include a typical joint between form panels, form tie conditions, and surface finish, texture, tolerances, and standard of workmanship.
1. Construct in a coordinated mock-up, concrete retaining wall mock-up where indicated on the drawings, incorporating all components specified for one coordinated assembly in conjunction with associated assemblies.
2. Minimum size of mock-ups as indicated.
3. In some intances, approved mock-up may remain as part of the Work if undisturbed at time of Substantial Completion.

D. Construct typical mock-up for site seat wall, 2 feet minimum in length, showing finish, color, joints, and skate stop.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.07 SYSTEM DESCRIPTION

A. Redesign or Departures from Requirements of the Contract Documents Initiated by Contractor:
   1. Obtain written acceptance from the Architect and Architect's consultants.
   2. Bear costs for Contractor-initiated or construction error due to changes in type, form, system, or details of construction from those indicated by the contract documents.
   3. Costs of review of such changes by Architect and Architect's consultants will be deducted from the Contract Sum by Change Order.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to manufacturers specified.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FORM-FACING MATERIALS

A. Class A, Smooth-Formed Finished Concrete Exposed in Public Spaces, Exposed in Semi-public spaces, including Open Offices and Conference Rooms, Hallways and Stairs, and North Wing Shear Walls: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1, or better.
   3. Formed corners: ¼' radius

B. Class A, Forms for Rectangular Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces without gradual or abrupt irregularities exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without deformation exceeding specified formwork surface class.

C. Class C, Formed Concrete at Concealed Locations: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Form material, contractor choice

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties exposed in Public Spaces: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Basis of Design: RJD Industries, Inc, SuperTie Fiberglass Formtie Systems
      a. Furnish symmetrical and uniform form tie layouts evenly spaced vertically and horizontally, and aligned vertically and horizontally.

G. Form Ties at Concealed Locations, and Exposed in Open Offices and Conference Rooms: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed. Refer to General Structural Notes.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

C. Regional Content: Provide steel products which are extracted/harvested and manufactured from within 500 miles of the project site.

D. Low-Alloy-Steel Reinforcing Bars: All reinforcing steel to be welded or bent in field: ASTM A 706, deformed.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.04 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60 plain steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice" of greater compressive strength than concrete, and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.05 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II.
      a. Fly Ash: ASTM C 618, Class C or F. Refer to General Structural Notes.
      b. Recycled Content: Provide cement, cementitious materials, and aggregate with postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
      c. Regional Content: Provide cement and cementitious materials which are extracted/harvested and manufactured from within 500 miles of the project site.

B. Normal-Weight Aggregate: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 1 inch at foundations, 3/4 inch at slabs and walls
      a. Regional Content: Provide aggregate materials which are extracted/harvested and manufactured from within 500 miles of the project site.

C. Water: ASTM C 94 and potable.

2.06 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.
   1. Use of admixtures requires Owner approval.

B. Chemical Admixtures:
   1. Use of admixtures requires Owner approval.

2.07 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 inch by 1 inch (19 by 25mm).
   1. Products:
      a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
      b. Concrete Sealants Inc., Conseal CS-231.
      c. Greensteak; Swellstop.
      d. Henry Company, Sealants Division; Hydro-Flex.
      e. JP Specialties, Inc.; Superstop.
      f. TCMiraDRI; Mirsastop.
      g. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 ACCESSORY MATERIALS

A. Underslab Vapor Barrier: Polyolefin multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs.
   1. Single ply polyethylene is prohibited.
   2. Water Vapor Permeance: less than.01 perms when tested in accordance with ASTM F-1249/ASTM E-96.
   3. Minimum thickness: 15 mils.
   4. Manufacturers:
      a. Fortifiber Corporation, www.fortifiber.com <http://www.fortifiber.com>; Product: Moistop Ultra 15 X.
      b. Insulation Solutions, Inc; www.insulationsolutions.com; Product: Viper VaporCheck II, 15 mil.
      c. Poly-America, Inc; www.yellowguard.com <http://www.yellowguard.com>; Product: 15 mil Yellow Guard.
      d. Raven Industries Inc, www.ravenind.com <http://www.ravenind.com>; Vapor Block VBLP15.
      e. Stego Industries, LLC www.stegoindustries.com <http://www.stegoindustries.com>; Product: Stego Wrap, 15 mils.
      f. W. R. Meadows, Inc., www.wrmeadows.com; Product: PERMINATOR, 15 mil.
      g. Substitutions: See Section 01 60 00 - Product Requirements.
   5. Details, transitions, terminations and penetrations to be installed per manufactuer's recommendations.

B. Vapor Emission Control Sealer and pH Suppression: Two-component high solids penetrating epoxy sealer for providing an effective membrane barrier to inhibit moisture migration and provide pH isolation. Details, transitions, terminations and penetrations to be installed per manufacturer's recommendations. See Section 01 45 19 for testing procrdures to determine if use of these products is necessary. Use of these products is applicable only when testing indicates need for floor covering application and individual Division 09 floor covering manufacturers do not have a preferred specific product for maintaining floor covering warranties.
   1. Manufacturers:
      a. Ardex
      b. Advanced Moisture Control
      c. Aquafin, Inc

d. Bostik
e. Dependable Floor Underlayments
f. Mapei
g. Substitutions: See Section 01 60 00 - Product Requirements.

C. Slab Isolation System: Roll-out batting with pre-spaced isolators for providing an effective high-performance resilient decoupler creating a floating floor system to minimize floor impact noise and airborne sound transmissions.
1. Manufacturers:
a. Kinetics Noise Control, Inc.
1) Product: Model RIM.
b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Concrete Topical Sealer: Clear single-component high resin solids, water-based low VOC concrete sealer for providing an effective anti-dusting wear surface for exposed concrete floors which are not recieving floor covering, penetrating sealers/hardeners or polished concrete floor surfacing.

E. Skate Stop
1. Size: Refer to Drawings.
2. Materials/Finish: Cast bronze with brown patina.
3. Approved Product: EMU Straddle by SkateStoppers, or approved; www.skatestoppers.com <http://www.skatestoppers.com>; Contact: Chris Loarie @ 619-447-6374.

F. Site Stormwater Planter Through-Wall Scupper: See drawings.

2.09 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products:
a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edoco; BurkeFilm
c. ChemMasters; Spray-Film
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (the); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, Div. of ChemRex; Confilm.
k. Meadows, W.R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
s. Substitutions: See Section 01 60 00 - Product Requirements.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
4. Water: Potable.
5. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, 30% solids content minimum. The only place in the project this is applied

are the top of exposed concrete slabs that are not receiving other floor finishes that cover the concrete slab visually or concrete polishing.

a. Products:
   1) Burke By Edoco; Cureseal 1315 WB.
   2) ChemMasters; Polyseal WB.
   3) Conspec Marketing & Manufacturing Co.; Inc., a Dayton Superior Company; Sealcure 1315 WB.
   4) Euclid Chemical Company (The); Super Diamond Clear VOX.
   5) Kaufman Products, Inc.; SureCure 25 Emulsion.
   6) Lambert Corporation; UV Safe Seal.
   7) L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
   8) Meadows, W.R., Inc.; Vocomp-30.
   9) Metalcrete Industries; metcure 30.
   10) Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
   11) Tamms Industries, Inc.; LusterSeal WB 300.
   12) Unitex; Hydro Seal 25.
   13) US Mix Products Company; US Spec Radiance UV-25.
   14) Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
   15) Substitutions: See Section 01 60 00 - Product Requirements.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class, suitable for application temperature and grade to suit requirements, and as follows:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Weep Hole Sleeve:
   1. Size: Schedule 40 standard steel pipe, 1 inch inside diameter.
   2. Finish: Hot dipped galvanized, G-185 complying with ASTM A 123/A 123 M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 and in accordance with the following:
   1. Compressive Strength: Refer to General Structural Notes.
   2. Maximum Water-Cementitious Materials Ratio: Refer to General Structural Notes.
   3. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having the air content specified in the General Structural Notes.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 20 percent.
   2. Combined Fly Ash and Pozzolan: 20 percent.
   3. Ground Granulated Blast-Furnace Slag: 50 percent.
   4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 20 percent.
   5. Silica Fume: 10 percent.

6. Combined Fly Ash, Pozzolans, and Silica Fume: 30 percent with fly ash or pozzolans not exceeding 20 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent portland cement minimum, with fly ash or pozzolans not exceeding 20 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

E. Concrete Mixture at Site Seat Walls, Site Accent Paving
1. All aggregates ¼” or smaller must be black.
2. Use color admixture, Davis Colors Silver Smoke, #860, or approved.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces at interior or exterior exposed to view concrete surfaces.
2. Class B, 1/4 inch for utility formed finished surfaces.
3. Class C, 1/2 inch utility formed finished surfaces hidden from view.
4. Class D, up to 1 inch for rough-formed finished surfaces burried and hidden from view.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Place form ties in patterns evenly space horizontally and vertically.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete if square corner with 1/4 inch radius is called for.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

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

3.03 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete if concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 SHORES AND RESHORES

A. Comply with ACI 318, and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 VAPOR BARRIER

A. Plastic Vapor Barrier: Place, protect, and repair vapor barrier according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturer's recommended tape.

2. Install vapor barriers per manufacturer's recommendations.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs. Provide continuous placement for exposed to view walls and columns so that there are no visible indication of placement stops and starts within the uniterupted planes of these concrete structures.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent or roughen interface to ¼" (6mm) amplitude at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.08 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field-fabricate joints in waterstops according to manufacturer's written instructions. Install per manufacturer's recommendations

3.09 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

C. Adjust mix as required to maintain specified air content at the point of discharge.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities to meet preparation requirements for waterproofing and dampproofing.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes, voids, bug holes and defects. Remove fins and other projections and formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
   2. Finish and measure surface to tolerances indicated.

C. Trowel and Fine-Broom Finish: Apply a first trowel finish, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel finished floor surfaces indicated.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
   2. Accent Paving Finish: Reference 32 13 13 - Site Paving.

3.12 FINISHING SITE WALLS

A. Concrete finish at seat and retaining walls: Green face hard trowel exposed surfaces (vertical and top of wall). Apply light sand blast once cured.

B. Apply an acrylic sealer on accent paving and seat walls.

C. For concrete finish at accent paving, reference 32 13 13 Site Paving

3.13 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for conformance to specified tolerances.

B. Screed slab on grade floors level, maintaining the following minimum F(F) Floor Flatness and F(L) Floor Levelness values when measured in accordance with ASTM E 1155 within 48 hours after slab installation; report both composite overall values and local values for each measured section. Verify finish with Architect.
   1. Non-critical areas, thickset tile:
      a. F(F): Specified Overall Value (SOV) of 20; Minimum Localized Value (MLV) of 15.
      b. F(L): Specified Overall Value (SOV) of 15; Minimum Localized Value (MLV) of 10.
   2. Carpet areas:
      a. F(F): Specified Overall Value (SOV) of 25; Minimum Localized Value (MLV) of 17.
      b. F(L): Specified Overall Value (SOV) of 17; Minimum Localized Value (MLV) of 15
   3. Thinset Flooring:
      a. F(F): Specified Overall Value (SOV) of 35; Minimum Localized Value (MLV) of 30.
      b. F(L): Specified Overall Value (SOV) of 30; Minimum Localized Value (MLV) of 20.
   4. Polished Concrete Flooring:
      a. F(F): Specified Overall Value (SOV) of 50; Minimum Localized Value (MLV) of 35.
      b. F(L): Specified Overall Value (SOV) of 30; Minimum Localized Value (MLV) of N/A.

C. Screed suspended slab floors level, maintaining the following minimum F(F) Floor Flatness and F(L) Floor Levelness values when measured in accordance with ASTM E 1155 within 48 hours after slab installation; report both composite overall values and local values for each measured section. Verify finish with Architect.
   1. Non-critical areas, thickset tile and parking structures:
      a. F(F): Specified Overall Value (SOV) of 20; Minimum Localized Value (MLV) of N/A.
      b. F(L): Specified Overall Value (SOV) of 15; Minimum Localized Value (MLV) of N/A.
   2. Carpet Areas:
      a. F(F): Specified Overall Value (SOV) of 25; Minimum Localized Value (MLV) of N/A.

b. F(L): Specified Overall Value (SOV) of 15; Minimum Localized Value (MLV) of N/A.

3. Thinset Flooring:
   a. F(F): Specified Overall Value (SOV) of 30; Minimum Localized Value (MLV) of N/A.
   b. F(L): Specified Overall Value (SOV) of 24; Minimum Localized Value (MLV) of N/A.
4. Polished Concrete Flooring:
   a. F(F): Specified Overall Value (SOV) of 50; Minimum Localized Value (MLV) of 35.
   b. F(L): Specified Overall Value (SOV) of 30; Minimum Localized Value (MLV) of N/A.

D. Total floor longitudinal levelness tolerance must be a maximum of 1/4 inch at glazing channel and metal base locations.

E. Telescoping Platform Tolerances: Reference Division 9 Finishes Sections for adequate floor and wall construction for operation of Telescoping Platforms. Flooring shall be level and rear wall plumb within 1/8” [3mm] in 8’-0 [2438mm]. Maximum bleacher force on the floor, of a 25’-6” [7772] section, shall be a static point load of less than 300 psi [2.068 N/mm2].

F. Seismic Expansion Joint Covers: A longitudinal dimensional tolerance of 1/16” (1.6mm) over a distance of 10’-0” (3.05m) is specified to allow for reasonable leeway for imperfections without compromising performance or functionality of the system.
   1. Cross-sectional dimensions must be level and in-plance with the final installation. The blockout must provide full an dcontinuous support of the frames and be free from voids or the use of supplemental shimming. Crisp edges for the entire depth/width of the specified block-out are required as well.

3.14 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases: Unless shown otherwise in the drawings provide 4” thick concrete pads under mechanical equipment as required. Reinforce with #4 @16” on center each way at center of pad. Dowel to floor structure with #3 hooked dowels with 12” horizontal legs, at 24” on center around perimeter of pad. Drill and epoxy with 3” embedment. Refer to Mechanical drawings for locations. Pad size to extend 6” beyond edge of equipment on all sides. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.15 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft./h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1 by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of a floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

F. General: Where structural slabs will be polished and exposed to view, protect structural concrete slab finished surface from surface damage and staining resulting from construction activities by utilizing appropriate membrane and sheet materials and other such measures as may be necessary to protect the finished slab surface appearance such as, but not limited to, diapering of equipment to eliminate oil leaks, and restricting construction activities that could be potentially detrimental to exposed to view slab finished surfaces. Protect concrete surfaces to receive polished finish:
   1. Moist cure for a minimum of 10 days before covering with protection board.
   2. Use Ram Board as protection board, with additional plywood during setting of steel. Do not use Masonite, hardboard.
   3. Do not use staining snap lines. Use blue only.
   4. Wet cure only, concrete slabs.
   5. Slab curing temperature is to remain below 120 degrees F where radiant heating/cooling system plastic piping is integral with slab.
   6. Forming and bracing must remain in place for support of structural slab until slab has come up to full strength.
   7. Allow slabs to adequately cure to eliminate possibility of discoloring slab surface and silhouetting of protect board onto concrete finish surface. Hardboard may not be used as a protection board.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports as specified in Section 01 40 00.

B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform tests, and inspections and to submit test reports

C. Inspections: As indicated in the General Structural Notes.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or fraction thereof of each concrete mix placed each day and at least one composite sample for each 5000 square feet of surface area of slabs or walls.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   5. Prior to finish flooring surfaces being installed, the relative humidity of the concrete slab shall meet the requirements of the flooring manufacturer or 80 percent, whichever is less, per ASTM F-2170-02 (Relative Humidity Probe Test).
   6. Compression Test Specimens: ASTM C 31.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   7. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days, two at 28 days, and hold one for later testing.
      a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
   9. Test results shall be reported in writing to Architect, Structural Engineer, concrete manufacturer, Building Official, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, type of break for both 7- and 28-day tests, and air content.
   10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
   11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
   12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION

SHOTCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pneumatically applied concrete for delegated design shoring.

1.02 REFERENCE STANDARDS

A. ACI 506.2 - Specification for Materials, Proportioning, and Application of Shotcrete; American Concrete Institute International; 1995.

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

C. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

D. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on admixtures.

C. LEED Submittals: Complete LEED Project Submittal Form, Section 01 33 00, for the following Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.
   1. Credit MR 2: Waste Material Tracking Form, Section 01 74 19.
   2. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
   3. Credit MR 5: (Regional) Straight-line distance to Manufacturer and distance to material extraction for each product. If greater than 500 miles, report “> 500”. Product cost data.

D. Shop Drawings: Indicate formwork, and dimensions, reinforcement, accessories.

E. Mix design test reports.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 506.2.

B. Design work of this section under direct supervision of a Professional Structural Engineer experienced in design of shotcrete structures and licensed in the State in which the Project is located.

C. Applicator Qualifications: Company specializing in performing shotcrete installations, with minimum five years of documented experience.

1.05 MOCK-UP

A. Sample Panel: Provide mock-up of sufficient size to indicate special treatment or finish required.

B. Test Panels: Prior to starting work provide mock-up for evaluation of materials and workmanship:

C. Locate mock-up where directed.

D. Mock-up may remain as part of the Work.

1.06 FIELD CONDITIONS

A. Maintain material and surrounding air temperature at minimum 50 degrees F prior to and during installation and maintain material at this minimum temperature for 7 days after completion of work. Provide equipment and cover to maintain minimum temperature.

B. Suspend shotcrete operations during high winds, rainy weather, or near freezing temperatures when work cannot be protected.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C150, Type I - Normal; white color.

B. Aggregate: Normal weight, ASTM C33, 3/8 inch maximum size.

C. Admixtures: Chemical type conforming to ASTM C494/C494M (wet mix only).

D. Water: Clean, potable, and not detrimental to shotcrete.

E. Curing Compound: Water-based, spray-on, penetrating curing compound and hardener; not detrimental to application of subsequent surface finish materials; containing no wax, resin, or solvents.

2.02 SHOTCRETE MIX

A. Provide wet or dry mix design that gives good compaction and low percentage of rebound, is stiff enough not to sag.

B. Conform to requirements in structural notes.

2.03 EQUIPMENT

A. Mixing Equipment: Capable of thoroughly mixing aggregate, cement, and water in sufficient quantity to maintain continuous placement.

B. Delivery Equipment: Capable of discharging wet mix aggregate, cement, and water accurately, uniformly, and continuously.

2.04 SOURCE QUALITY CONTROL

A. An independent testing agency will provide inspection and testing services, as specified in Section 01 40 00.

B. Prior to start of work, testing agency will review mix proportions, gradation, and quality of aggregate.

C. Test samples in accordance with ACI 506.2.

D. Independent testing agency will test mock-up panels as follows:
   1. Drill 3 inch diameter core samples from test panels.
   2. Test for strength.

E. Modify mix design as required based on results of testing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are acceptable and are ready to receive work.

B. Verify that field measurements are as shown on drawings.

C. Verify fabricated forms are:
   1. True to line and dimension.
   2. Adequately braced against vibration during placement.
   3. Constructed to permit escape of trapped air during gunning operations.
   4. Constructed to minimize rebound during gunning operations.

D. Verify that embedded fittings, pipe, conduits, and other items are correctly and securely placed.

E. Ensure easy access to shotcrete surfaces for screeding and finishing, and to permit uninterrupted application.

3.02 PREPARATION

A. Remove existing unsound concrete from substrate surfaces.
   1. Minimize abrupt changes in depth of area to be repaired.
   2. Remove square external corners from substrate by radiusing the edges.

B. Determine operating procedures for placement in close quarters, extended distances, or around unusual obstructions where placement velocities and mix consistency may be adjusted during application.

C. Clean and wet cementitious or absorptive substrate surfaces prior to receiving shotcrete. Keep porous surfaces damp for several hours prior to placement of shotcrete.

D. Protect adjacent surfaces not receiving shotcrete.

3.03 ALIGNMENT CONTROL

A. Provide alignment wire to establish thickness and plane of required surfaces.

B. Install alignment wire at corners and offsets not established by forms.

C. Tighten alignment wire true to line. Position adjustment devices to permit additional tightening.

3.04 APPLICATION

A. Place reinforcement in accordance with ACI 506.2.

B. Use mixing and delivery equipment capable of thoroughly mixing aggregate, cement, and water in sufficient quantity to maintain continuous and uniform placement.

C. Do not apply shotcrete more than 45 minutes after adding Portland cement to the mix.

D. Do not place shotcrete on surfaces that are frozen, spongy, or where there is free water.

E. Achieve maximum compaction with minimum rebound.

F. Build-up to required thickness in multiple passes to achieve layering. Encase reinforcement with the first pass.

G. Allow each layer to take initial set before applying succeeding layers.

H. Do not permit applied shotcrete to sag, slough, or displace.

I. After initial set of final layer, remove excess material outside of forms and alignment lines.

J. Finish surface of final layer with natural gun finish.

K. Remove rebound at construction and expansion joints.

L. Remove rebound material that does not fall clear of work; discard salvaged rebound.

M. Maintain shotcrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of shotcrete.

N. Immediately after placement, protect shotcrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

O. Maintain surfaces wet for a minimum of 7 days.

P. Sound test the applied material with hammer for voids. Expose voids and replace with new shotcrete ensuring full bond with adjacent work.

3.05 FIELD QUALITY CONTROL

A. Provide additional test panels, as specified for mock-up, during the course of the work as may be requested by the testing agency.

3.06 PROTECTION

A. Do not permit applied work to damage adjacent surfaces.

END OF SECTION

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members, support members, and struts.

B. Base plates, shear stud connectors and expansion joint plates.

C. Grouting under base plates.

1.02 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2011.

B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2005.

C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2007.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.

H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

I. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2004 (Reapproved 2009).

J. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2012.

K. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.

L. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2013.

M. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi Minimum Tensile Strength; 2012.

N. ASTM A490M - Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric); 2012.

O. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010a.

P. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2007.

Q. ASTM A514/A514M - Standard Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2005 (Reapproved 2009).

R. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2005 (Reapproved 2009).

S. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a.

T. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

U. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2012.

V. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011.

W. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2012.

X. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability and Ultra-High Strength; 2012a.

Y. ASTM E94 - Standard Guide for Radiographic Examination; 2004 (Reapproved 2010).

Z. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2008.

AA. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.

AB. ASTM F 436M-93 - Specification for Hardened Steel Washers(Metric); 2000.

AC. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2009.

AD. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.

AE. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

AF. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

AG. AWS D1.8/D1.8M – Structural Welding Code – Seismic Supplement; 2009.

AH. AISC 341 – Seismic Provisions for Structural Steel Buildings; 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product indicated.

C. LEED Submittals: Complete LEED Checklist and Tracking Form, Section 01 35 15, and other data for the following LEED Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.
   1. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
   2. Credit MR 5: List products that are extracted, harvested or recovered as well as manufactured or processed within 500 straight-line miles of Project Site, or percent of regional material by weight. Include address and distance of material source and product manufacture, product cost data.

D. Shop Drawings: Show fabrication of structural-steel components.
   1. Structural steel shop drawings shall contain sufficient detail and information to allow complete fabrication and erection of the structure without reference to the contract drawings either on the fabrication shop floor or at the project site. The steel detailer shall generate all shop drawing fabrication and installation details from the structural and architectural drawings and specifications. The use of reproductions or photocopies of the contract drawings shall not be permitted.
   2. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   3. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   4. Include embedment drawings.
   5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
   7. Additional seismic submittal requirements:
      a. Identify members and connections that are part of the SLRS as indicated in the construction documents.
      b. Locations of demand critical welds.
      c. Locations and dimensions of protected zones.
      d. Locations of slip critical bolts.
      e. Access hole dimensions, surface profile and finish requirements.

f. Locations where backing bars and weld tabs are to be removed.
g. Locations where supplemental fillet welds are required when backing in permitted to remain.
h. Connection assembly sequence where special precautions are required.
i. Non-Destructive Testing (NDT) to be performed by the fabricator, if any.
j. AISC 341 Appendix Q – Quality Assurance Plan and Appendix W – Welding Provisions.
k. AWS D1.8/D1.8M – Structural Welding Code – Seismic Supplement; 2009.

8. Shop drawing re-submittals shall clearly identify all revisions to previous submittals.
   a. Heavy ink, clouded outlines (revision clouds) shall be drawn around revised areas of individual sheets.
   b. Engineer/Architect will not review information outside of revision clouds on resubmitted drawings.

E. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

F. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

G. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

H. See structural drawings for additional requirements.

1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."

B. Comply with Section 10 of AISC "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.

C. Fabricator: Company specializing in performing the work of this section with minimum five years of documented experience.

D. Erector: Company specializing in performing the work of this section with minimum five years of documented experience.

E. Fabricator and Erector shall follow the AISC 341 Appendix Q “Quality Assurance Plan”.

PART 2 PRODUCTS

2.01 GENERAL

A. Availability: During bidding, confirm availability of all products and notify Architect of any that cannot be provided.

B. Metal Surfaces: For work that will be exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding or by welding and grinding prior to cleaning, treating, and application of surface finishes.

2.02 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Shapes, Plates, and Bars: ASTM A 242/A 242M high-strength, corrosion-resistant structural steel.

E. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.

F. Steel Plates and Bars: ASTM A572/A572M, Grade 50 (345) high-strength, columbium-vanadium steel.

G. Cold-Formed Structural Tubing: ASTM A500, Grade B.

H. Hot-Formed Structural Tubing: ASTM A501, seamless or welded.

I. Steel Bars: ASTM A108 Grades 1015 through 1020.

J. Steel Plate: ASTM A514/A514M.

K. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.

L. Pipe: ASTM A53/A53M, Grade B, Finish black.

M. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars.

N. Structural Bolts, Nuts and Washers: Carbon steel, ASTM A307, Grade A galvanized to ASTM A 153/A 153M, Class C.

O. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, medium carbon, galvanized.

P. High-Strength Structural Bolts: ASTM A490 (ASTM A490M), with matching ASTM A563 (ASTM A563M) nuts and ASTM F436 washers; Type 1 alloy steel.

Q. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563 or A563M nuts and ASTM F436 Type 1 washers.

R. Headed Anchor Rods: ASTM F1554, Grade 36, straight, with matching ASTM A563 or A563M nuts and ASTM F436 Type 1 washers. Use setting templates with jamb nuts top and bottom as required.

S. Welding Materials: AWS D1.1; type required for materials being welded.

T. Sliding Bearing Plates: Teflon coated.

U. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

V. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

W. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.03 GROUT

A. Shop fabricate to greatest extent possible. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. Minimum compressive strength shall be 5,000 psi

2.04 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Space shear stud connectors as indicated.

C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

D. Fabricate connections for bolt, nut, and washer connectors.

E. Develop required camber for members.

F. Cut, drill or punch standard bolt holes perpendicular to metal surfaces.

2.05 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 2.

B. Shop Prime Exposed to View Structural Steel Members: Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.
   1. Exposed to View Structural Steel Members: Field paint custom color, see section 09 90 00 for interior steel and 09 96 00 for exterior exposed to view structural steel.
   2. Structural Steel Members Exposed to View with Intumescent Fireproofing: If structural steel members are to recieve intumescent fireproofing primer must be compatible with fireproofing.

C. Structural Steel Members Not Exposed to View: Leave structural steel members un-primed.

D. Galvanize structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

2.06 SOURCE QUALITY CONTROL

A. Provide shop testing and analysis of structural steel as required in structural notes.

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

C. Welded Connections: Visually inspect all shop-welded connections and test using one of the following:
   1. Radiographic testing performed in accordance with ASTM E94.
   2. Ultrasonic testing performed in accordance with ASTM E164. Use for all Full Penetration welds.
   3. Liquid penetrant inspection performed in accordance with ASTM E165.
   4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.01 ERECTION

A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".

B. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

C. Welded Connections: Visually inspect all field-welded connections and using one of the following:
   1. Radiographic testing performed in accordance with ASTM E94.
   2. Ultrasonic testing performed in accordance with ASTM E164. Use for all Full Penetration Welds.
   3. Liquid penetrant inspection performed in accordance with ASTM E165.
   4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION

STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof deck.

B. Composite floor deck.

C. Bearing plates and angles.

D. Stud shear connectors.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2007.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

E. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society; 2008.

F. SDI (DM) - Publication No.31, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute; 2007.

G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); The Society for Protective Coatings; 2002 (Ed. 2004).

H. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).

I. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. LEED Submittals: Complete LEED Checklist and Tracking Form, Section 01 35 15, and other data for the following LEED Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.
   1. Credit MR 2: Waste Material Tracking Form, Section 01 74 19.
   2. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
   3. Credit EQ 4.2: Manufacturers' product data for paints and coatings including printed statement of VOC content if inside the thermal envelope of the LEED building.
   4. Credit MR 5: List products that are extracted, harvested or recovered as well as manufactured or processed within 500 straight-line miles of Project Site, or percent of regional material by weight. Include address and distance of material source and product manufacture, product cost data.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

D. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

E. Certificates: Certify that products furnished meet or exceed specified requirements.

F. Submit manufacturer's installation instructions.

G. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:

2.02 STEEL DECK

A. All Deck Types: Select metal deck in accordance with SDI Design Manual.

B. Roof Deck: Non-composite type, fluted steel sheet:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), with G90/Z275 galvanized coating.
      a. Grade as required to meet performance criteria.
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Structural Properties:
   4. Minimum Metal Thickness, Excluding Finish: As indicated.
   5. Nominal Height: As indicated.
   6. Profile: Fluted; SDI WR.
   7. Formed Sheet Width: As indicated.
   8. Side Joints: Lock seam.
   9. End Joints: Lapped, welded.

C. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Structural Properties:
   4. Span Design: Triple.
   5. Minimum Metal Thickness, Excluding Finish: As indicated.
   6. Nominal Height: As indicated.
   7. Profile: Fluted; SDI WR.
   8. Formed Sheet Width: As indicated.
   9. Side Joints: Lock seam.
   10. End Joints: Lapped, welded.

2.03 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.

B. Stud Shear Connectors: Made from ASTM A 108 Grade 1015 bars.

C. Welding Materials: AWS D1.1.

D. Fasteners: Galvanized hardened steel, self tapping.

E. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

F. Shop and Touch-Up Primer: SSPC-Paint 25, zinc oxide, complying with VOC limitations of authorities having jurisdiction.

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage thick sheet steel; of profile and size as indicated; finished same as deck.

B. Cant Strips: Formed sheet steel, 20 gage thick, 45 degree slope, 3 1/2 inch nominal width and height, flange for attachment.

C. Roof Sump Pans: 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

D. Floor Drain Pans: 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. Clinch lock seam side laps.

C. At mechanically fastened male/female side laps fasten at 24 inches on center maximum.

D. At welded male/female side laps weld at 18 inches on center maximum.

E. Weld deck in accordance with AWS D1.3.

F. At deck openings from 6 inches to 18 inches in size, provide 2 x 2 x 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.

G. Where deck changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.

H. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

I. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

J. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

K. Place metal cant strips in position and fusion weld.

L. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

M. Position floor drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

N. Weld stud shear connectors through steel deck to structural members below.

O. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Exterior wall sheathing.

C. Formed steel joist framing and bridging.

D. Water-resistive barrier over sheathing.

1.02 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2012.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2012.

F. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.

G. PS 1 - Structural Plywood; 2009.

H. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish.
   1. Provide manufacturer’s data on factory-made framing connectors, showing compliance with requirements.

C. LEED Submittals: Complete LEED Checklist and Tracking Form, Section 01 35 15, and other data for the following LEED Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.
   1. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
   2. Credit MR 5: List products that are extracted, harvested or recovered as well as manufactured or processed within 500 straight-line miles of Project Site, or percent of regional material by weight. Include address and distance of material source and product manufacture, product cost data.

D. Shop Drawings: Indicate framing layout, framed openings, bearing, anchorage,l loading, welds and type and lcoations of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.
   2. Provide design engineer’s stamp on drawings.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Marino: www.marinoware.com.
   3. The Steel Network, Inc: www.SteelNetwork.com.

2.02 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape; U-shaped track in matching nominal width and compatible height.

B. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for thicknesses less than 10 gage (0.118 inch), and factory punched holes and slots.

2.03 WALL SHEATHING

A. Glass Mat Faced Gypsum Sheathing: ASTM C 1177/C 1177M, water-resistant core, square long edges; see Section 06 16 53.

2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

C. Water-Resistive Barrier: As specified in Section 07 25 00.

2.05 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C 1007 requirements.

3.03 WALL SHEATHING

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
   1. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch.

B. Maximum Variation of any Member from Plane: 1/4 inch.

END OF SECTION

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

B. Prefabricated ladders and ship ladders.

C. Manufactured metal items.

1.02 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

F. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.

G. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2013.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

K. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.03 DESIGN REQUIREMENTS

A. Design and fabricate stair assembly to support a uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/180 of span.

B. Design railing assemblies, wall rails, and attachments to resist lateral force of 200 lbs at any point without damage or permanent set. Test in accordance with ASTM E 935.

C. Design and fabrication of stairs and railings are at a minimum required to conform to NAAMM AMP 510 for metal stairs and AMP 521 for railings.

D. Design and fabrication of railings in longer than 12 feet are required to meet more stringent requirements than industry standards to achieve a visual aesthetic straight line appearance and higher level of tolerance in joint smoothness without gaps.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Samples: Manufactured units.

D. LEED Submittals: Complete LEED Checklist and Tracking Form, Section 01 33 00, and other data for the following LEED Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.

1. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
2. Credit MR 5: List products that are extracted, harvested or recovered as well as manufactured within 500 straight-line miles of Project Site, or percent of regional material by weight. Include address and distance of material source and product manufacture. Product cost data.
3. Credit EQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content.
4. Credit EQ 4.2: Manufacturers' product data for paints and coatings, including printed statement of VOC content and list of prohibited chemical quantities.

E. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Design beams and railings under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.

C. Plates: ASTM A 283.

D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

E. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M where connecting galvanized components.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop Primer: Multi-purpose structural steel primer, complying with VOC limitations of authorities having jurisdiction.
   1. Tnemec Series 394 Mio-Zinc filled polyurethane primer.

H. Touch-Up Primer for Galvanized Surfaces, Shop and Field: SSPC-Paint 20, Type II - Organic, complying with VOC limitations of authorities having jurisdiction.
   1. Tnemec Series 135 Modified epoxy primer. Tint to match zinc.

2.02 MANUFACTURED UNITS

A. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
   1. Size of Channels: 1-5/8 by 1-5/8 inches.
   2. Material: Steel complying with ASTM A 1008/A 1008M, commercial steel, Type B; [] minimum thickness; [].
   3. Fasteners and Accessories: Designed for use and loads, same finish as channel.
   4. Acceptable Manufacturer: Unistrut Corp.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; galvanized finish.
   1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
   2. Rungs: one inch diameter solid round bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.

B. Delegated Design Ships Ladders and Railings:
   1. Fabricate to detail from structural steel complying with referenced standards.
      a. Dimensions: As indicated on drawings.
         1) Width: 24 inches.
      b. Stringers: 10” structural channel.
      c. Treads: Heavy duty welded serrated bar grating treads with 12 inch center to center spacing; 1 x 1/8 inch bars at 1/2 inches on center with 4 inch cross bar centers.
      d. Railings: Welded handrails of 1 1/2” x 14 gage square tubing.
      e. Finish: Prime paint for field painted finish.
   2. Base and Top Mounting brackets and attachments; prime paint finish for field painted custom color; see Section 09 90 00..

C. Delegated Design Railings: Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E 985 and applicable local code.
   1. Aesthetic Design Intent: As indicated.
   2. Material: Round structural steel pipe or tube complying with referenced standards.
   3. Jointing: Fully welded, Continuously welded and ground smooth, flush and straight without buldge or divetflush.
   4. Dimensions: As indicated on drawings.
   5. Finish:
   6. Railing Conditions:
      a. Wall mounted handrails.
      b. Stair railings and guardrails.
      c. Free-standing railings at steps.
   7. Accessories: Per anchoring and securing requirements.

D. Sill Angles for Tempered Glass Railing Assemblies: ASTM A36/A36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.

E. Metal Wall Base:
   1. Material: Stainless steel, ASTM A666 Type 304, 16 gauge; smooth No. 4 finish.
   2. Height: See Schedule at the end of Part 3.
   3. Profile: As indicated.

F. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

G. Lintels: As detailed; galvanized finish.

H. Sill Angles for Tempered Glass Railing Assemblies: ASTM A36/A36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.

I. Elevator Hoistway and Hoistway Divider Beams: Beam sections; prime paint finish.

J. Welded Heavy Duty Bar Grates with Anchored Embed Angle Frames:
   1. Elevator Pit Sump Grate: 1-1/4 x 1/4 inches 12 WH 4; galvanized finish.

K. Structural Steel Embeds: Galvanize structural steel embed members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

L. Interior Metal Flashing;
   1. Material: 20 guage
   2. Profile and Size: As indicated via detail
   3. Finish: As indicated via detail

2.05 FINISHES - STEEL

A. Prime paint all steel items.
   1. Exceptions: Galvanize items to be embedded in concrete or masonry and items specified for exterior exposure with no painted finish.

B. Prime Painting: One coat, 2.5 mils dry film thickness. Field interior finish painting will be a custom color; see Section 09 90 00

C. Steel items for exterior exposure are to recieve surface preparation immediately prior to a high performance coating application, see Section 09 96 00.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

D. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.05 SCHEDULE

A. MB-1
   1. Location: Interior curtain wall corridor, conference, vestibule, and student street.
   2. Product: 2-1/2 inch stainless steel wall base

END OF SECTION

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exposed timber structural framing.

B. Rough opening framing for doors, windows, and roof openings.

C. Underlayment.

D. Preservative treated wood materials.

E. Fire retardant treated wood materials.

F. Miscellaneous framing and sheathing.

G. Communications and electrical room mounting boards.

H. Concealed wood blocking, nailers, and supports.

I. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.

D. PS 1 - Structural Plywood; 2009.

E. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; National Institute of Standards and Technology, U.S. Department of Commerce; 2010.

F. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology, Department of Commerce; 2010.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

C. LEED Submittals: Complete LEED Checklist and Tracking Form, Section 01 33 00, and other data for the following LEED Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.

1. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
2. Credit MR 5: List products that are extracted, harvested or recovered as well as manufactured within 500 straight-line miles of Project Site, or percent of regional material by weight. Include address and distance of material source and product manufacture. Product cost data.
3. Credit MR 7: Chain of custody documentation for products containing FSC certified wood. New wood cost data; see 01 35 15 for details.
4. Credit EQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content.
5. Credit EQ 4.2: Manufacturers' product data for paints and coatings, including printed statement of VOC content and list of prohibited chemical quantities.
6. Credit EQ 4.4: Composite wood manufacturer's product data for each composite wood product used indicating that bonding agent used contains no urea formaldehyde if installed inside the thermal envelope of the LEED building.

D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

B. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood and harvested within a 500 mile radius of the project site.

2.02 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Subflooring: Any PS 2 type, rated Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 48.
   3. Performance Category: 3/4 PERF CAT.

B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls. Provide Weathermate Sill Seal Foam Gasket manufactured by DOW Corporation; dow.com, or FoamSealR Sill Plate Gasket, manufacturered by Owens Corning; www.owenscorning.com.

B. Subfloor Glue: Waterproof, water base, air cure type, cartridge dispensed. Provide _____ manufactured by _____.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Do not use treated wood in direct contact with the ground.
   2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:

D. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   2. Treat lumber in contact with roofing, flashing, or waterproofing.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Specifically, provide the following non-structural framing and blocking:

G. Subject to compliance with requirements, provide provide the following non-structural framing and blocking that may be incorporated into the Work include, but are not limited to, the following:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring: Glue and nail to framing; staples are not permitted.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.04 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.05 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

WOOD DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plywood structural wood decking.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials.

C. Shop Drawings: Indicate deck framing layout.

D. LEED Submittals: Complete LEED Project Submittal Form, following Section 01 33 00, for the following Credits. Requirements and definitions are located in Section 01 35 15, and Section 01 60 00.
   1. Credit MR 2: Waste Material Tracking Form, Section 01 74 19.
   2. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
   3. Credit MR 5: (Regional) Straight-line distance to Manufacturer and distance to material extraction for each product. If greater than 500 miles, report “> 500”. Product cost data.
   4. Credit MR 7: Documentation for products containing FSC Certified wood; See 01 35 15 for details..
   5. Credit EQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content.
   6. Credit EQ 4.2: Manufacturers' product data for paints and coatings, including printed statement of VOC content and statement concerning list of prohibited chemicals.
   7. Credit EQ 4.4: Composite wood manufacturer's product data for each composite wood product used indicating that bonding agent used contains no urea formaldehyde, if installed inside the thermal envelope of the LEED building.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience and certified by AITC.

B. Installer: Company specializing in performing work of the type specified in this section with minimum three years of experience.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire retardant requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect glue laminated members in accordance with AITC 111 requirements for unwrapped material.

PART 2 PRODUCTS

2.01 WOOD MATERIALS

A. Wood fabricated from old growth timber is not permitted.

B. Plywood Decking: PS 1 veneer plywood; APA Rated Sheathing, Span Rating 32/16; Exterior grade; 1 A interior veneer appearance grade; sanded.

C. Architectural Grade Tongue and Groove Decking: FSC Certified Douglas-Fir Select Dex or approved equal. Decking sizes indicated on structural drawings.

2.02 ACCESSORIES

A. Fasteners and Anchors:
   1. Fastener Type and Finish: Hot-dipped galvanized steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Interior Finish: Field finish with water based non-yellowing custom tinted transparent crystal urethane varnish. See Section 09 90 00.

a. Factory seal all surfaces to protect from water exposure staining. Provide all filler, sealer, stain and varnish products used in any individual system from the same manufacturer.

3. See Structural Notes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support framing is ready to receive decking.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 INSTALLATION - PLYWOOD DECKING

A. Install decking perpendicular to framing members, with ends staggered over firm bearing. On sloped surfaces, lay decking with tongue upward.

B. Engage plywood tongue and groove edges.

C. Allow expansion space at edges and ends.

3.04 TOLERANCES

A. Surface Flatness of Decking Without Load: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

END OF SECTION

MOISTURE RESISTANT GYPSUM SHEATHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Moisture resistant wall sheathing fire-rated.

B. Structural moisture resistant wall sheathing fire-rated.

C. Accessories.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's technical data on sheathing product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Manufacturer's Certificate: Certify that products supplied meet or exceed specified requirements.

D. LEED Submittals: Complete LEED Checklist and Tracking Form, following Section 01 33 00, and other data for the following LEED Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.
   1. Credit MR 2: Waste Material Tracking Form, following Section 01 74 19
   2. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
   3. Credit MR 5: List products that are extracted, harvested or recovered as well as manufactured within 500 straight-line miles of Project Site, or percent of regional material by weight. Include address and distance of material source and product manufacture. Product cost data.
   4. Credit EQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content.
   5. Credit EQ 4.2: Manufacturers' product data for paints and coatings, including printed statement of VOC content and list of prohibited chemical quantities.

1.03 DELIVERY, STORAGE, AND HANDLING

A. General: Cover products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gypsum Sheathing Type X Fire-Rated:
   1. Georgia-Pacific; www.gpgypsum.com
   2. Gold Bond Building Products Division, National Gypsum Company: www.nationalgypsum.com <http://www.nationalgypsum.com>.
   3. United States Gypsum: www.usg.com <http://www.usg.com>.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Structural Gypsum Sheathing:
   1. Sure-Board Series 200 Type X Fire-Rated:
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Sheathing: Glass mat faced gypsum, ASTM C 1177C/1177M, Type X fire-resistant core, long edges.
   1. Fire Resistance:
      a. Dens-Glass Gold Fireguard: One hour rated systems when tested in accordance with ASTM E 119, UL Classified.
      b. If roofing manufacturer will not warrant the roof system with Dens-Glass Gold, provide manufacturer's approved sheathing where interfacing with roofing system.

c. Sheathing must also be rated to conform to roofing installation requirements including roofing temperature required for hot application roofing.

2. Thickness: 5/8 inch for rated assemblies.
3. Edges: Square.

2.03 ACCESSORIES

A. Fasteners and Anchors:

B. Self-Adhered Membrane Weather Barriers: See Section 07 25 09.

C. Self-Adhered Membrane Flashing: See Section 07 25 11.

D. Screws: ASTM C1002, corrosion resistant treated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

E. Construction Adhesive/Glue: Per Industry Standard APA AFG-01.
1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Sealant: Manufacturer's Silicone Sealant; gunnable silicone.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until framing is complete and properly prepared.

B. If framing is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Wall: Sheathing: Install in accordance with manufacturer's instructions and building code.

B. Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.

C. Gypsum Sheathing Fastening: Screw to steel studs and runners with bugle head screws spaced, sized, and located as required by building code.

D. Seal Wall Sheathing Joints:
1. As required to provide code required fire-rating.
2. As required to meet building envelope air barrier requirements.

END OF SECTION

GLUE-LAMINATED CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glue laminated wood beams and purlins.

B. Steel hardware and attachment brackets.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.

C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings.

D. LEED Submittals: Complete LEED Project Submittal Form, following Section 01 33 00, for the following Credits. Requirements and definitions are located in Section 01 35 15 and Section 01 60 00.
   1. Credit MR 2: Waste Material Tracking Form, Section 01 74 19.
   2. Credit MR 4: Recycled content for each product, post-consumer and post-industrial. Product cost data.
   3. Credit MR 5: (Regional) Straight-line distance to Manufacturer and distance to material extraction for each product. If greater than 500 miles, report “> 500”. Product cost data.
   4. Credit MR 7: Documentation for products containing FSC Certified wood; see 01 35 15 for details.
   5. Credit EQ 4.1, 4.2, 4.3: Manufacturers' product data for adhesives, sealants, paints and coatings including printed statement of VOC content, and proof of no added ureaformaldehyde.

1.03 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience, and certified by AITC in accordance with AITC A190.1.

B. Erector Qualifications: Company specializing in erection of products of the type specified, with three years of experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect members to AITC requirements for not wrapped.

B. Leave individual wrapping in place until finishing occurs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glued-Laminated Structural Units:
   1. Sentinel Structures, Inc: www.sentinelstructures.com.
   2. Unit Structures: www.unitstructures.com.
   3. Western Wood Structures, Inc: www.westernwoodstructures.com.
   4. Rosboro: www.rosboro.com
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GLUED-LAMINATED UNITS

A. Glued-Laminated Units: Fabricate in accordance with AITC 117 Architectural grade.
   1. Verify dimensions and site conditions prior to fabrication.
   2. Cut and fit members accurately to length to achieve tight joint fit.
   3. Fabricate member with camber built in.
   4. Do not splice or join members in locations other than those indicated without permission.
   5. After end trimming, seal with penetrating sealer in accordance with AITC requirements.
   6. Interior Finish: Field finish with water based non-yellowing custom tinted transparent crystal urethane varnish. See Section 09 90 00.

a. Factory seal all surfaces to protect from water exposure staining. Provide all filler, sealer, stain and varnish products used in any individual system from the same manufacturer.

2.03 MATERIALS

A. Lumber: Softwood lumber conforming to RIS grading rules with 12 percent maximum moisture content before fabrication. Design for values indicated on structural drawings. Provide FSC Architectural grade materials.

B. Steel Connections and Brackets: ASTM A36/A36M weldable quality, galvanize per ASTM A 123/A 123M, only at exterior and intallations in contact with concrete.
   1. Finish: Factory prime for field applied custom funish; see Section 09 90 00.

C. Hardware: ASTM A325/A325M Type 1 high strength heavy hex bolts and ASTM A563/A563M nuts, with matching washers.
   1. Provide hardware to detail indicated; see Structural requirements.
   2. Finish: Custom color; See Section 09 90 00.

2.04 FABRICATION

A. Fabricate glue laminated structural members in accordance with AITC Architectural grade.

B. Welding: Perform welding in accordance with AWS D1.1.

C. Verify dimensions and site conditions prior to fabrication.

D. Cut and fit members accurately to length to achieve tight joint fit.

E. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports are ready to receive units.

B. Verify sufficient end bearing area.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Lift members using protective straps to prevent visible damage.

B. Set structural members level and plumb, in correct positions or sloped where indicated.

C. Provide temporary bracing and anchorage to hold members in place until permanently secured.

D. Fit members together accurately without trimming, cutting, splicing, or other unauthorized modification.

E. Countersink bolts flush with beam surface at areas indicate.

F. Dap beams for connection plates where indicated or as required to accurately fit structural connectors to beams

G. Swab and seal the interior wood surfaces of field drilled holes and dapped areas of members with sealer.

3.04 PROTECTION

A. Protect installed products from wet conditions at all times untilcover by structure.

3.05 TOLERANCES

A. Framing Members: 1/2 inch maximum from true position.

END OF SECTION

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and Division 01 - General Requirements, and all Plumbing Sections specified herein.

1.2 SCOPE OF THIS SECTION

A. Work to be furnished and installed under this Section shall include, but not necessarily be limited to, the following:
1. Compliance with all codes and standards applicable to this jurisdiction.
2. Shop Drawings for Equipment
3. Coordination Documents
4. Record Drawings
5. Start-up Service and Building Commissioning
6. Instruction, Maintenance, and O & M Manuals
7. Work associated with Delivery, Storage, and Handling of products
8. Work associated with provision of Temporary Facilities
9. Preparation of Posted Operating Instructions
10. Meeting Project Safety and Indemnity requirements
11. Proper Cleaning and Closing
12. Supplying proper Warranty information
13. Supply specified Guarantee documentation
14. Design and provision of Supports and Anchors
15. Design and provision of Seismic Restraints and Vibration Isolation
16. Pipe Portals
17. Identification Markers
18. Coordination of Electrical requirements for equipment provided

1.3 DESCRIPTION OF WORK

A. The Contract Documents, including Specifications and Construction Drawings, are intended to include all material and labor to install complete plumbing systems for the building and shall interface with all existing building systems affected by new construction.

B. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and shall coordinate the work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the fixtures, equipment, and pipe lines and are not to be scaled; all dimensions and existing conditions shall be checked at the building.

C. The Contractor shall comply with the project closeout requirements as detailed in General Requirements of Division 01.

D. Where project involves interface with existing building and/or site systems, existing utilities and services have been indicated on the drawings to the extent possible based on available record drawings. The Contractor shall thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available as to concealed conditions, which exist in portions of the existing building affected by this work.

1.4 DESCRIPTION OF BID DOCUMENTS

A. Specifications:
1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.

B. Drawings:
   1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and details of installation.
   2. Before proceeding with work check and verify all dimensions.
   3. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
   4. Make adjustments that may be necessary or requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
   5. Verify exact location and elevation of existing piping, ductwork, conduits and structure and coordinate to accommodate installation of new work as indicated on the drawings.
   6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for interpretation and decision as early as possible, including during bidding period.

1.5 DEFINITIONS

A. "Above Grade": Not buried in the ground and not embedded in concrete slab on ground.

B. "Below Grade": Buried in the ground or embedded in concrete slab on ground.

C. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.

D. "Connect": Complete hook-up of item with required service.

E. "Exposed": Not installed underground or "concealed."

F. "Furnish": To supply equipment and products as specified.

G. "Indicated," "Shown" or " "Noted": As indicated, shown or noted on Drawings or Specifications.

H. "Install": To erect, mount and connect complete with related accessories.

I. “Lead Free”: Materials containing not more than 0.2 percent lead when used with respect to solder and flux and not more than a weighted average of 0.25 percent when used with respect to the wetted surfaces of pipes and pipe fittings, plumbing fittings, and fixtures, providing a specified definition and formula for determining “weighted average”.

J. "Must": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall."

K. “NRTL”: Nationally Recognized Testing Laboratory, including UL and/or ETL.

L. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

M. "Provide": To supply, install and connect as specified for a complete, safe and operationally ready system.

N. "Reviewed," "Satisfactory" or "Directed": As reviewed, satisfactory, or directed by or to Architect/Engineer/Owner’s Representative.

O. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.

P. "Shall": An exhortation or command to complete the specified task.

Q. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified products.

R. "Supply": To purchase, procure, acquire and deliver complete with related accessories.

S. “Typical” or “Typ”: Exhibiting the qualities, traits, or characteristics that identify a kind, class, number, group or category. Of or relating to a representative specimen. Application shall apply to all other similarly identified on plan or detail.

T. "Will": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall."

U. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

1.6 RELATED WORK SPECIFIED ELSEWHERE

A. All Division 22 Plumbing sections included herein.

B. Division 01: General Requirements
   1. Including commissioning requirements.

C. Division 02: Existing Conditions
   1. Coordination of excavation of trenches and the installation of mechanical systems and piping on site.

D. Division 03: Concrete.
   1. All concrete work required for plumbing work shall be coordinated by Division 22 with Division 03 including:
      a. Concrete curbs and housekeeping pads for the mechanical equipment.
      b. Thrust blocks, pads, and boxes for mechanical equipment.
      c. Coordination of floor drain and floor sink installations in sloped floors.

E. Division 07: Thermal and Moisture Protection.
   1. Flashing and sheet metal
   2. Sealants and caulking
   3. Firestopping

1.7 CODES AND STANDARDS

A. The Contractor is cautioned that code requirements not explicitly detailed in these specifications or drawings, but which may be reasonably inferred or implied from the nature of the project, must be provided as part of the contract.

B. Perform all tests required by governing authorities and required under all Division 22 Sections. Provide written reports on all tests.

C. All plumbing work shall comply with the Americans with Disabilities Act (ADA).

D. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

E. Provide in accordance with rules and regulations of the following:
   1. Building Codes enforced by the Authority Having Jurisdiction in Oregon:
      a. 2010 Oregon Structural Specialty Code (OSSC) based on 2009 International Building Code (IBC)
      b. 2010 Oregon Mechanical Specialty Code (OMSC) based on 2009 International Mechanical Code (IMC) and 2009 International Fuel Gas Code (IFGC) with State Amendments
      c. 2010 Oregon Plumbing Code (OPC) based on 2009 Uniform Plumbing Code (UPC) with State Amendments
      d. 2010 Oregon Fire Code (Based on the 2009 International Fire Code)
      e. 2008 Oregon Electric Specialty Code (Based on the 2008 National Electric Code (NEC) with State Amendments

2. Building Codes enforced by the Authority Having Jurisdiction for International Code Council (ICC) Codes:
   a. 2012 International Building Code (IBC) with State Amendments
   b. 2012 International Mechanical Code (IMC) with State Amendments
   c. 2012 International Plumbing Code (IPC) with State Amendments
   d. 2012 International Fire Code (IFC) with State Amendments
   e. 2011 National Electric Code (NEC) with State Amendments
3. Local, city, county and state codes and ordinances
4. Local Health Department
5. Local and State Fire Prevention Districts
6. State Administrative Codes

F. Provide in accordance with appropriate referenced standards of the following:
1. NFPA - National Fire Protection Association
2. ADC - Air Diffuser Council
3. ANSI - American National Standards Institute
4. ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers
5. ASME - American Society of Mechanical Engineers
6. ASTM - American Society for Testing Materials
7. AWS - American Welding Society
8. AWWA - American Water Works Association
9. FM - Factory Mutual
10. MSS - Manufacturer's Standardization Society
11. UL - Underwriter's Laboratories
12. ADA - Americans with Disabilities Act
13. ETL - Electrical Testing Laboratories
14. ASSE - American Society of Sanitary Engineers
15. PDI - Plumbing and Drainage Institute
16. IAPMO - International Association of Plumbing and Mechanical Officials
17. CISPI - Cast Iron Soil Pipe Institute

1.8 QUALITY ASSURANCE

A. Manufacturer's Nameplates: Nameplates on manufactured items shall be affixed to each piece of equipment and resistant to ambient conditions.

B. Current Models. All work shall be as follows:
1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
2. Replacement parts shall be readily available and stocked in the USA.

1.9 GENERAL REQUIREMENTS

A. Examine all existing conditions at building site.

B. Review contract documents and technical specifications for extent of new work to be provided.

C. Provide and pay for all permits, licenses, fees and inspections.

D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to Equipment Specifications in Divisions 02 through 48 for rough-in requirements.

F. Coordinate plumbing equipment and materials installation with other building components.

G. Verify all dimensions by field measurements.

H. Arrange for chases, slots, and openings in other building components to allow for plumbing installations.

I. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

J. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Contractor to provide for all cutting and patching required for installation of his work unless otherwise noted.

K. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

L. Coordinate with Owner's Representative in advance to schedule shutdown of existing systems to make new connections. Provide valves in new piping to allow existing system to be put back in service with minimum down time.

M. Coordinate installation of floor drains and floor sinks with work of other trades. Finished floors shall slopes to floor drains as shown on architectural drawings. Floor sinks will typically be installed flush with surrounding floor. Review plans and design intent for floor sinks that may require elevated rims.

N. Products made of or containing lead, asbestos, mercury or other known toxic or hazardous materials are not acceptable for installation under this Division. Any such products installed as part of the work of the Division shall be removed and replaced and all costs for removal and replacement shall be borne solely by the installing Contractor.

O. Pipes, pipe fittings, plumbing fittings and fixtures that come into contact with the wetted surface of a public water system or any plumbing in a facility providing water for human consumption shall be "Lead Free".

1.10 MINOR DEVIATIONS

A. The Drawings are diagrammatic and show the general arrangements of all plumbing work and requirements to be performed. It is not intended to show or indicate all offsets, fittings, and accessories which will be required as a part of the work of this Section.

B. The Contractor shall review the structural and architectural conditions affecting the work. The contractor's scope of work shall include
   1. Proper code complying support systems for all equipment whether or not scheduled or detailed on drawings or in these specifications
   2. Minor deviations from the plumbing plans required by architectural and structural coordination.

C. The Contractor shall study the operational requirements of each system, and shall arrange the work accordingly, and shall furnish such fittings, offsets, supports, accessories, as are required for the proper and efficient installation of all systems within the physical space available for use by this section. This requirement extends to the Contractor's coordination of this section's work with the "Electrical Work." Should conflicts occur due to lack of coordination, the time delay, cost of rectification, demolition, labor and materials, shall be borne by the Contractor and shall not be at a cost to the Owner.

D. Minor deviations in order to avoid conflict shall be permitted where the design intent is not altered.

E. Advise the Owner's Representative, in writing, in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Owner's Representative of conflict.

1.11 PRODUCT SUBSTITUTIONS

A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:
   1. The proposed substitution does not affect dimensions shown on drawings.
   2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
   3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
   4. Maintenance and service parts are available locally and readily obtainable for the proposed substitute.

B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.

C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to the proposed substitution.

1.12 SHOP DRAWINGS AND EQUIPMENT SUBMITTALS

A. Provide submittals for all materials and equipment in accordance with Division 01 requirements.

B. After approval of preliminary list of materials, the Contractor shall submit Shop Drawings and manufacturer's Certified Drawings to the Owner's Representative for review and approval.

C. The Contractor shall submit approved Shop Drawings and manufacturer's equipment cuts, of all equipment requiring connection by Division 26, to the Electrical Contractor for final coordination of electrical requirements. Contractor shall bear all additional costs for failure to coordinate with Division 26.

D. Submittals and Shop Drawings:
   1. Submitting contract drawings for compliance with the requirement for preparation of shop drawing will not be accepted.
   2. Provide paper or electronic submittals as follows:
      a. Paper Submittals: Provide submittal as a complete package bound in 3-ring binders with tabs for each specification section. Submit six (6) typed copies of submittals.
      b. Electronic Submittals: Provide electronic submittals as a coordinated package, and not separate submittals for each piece of equipment.
   3. The approved submittals shall be converted into Operations & Maintenance Manuals at the completion of the project. Refer to Division 01 for additional requirements.

1.13 COORDINATION DOCUMENTS

A. Contractors shall prepare coordinated Shop Drawings to coordinate the installation and location of all equipment, piping and all system appurtenances with other trades. The Drawings shall include all equipment rooms and floor plans. The Drawings shall be keyed to the structural column identification system.

B. Contractors shall coordinate the proposed installation with architectural and structural requirements, and all other trades (including HVAC, Fire Protection, Electrical, Ceiling Suspension, and Tile Systems), and provide manufacturer and code required maintenance access requirements. When conflicts are identified, modify system layout as necessary to resolve. Do not fabricate, order or install any equipment or materials until coordination documents are approved by the General Contractor (including other trades and sub-contractors) and Owner's Representative. Within thirty (30) days after award of Contract, submit proposed coordination document Shop Drawing schedule, allowing adequate time for review and approval by parties mentioned above. Drawings should be prepared and submitted for approval on a floor-by-floor basis to phase with building construction.

C. The coordination work shall be prepared as follows:
   1. Two dimensional paper or AutoCAD/Revit based documents:
      a. The Plumbing Contractor shall obtain reproducible plans or AutoCAD files from the Mechanical Contractor, and indicate all plumbing lines including fittings and bottom of pipe elevations above finished floor. Provide a “Hold Harmless Release” to obtain files of the HVAC design from the Architect or Engineer.
      b. Coordination drawings are to incorporate all addenda items and change orders.
      c. Distribute plans to all trades and provide additional coordination as needed.
   2. Three dimensional or BIM based documents:
      a. The Sheet Metal (Mechanical) Contractor shall provide a three dimensional model of the work using the project model. If a 3-D model is not available use the available two-dimensional CAD files to construct a three dimensional model for coordination purposes.
      b. The Plumbing Contractor shall provide 3-D input to indicate all major plumbing pipes including fittings and bottom of pipe elevations above finished floor. Provide a “Hold Harmless Release” to obtain the 3-D model of the project structural, architectural, and HVAC design from the Architect and Engineers.
      c. The Fire Protection Contractor shall provide 3-D information to the Plumbing Contractor for coordination of all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.
      d. 3-D models are to incorporate all addenda items.

D. Advise the Owner’s Representative in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Owner’s Representative of conflict.

E. Provide means of access to all valves operable devices, and other apparatus that may require adjustment or servicing.

F. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Owner’s Representative of any discrepancies between those indicated on the Drawings and those existing in the field prior to any installation related thereto.

G. Final Coordination Drawings with all appropriate information added are to be submitted as Record Drawings at completion of project.

1.14 RECORD DRAWINGS

A. Before commencing installation, maintain an extra set of Drawings, or electronic image files, such as AutoCAD or Revit, marked "Record.” Keep this set of Drawings, or electronic files, at the job site at all times, and use it for no other purpose but to record all the changes and revisions resulting from coordination with other trades, request for information, supplemental field instructions, change orders, etc. At the completion of the project:
   1. Transfer the revisions to a clean set of Coordination Drawings in a neat and orderly fashion. Submit two copies of these Record Drawings to the Owner’s Representative.
   2. Or, edit project electronic image files, such as AutoCAD/Revit, to incorporate all site markups, changes, and revisions to the Coordination Drawings. Submit two electronic media disks with final Record Drawings, including all record electronic image drawing files, to the Owner’s Representative.

B. Record Drawings shall indicate revisions to piping size and location, both exterior and interior; including locations of valves and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves located and numbered, concealed unions located, and with items requiring maintenance located (i.e. – valves, etc.).

C. Record Specifications shall indicate approved substitutions; Change Orders; actual equipment and materials used.

D. Refer also to Division 01 for full scope of additional requirements.

1.15 INSTRUCTION, MAINTENANCE, AND O&M MANUALS

A. O&M Manuals: Contractor shall submit to the Owner's Representative complete set of operating instructions, maintenance instructions, part lists, and all other bulletins and brochures pertinent to the operation and maintenance for equipment furnished and installed as specified in this section.

B. The Contractor shall be responsible for proper instruction of Owner's personnel for operation and maintenance of equipment, and apparatus installed as specified in Division 22, to be no less than two (2) hours for each type of equipment.

C. Refer to Division 01 for additional requirements.

1.16 DELIVERY, STORAGE AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials in an environmentally controlled area at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage. Piping and equipment showing signs of rust shall be removed from site and replaced with new.

1.17 TEMPORARY FACILITIES

A. Refer to Division 01 for the requirements of temporary water and sewer for construction and safety. Provide temporary water, and sewer, etc. services as necessary during the construction period and as required to maintain operation of existing systems.

1.18 SAFETY AND INDEMNITY

A. The Contractor shall be solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work for the duration of the project.

B. No act, service, Drawing, review, or Construction Review by the Owner, Architect, the Engineers or their consultants, is intended to include the review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify and defend the Owner, the Architect, the Engineers and their consultants, and each of their officers, employees and agents from any and all liability claim, losses or damage arising, or alleged to arise from bodily injury, sickness, or death of a person or persons, and for all damages arising out of injury to or destruction of property arising directly or indirectly out of, or in connection with, the performance of the work under the Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the Construction Contract Documents; but not including the sole negligence of the Owner, the Architect, the Engineers, and their consultants or their officers, employees and agents.

1.19 CLEANING AND CLOSING

A. All work shall be inspected, tested, and approved before being concealed or placed in operation.

B. Upon completion of the work, all equipment installed as specified in this section, and all areas where work was performed, shall be cleaned to provide operating conditions satisfactory to the Owner's Representative.

1.20 WARRANTIES

A. All equipment shall be provided with a minimum one-year warranty to include parts and labor. Refer to individual Equipment Specifications for extended or longer-term warranty requirements.

B. Provide complete warranty information for each item, to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.

C. Service during warranty period: Contractor shall provide maintenance as specified elsewhere during the 12-month warranty period.

1.21 GUARANTEE

A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of one (1) year after the Date of Final Acceptance, ordinary wear and tear excepted.

B. Contractor shall be responsible for and pay for any damages caused by or resulting from defects in their work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.

B. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturers' names used herein, unless specifically noted that substitutes are not allowed.

2.2 SUPPORTS AND ANCHORS

A. General: Comply with applicable codes pertaining to product materials and installation of supports and anchors, including, but not limited to, the following:
1. UL: Provide products which are UL listed.
2. FM: Provide products which are FM approved.
3. ASCE 7-05: "American Society of Civil Engineers."
4. MSS Standard Compliance: Manufacturer's Standardization Society (MSS).
5. SMACNA: "Seismic Restraint Manual: Guidelines for Mechanical Systems."
6. NFPA: Pamphlet number 13 and 14 for fire protection systems.

2.3 IDENTIFICATION MARKERS

A. Mechanical Identification Materials: Provide products of categories and types required for each application as referenced in other Division 22 Sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category. Stencils, hand printed, painted, and felt pen markers are not acceptable.

B. Underground-Type Plastic Line Markers: Provide 6" wide x 4 mils thick multi-ply tape, consisting of solid metallic foil core between 2 layers of plastic tape. Markers to be permanent, bright colored, continuous printed, intended for direct burial service.

C. Valve Tags:
1. Brass Valve Tags: Provide 1 1/2" diameter 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Fill tag engraving with black enamel.
2. Plastic Laminate Valve Tags: Provide 3/32" thick engraved plastic laminate valve tags, with piping system abbreviations in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32" hole for fasteners.
3. Valve Tag Fasteners: Provide solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

4. Access Panel Markers: Provide 1/16” thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8” center hole to allow attachment.
5. Non-potable Water Tags: 1/16” thick, engraved, plastic tags as indicated on Drawings.

D. Plastic Equipment Signs:
1. Provide 4-1/2” x 6” plastic laminate sign, ANSI A.13 color coded with engraved white core lettering.
2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
3. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters, such as pressure drop, entering and leaving conditions, rpm, etc.

E. Acceptable Manufacturers: Craftmark, Seton, Brady, Marking Services, Inc., or Brimar.

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.

B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal or otherwise irregular work, unless so indicated on Drawings or approved by Owner’s Representative.

3.2 MANUFACTURER'S DIRECTIONS

A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles provided on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

3.3 INSTALLATION

A. Coordinate the work between the various Plumbing Sections and with the work specified under other Divisions. If any cooperative work must be altered due to lack of proper supervision, coordination or failure to make proper and timely provisions, the alterations shall be made to the satisfaction of the Engineer and at the Contractor’s cost.

B. Inspect all material, equipment, and apparatus upon delivery and do not install any damaged or defective materials.

3.4 SUPPORTS AND HANGERS

A. Sloping, Air Venting, and Draining:
1. Slope all piping as specified and as indicated, true to line and grade, and free of traps and air pockets. Unless indicated otherwise, slope piping in the direction of flow as follows:

Service	Inclination	Slope
Domestic Water	Down	1" per 100'
Soil and Waste	Down	1/4" per foot (1/8" per foot)
Storm Water	Down	1/4" per foot (1/8" per foot)
Sanitary Vent	Up (towards roof terminal)	1/4" per foot (1/8" per foot)

3.5 WALL AND FLOOR PENETRATION SIZING

A. All pipe penetrations through rated and non-rated assemblies shall be sized to allow for compliance with structural integrity and fire ratings, as applicable. Where sleeves are required, the sleeve size shall be installed with the inside clear diameter providing clearances as required below.
   1. Uninsulated pipe penetrations through non-rated walls and floors: pipe penetration sizes shall be a 1” (minimum) to 2” (maximum) larger than the outside diameter of each uninsulated pipe.
   2. Insulated pipes penetrations through non-rated walls and floors: pipe penetration sizes shall be a 1” (minimum) to 2” (maximum) larger than the outside diameter of each insulated pipe.
   3. Uninsulated pipe penetrations through fire rated walls and floors: penetration sizes shall be a 1/2” (minimum) to 1-1/2” (maximum) larger than the outside diameter of each uninsulated pipe to provide minimum 1/4” annular space between the outside of the pipe surface and assembly. Coordinate with specific manufacturer requirements and UL listing.
   4. Insulated pipe penetrations through fire rated walls and floors: pipe penetration sizes shall be a 1/2” (minimum) to 1-1/2” (maximum) larger than the outside diameter of each insulated pipe to provide minimum 1/4” annular space between the outside of the insulation surface and assembly. Coordinate with specific manufacturer requirements and UL listing.
   5. Uninsulated pipe penetrations through foundation and basement walls: penetration sizes shall be larger than the outside diameter of each uninsulated pipe to allow adequate space for installation of mechanical link seals. Coordinate with specific manufacturer requirements.

3.6 PAINTING

A. All painting shall be provided under this Division work, unless otherwise specified under Division 9: Painting. Painting schemes shall comply with ANSI A13.1. Paint all exposed materials such as piping, equipment, insulation, steel, etc. Exposed gas piping outside the building shall be painted. Exposed copper indirect waste piping serving food service equipment shall be painted metallic chrome.

B. All exposed work under Division 22 shall receive either a factory finish or a field prime coat finish, except:
   1. Exposed copper piping.

3.7 IDENTIFICATION MARKERS

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

B. Underground Piping Identification: During backfilling/topsoiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6” to 8” below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16”, install single line marker.

END OF SECTION

PLUMBING

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods

B. Section 222113: Plumbing Piping, Valves and Specialties

C. Section 221123: Plumbing Equipment

1.3 SCOPE

A. All work includes removing and modifying existing and providing new plumbing. Systems as specified under this section shall include but not necessarily be limited to the following:
1. Connection to utilities at five (5) feet from the building. Coordinate with the Civil Engineering Plans and/or Division 02 work.
2. Connection of all waste, vent, and piping to all plumbing fixtures, drains and mechanical equipment.
3. Provide for future expansion as indicated.
4. Provide traps on all floor drains with trap primer where specified. Pipe to trap shall be ½" minimum.
5. Provide floor drainage in core toilets, mechanical rooms and equipment rooms.
6. Provide connections for all area drains, catch basins, downspouts, roof drains and overflow drains to storm sewer system.
7. Temporary Water Service: As directed by the General Contractor, the plumber shall provide a temporary metered water service and temporary water risers with four (4) hose bibbs installed at each level as the building proceeds upwards to the roof.

1.4 SUBMITTALS

A. Prior to construction submit for approval all materials and equipment in accordance with Division 01. Submit manufacturer's data, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:
1. Plumbing specialties.
2. Trap primers.
3. Cleanouts.
4. Drains
5. Wall hydrants and hose bibbs
6. Backwater valve

B. Contractor shall submit a letter that all products used in the plumbing system are certified for use in the State and Municipality of the project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.6 WARRANTY

A. Provide one-year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment under this Division of the Specifications shall be new, of best grade and as listed in printed catalogs of the manufacturer.

B. All manufactured materials shall be delivered and stored in their original containers. Equipment shall be clearly marked or stamped with the manufacturer's name and rating.

C. <All items shall be furnished Vandal Proofed. One type of vandal proof screw is to be used through out this facility. Coordinate with general contractor for type.>

D. The following products to be included as part of this work but specified under Section 220500 Basic Materials and Methods and Section 222113 Plumbing Piping, Valves and Specialties:
1. Piping.
2. Valves.
3. Flashings and sleeves.
4. Identification markers.
5. Excavation and backfill.

E. Plumbing Fixtures: Refer to Section 224000.

F. Plumbing Equipment: Refer to Section 221123.

2.2 CLEANOUTS

A. Acceptable Manufacturers: J. R. Smith, Zurn, Wade, Sioux Chief and Josam.

B. Cleanout Plugs: Bronze, taper thread countersunk head.

C. Floor Cleanouts: Service weight cast-iron body and frame, flange with flashing clamp, adjustable cast-iron collar, caulk inside, Ty-seal or No-hub joints, neoprene plug gasket seal.
1. Carpeted Areas: Zurn ZN-1400-KC-VP-BP-CM or J. R. Smith 4028 C - F- C - Y - U
2. Tiled Areas: Zurn ZN-1400-X-KC-VP-BP or J.R. Smith 4148 - F - C - U
3. Unfinished Areas: Zurn ZN-1400-HD-KC-VP-BP or J.R. Smith 4108 C - F - C - U
4. Yard Areas: Zurn Z 1474-IN-VP or J.R. Smith 4258 - C - U

D. Cleanout Tee: Cast iron cleanout tee with countersunk brass plug, neoprene plug gasket seal and smooth stainless steel cover.
1. Manufacturer: Zurn Z-1446-BP or J. R. Smith 4532 S (Y)

2.3 DRAINS

A. Provide drains of type and size as indicated in plumbing schedule on drawings, including features, as specified herein.
1. Acceptable Manufacturers: J.R. Smith, Zurn, Wade, Sioux Chief, Josam and Watts.

B. Floor Drain, FD-1 - Finished Areas: Enamel coated cast iron body with flange, integral reversible clamping collar, seepage openings, adjustable round satin nickel bronze strainer, sediment bucket, bottom outlet, caulk inside or Ty-Seal or no-hub joint. Provide trap primer.
1. Manufacturer: Zurn ZN-415-5B-Y-P or J.R. Smith 2010 - A - C(Y).

C. Floor Drain, FD-2 - Mechanical Rooms: Enamel coated cast iron body with flange, clamping collar, seepage openings, 8-1/2" diameter adjustable cast iron bar strainer, sediment bucket, bottom outlet, caulk inside or Ty-Seal or no-hub joint. Provide trap primer.
1. Manufacturer: Zurn Z-520-Y-P or J.R. Smith 2350 C(Y).

D. Floor Sink, FS-1: Enamel coated cast iron body with seepage flange, acid resistant interior surfaces, aluminum dome strainer, 12" x 12" x 6", half grate, bottom outlet, caulk inside, Ty-Seal or no-hub joint. Provide trap primer.
1. Manufacturer: Commercial Enameling series 906-1 or Zurn-ZFD-2375-K-H-Y.

E. Floor Sink, FS-2: Enamel coated cast iron body with seepage flange, acid resistant interior surfaces, aluminum dome strainer, 12" x 12" x 10", half grate, bottom outlet, caulk inside, Ty-Seal or no-hub joint. Provide trap primer and sediment bucket.
   1. Manufacturer: Commercial Enameling series 906-1 sediment bucket #1001 or Zurn-ZFD-2377-K-H-Y.

F. Downspout Fitting, DSN-1: Cast bronze body construction and flange, satin bronze finish, threaded outlet. Fabricated stainless steel downspout cover with hinged perforated cover. Provide with low profile connector elbow Zurn Z-1042.
   1. Manufacturer: Zurn Z-199, Watts RD-940 or J.R. Smith 1770 J.R. Smith 1775.

G. Downspout connector, DSC-1: Cast iron construction, plain end outlet.
   1. Manufacturer: Neenah Series, R4927 or Zurn Z-192.

2.4 TRAP PRIMER

A. Flow activated trap primer, cast bronze construction, vacuum breaker ports, NPT inlet and outlet connections, for use up to four (4) drains. Install in accessible location or provide access panel. PPP PRO1-500 Prime-Pro, PPP Oregon #1, Sioux Chief PrimePerfect, or equal.

B. For Multiple Units or Kitchen Areas or remote locations: Coordinate 120 volt electrical service with Division 26. PPP Prime Time or Sioux Chief electronic trap primer Series PT, or equal.

C. Alternate for single trap application adjacent to a flush valve toilet: One piece, chrome plated flush valve connection with vacuum breaker, 3/8” elbow, flex-bend tube connection, diverter. Sloan VBF-72A or equal.

2.5 BACKWATER VALVE

A. Backwater Valve. Enamel coated body and cover with removable wheel handle, bronze gates and flapper valve. Zurn #Z-1088 or J.R. Smith series 7150-Y.

PART 3 - EXECUTION

3.1 GENERAL

A. This system to be installed by an experienced firm regularly engaged in the installation of plumbing systems as specified by the requirements of the Specifications.

B. Install all items specified in this section of the Specification under the full purview of local and state governing agencies.

C. Refer to Section 220500: General Plumbing Requirements for installation of piping, valves and other requirements.

3.2 PERFORMANCE OF WORK

A. Examine areas, physical conditions and phasing requirements under which materials are to be installed. Layout the system to suit the different types of construction and equipment as indicated on the drawings.

B. Work shall start immediately after authorization has been given to proceed so that the overall progress of the construction is not delayed. No foundry items to be installed until submittals have been approved.

C. Coordinate with other trades as necessary to properly interface components of the plumbing system.

D. Follow manufacturer's directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the drawings or covered in these Specifications.

E. The omission from the drawings or Specifications of any details of construction, installation, materials, or essential specialties shall not relieve the Contractor from furnishing the same in place for a complete system.

3.3 PIPING INSTALLATION

A. The word “piping” shall mean all pipes, fittings, nipples, valves and all accessories connected thereto.

B. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts flues, conduits and work of other trades and close to ceiling or other construction as practical, free of unnecessary traps or bends.

C. Run horizontal sanitary drainage at uniform pitch of not less than 1/8" per foot, unless otherwise indicated. Pitch horizontal vent piping downward from stack to fixtures.

D. Run drainage piping as straight as possible with long radius turns. Offsets shall be made at an angle of 45° or less.

E. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageway.

F. Cover, cap or otherwise protect open ends of all piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect water supply piping as specified.

G. All ferrous to non-ferrous connections shall be made by means of dielectric fittings. Submit shop drawings for approval.

H. All piping shall be inspected for defects and flaws prior to installation. Remove any damaged piping from job site. Piping shall be thoroughly cleaned of dirt, debris or rust.

I. Cleanouts to be provided at each change in direction greater than 135° or 100' maximum intervals on underground piping.

J. Revise existing cleanout elevations to be flush with new floor elevation.

K. Cleanouts to be same size as pipe except cleanout plugs larger than 4" shall not be required.

L. Cleanouts on concealed piping to be extended through and terminate flush with the finished wall or floor. Cover plates to be provided on all cleanout plugs in finished areas.

M. The bodies of cleanout ferrules to conform in thickness to that required for pipe and fittings of the same metal.

3.4 TESTING AND DISINFECTING - PLUMBING SYSTEMS

A. General: The Contractor to perform all field tests and provide all labor, equipment, and incidentals required for the tests. Owner’s Representative to witness all field tests and conduct all field inspections. The Contractor to give the Owner’s Representative ample notice of the dates and times scheduled for tests. Any deficiencies to be completely retested at no additional cost.

1. Inspection: Inspection to continue during installation and testing. Perform a final inspection of the equipment prior to installation to determine conformity to the type, class, grade, size, capacity, and other characteristics specified herein or indicated. Correct or replace all rejected equipment prior to installation.
2. Sanitary, Waste, Storm, Rainwater, and Vent Piping Test: Before the installation of any fixtures or drains, cap the ends of the system and fill all lines with water to the roof level and allow to stand for at least 30 minutes without leakage. Make tests within building with piping exposed. If the system is tested in sections, tightly lug each opening, except the highest opening of the section under test, and fill each section with water and test with at least a 10' head of water.
3. Sanitary Drainage Vent, Storm, Rainwater and Fixture System Final Test: Give sanitary, drainage vent, and fixture systems an in-service test after complete installation. After all

fixtures are installed, test the entire vent and sewer system and prove gas and water tight. Final test shall be with air. Before proceeding with test, fill all traps with water. Close all stacks and line openings during test, for a minimum period of 24 hours. If test reveals leakage of air at any point, repair and retest the system.

3.5 OPERATING TESTING AND CERTIFICATION - PLUMBING SYSTEMS

A. Upon completion and disinfection, and prior to acceptance of the installation, the Contractor to subject the plumbing system to operating tests to demonstrate satisfactory, functional, and operating efficiency. Such operating tests to include the following information in a report with conclusions as to the adequacy of the system.
   1. Time, date, and duration of tests.
   2. Operation of all floor drains by flooding with water.
   3. Read all indicating instruments at half-hour intervals unless otherwise directed. Supply four copies of the test report to the Owner's Representative.

3.6 CLEANING EQUIPMENT AND MATERIALS

A. In addition to the requirements of Section 220500, provide for the safety and good condition of all materials and equipment until final acceptance by the Owner's Representative. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care to be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors, and similar equipment.

B. All piping, finished surfaces, and equipment to have all grease, adhesive labels, and foreign materials removed.

C. When connections are to be made to existing systems, the Contractor is to do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.

3.7 OPERATION MANUALS, START-UP SERVICE, WARRANTIES, ACCEPTANCE AND GUARANTEES

A. General: Refer to Section 220500 for details.

END OF SECTION

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this section shall include but not necessarily be limited to the following:
1. Grease Interceptor

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods

B. Section 220501: Plumbing

C. Section 224000: Plumbing Fixtures

D. Section 222123: Plumbing Pumps

1.4 SUBMITTALS

A. Prior to construction submit for approval all materials and equipment in accordance with Division 01. Submit manufacturer's data, colors, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:
1. Grease Interceptor

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver units to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.6 WARRANTY

A. Provide one year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses to repair or replace products or systems.

PART 2 - PRODUCTS

2.1 GREASE INTERCEPTOR, GT-1

A. Grease interceptor to be constructed of concrete with two / three 24” clear access manholes with traffic weight frame and covers.

B. Interceptor to be IAPMO listed and have a minimum of 2 components. See schedule for capacity.

C. Provide sampling vault downstream of interceptor. Utility Vault 233-B-SAMP with 23-25C top.

D. Manufacturer: Utility Vault.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Orient so controls and devices needing service and maintenance have adequate access.

D. Connect water piping to units with shutoff valves and unions as indicated.

E. Start-Up: Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls. Start-up to be by authorized manufacturer's representative or agent.

3.2 OPERATION MANUALS, START-UP SERVICE, WARRANTIES, ACCEPTANCE AND GUARANTEES

A. General: Refer to Section 220500 for requirements.

END OF SECTION

PLUMBING PIPING, VALVES AND SPECIALTIES

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to the following:
1. Pipe and Fittings
   a. Sanitary waste and vent
   b. Storm drain and overflow
   c. Cold water
2. Valves
   a. Backwater valves
3. Piping specialties
4. Pipe sleeves
5. Sleeve seals
6. Valve boxes
7. Pipe coating

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods

B. Section 220501: Plumbing

C. Section 224000: Plumbing Fixtures

D. Section 221123: Plumbing Equipment

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications:
1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
2. Replacement parts shall be readily available and stocked in the USA.

B. Codes and Standards:
1. All work shall be in full accordance with all applicable codes, ordinances and code rulings.
2. The Contractor shall furnish without any extra charge the labor and material required for compliance of codes.
3. Perform all tests required by governing authorities and as required under all Division 22 Sections. Provide written reports on all tests.
4. All plumbing work shall comply with the Americans with Disabilities Act (ADA).
5. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for all piping, valves and specialties indicating dimensions, valve CV, tolerances etc.

B. Shop Drawings: Submit shop drawings indicating underground piping installation showing all fittings with inverts. Indicate all footings and grade beams.

C. Maintenance Data: Submit maintenance instructions on accordance with requirements of Division 01.

PLUMBING PIPING, VALVES AND SPECIALTIES

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.
   1. All pipe, pipe fittings and valves shall be manufactured in North America. Alternatives may be acceptable, but must be submitted and approved by the Engineer prior to bidding.

B. Type M copper piping is not acceptable for any pressure water piping unless specifically noted otherwise.

C. For all Grade B piping specified below grade provide a mill report with production identification numbers for piping submitted to permit tracking of pipe by mill and production lot.

D. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturer's names used herein, unless specifically noted that substitutes are not allowed.

2.2 STANDARD PIPE AND FITTING

A. Domestic Water Pipe & Fittings (Below Grade):
   1. Pipe: ASTM B88, Type K hard drawn copper water tube.
   2. Fittings: Domestic Only, Elkhart, ANSI B16.22, wrought copper, 95%-5% tin-antimony solder joints. Wrap underground piping with Scotch Wrap or Pasco Wrap.

B. Trap Primer Piping:
   1. Pipe: Domestic Only, ASTM B88, Type K, soft drawn copper water tube. PEX tubing may be allowed as an alternate material as approved by the local authority having jurisdiction.
   2. Fittings: No joints below ground. For pipes below grade double wrap with Scotch Wrap #51 or PASCO Wrap, with 50% overlap.

C. Sanitary Sewer, Vent, Rainwater Pipe & Fittings:
   1. Pipe: ASTM A-74, ASTM A-888 cast iron, bituminous coated, “No-Hub”. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and manufactured by AB&I, Charlotte, Tyler or approved equal. Pipe showing rust or cracks in coating shall be removed and replaced.
   2. Fittings: No-hub, ASTM A-888.
   3. Couplings Below Grade: Heavy Duty Type 304 stainless steel couplings conforming to FM 1680 with neoprene sealing sleeve conforming to ASTM C-1540 having minimum shield thickness of 28 gauge. Husky SD-4000 or Clamp All 125 only.

D. Water Service to Building:
   1. Pipe: Class 52 ductile iron, ANSI A21.51, AWWA C1510-70, 150 psi cement lined; factory encased with 8 mil polyethylene tube or sheet.
   2. Fittings: ANSI A21.10 mechanical joint, AWWA C110-1971, 250 psi. fittings to be double field wrapped with 2”, 20 mil vinyl tape, 50% overlap.
   3. All fittings shall be restrained with 2000 psi thrust blocks in accordance with NFPA
   4. Fire Protection: Refer to Specification Section 211000.

2.3 FIRE PROTECTION VALVES:

A. Refer to Section 211000.

2.4 PIPING SPECIALTIES

A. General:
   1. Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or provide proper selection to comply with installation requirements.

Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is installer's option.

B. Unions:
1. Unions shall be of type specified in following schedule:
   a. Black Steel, 2" and smaller: 250 lb. screwed malleable iron, ground joint, brass to iron seat.
   b. Black Steel, 2-1/2" and larger: 150 lb. cast iron screwed flanged, flat faced, full faced gasket.
   c. Soldered Copper or Brass Pipe, 2" and smaller: 150 lb. cast bronze or copper, ground joint, non-ferrous seat with soldered ends.
   d. Screwed Copper or Brass Pipe, 2" and smaller: 150 lb. cast brass, ground joint, brass to brass seat, with threaded ends.
   e. Flanged Copper or Brass Pipe, 2-1/2" and larger: two (2) 150 lb. cast bronze flanges.
   f. Manufacturer: EPCO, Mueller, Stanley G. Flagg or Watts.

C. Flanges:
1. Provide flanges at flanged connections to equipment, tanks and valves. Faces of flanges being connected shall be alike in all cases. Connection of raised-face flange to flat-faced flange not permitted.
2. Use ASTM A307, Grade B, bolts and nuts for cast iron flanges and ASTM A193 for steel flanges. Regular square head unfinished bolts with heavy semi-finished hex nuts ASTM A194. Cadmium plated where exposed to weather. Rating: 150 lb. or 300 lb. in high pressure portions.
3. Type of pipe and corresponding flanges as follows:
   a. Screwed Black Steel Pipelines: 125 lb. black cast iron screwed flange, flat faces.
   b. Welded Steel Pipe, 150 lb. black forges steel welding flanges, 1/16" raised fact ASTM A181 Grade I. Use flat face when connected to flat faced companion flange.

D. Pipe Sleeves:
1. Provide fire proof sleeve assemblies utilizing UL rated sealant systems at all fire rated penetrations. For non-rated sleeve penetrations pack the annular space between the pipe and sleeve with fiberglass and/or mastic.
2. Sleeves shall provide a minimum ½" annular clearance around pipe.
3. Sheet metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gauge; 4" to 6", 16 gauge; over 6", 14 gauge.
4. Steel pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
5. Iron pipe: Fabricate from cast iron or ductile-iron pipe; remove burrs.
6. Plastic and copper pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
7. Sleeves through interior concrete walls and floors: Telescopic, submerged, adjustable sleeves by Adjust-to-Crete, AMI or Shamrock. Floor sleeves to extend a minimum of 1” above finished floor.
8. Through exterior walls and floor on grade: 150-pound class cast-iron pipe sleeve. Where waterproof membranes are used, provide membrane clamps. For insulated piping, sleeve diameter shall not be less than diameter of insulated pipe.
9. Cast-in-place watertight device for protecting penetrating objects from expansion and contraction of concrete. Factory-assembled for use in cast-in-place concrete floors and walls and consisting of two outer sleeves and a one-piece radial extended-flange waterstop gasket, with mid-body seal for embedment and sealing to concrete slab and continuous water seal extending to the penetrating pipe.
   a. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbard Enterprises/HOLDRITE; Hydro Preseal.

b. Outer Sleeves: [EPDM] [NBR] <Insert other> attached to the mid-body seal forming an area with which to attach the device to the structural reinforcing rod determining the position of sleeve in the wall.

c. Water Stop Mid-body Seal: Flexible polymer seal with radial extended flange consisting of one to three concentric raised rings which lock into concrete, maintaining seal over time as concrete contracts from sleeve. <Describe size and type of pipe to be inserted in sleeve seal>.

E. Sleeve Seals:

1. All sleeves shall be sealed to prevent intrusion of moisture, dust or insects.
2. Underground: For sleeves passing through exterior or foundation walls, provide mechanical link seal assembly.
3. Aboveground: For sleeves passing through walls or floors provide a non-toxic 3-hour rated fire resistant silicone foam sealant with a Flame Spread Rating of 20. Sealant to be tested and approved under UL 263, ASTM E119, and NFPA 251 Standards. All fire rated penetrations shall be sealed with approved UL System.
4. Local Approvals: All seals to be provided shall be in accordance with the regulations of all governing agencies of the city, county, and State Fire Marshal's Office.

2.5 PIPE COATING

A. All underground steel and copper pipe and fittings, and all above ground steel and copper pipe and fittings in corrosive air environments shall be covered with one of the following methods:

1. Twice Wrap 20 Mil. Scotch Wrap PVC No. 51, 50% overlap.
2. Prefabricated extruded plastic cover with joints sealed with two coats of 20 Mil. Scotch Wrap No. 51 or Pasco Wrap 20 mil weight.

B. Furnish corrugated stainless steel tubing (CSST) with factory-applied corrosion –resistant polyethylene jacket for use in corrosive atmosphere. Coating properties include the following:

1. Gastite corrugated stainless steel tube jacket shall be UV-Resistant polyethylene meeting the requirements of ASTM E84 for flame spread and smoke density.

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.

B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

3.3 INSTALLATION

A. Coordinate the work between the various Plumbing Sections and with the work specified under other Divisions of the work or contracts toward rapid completion of the entire project. If any cooperative work must be altered due to lack of proper supervision or failure to make proper provisions in time, then the work hereunder shall include all expenses of such changes as are necessary in the work under other contracts, and such changes shall be directly supervised by and made to the satisfaction of the Engineer.

B. The cooperative work not included in the Plumbing Division related to the general construction work is as follows:

1. Sloping of floors to drains and floor sinks.

C. Inspect all material, equipment, and apparatus upon delivery and do not install any that may be subject to rejection as a result of damage or other defects. Provide tarps and visqueen cover to protect equipment and piping delivered to and stored at the site.

3.4 WORKING PRESSURES

A. All fittings, valves, pipe, specialties equipment shall be rated for the working pressure subjected in the installed locations.

B. Drawings indicate working pressure in each system. The rating of the equipment and material shall not be less than that of the system pressures.

3.5 PIPING INSTALLATION

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints or couplings.

3.6 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs.
Retain subparagraph below when cast-in-place watertight sleeve seals are required.
1. When cast-in-place watertight sleeve seals are required, select sleeve size to match the size and type of pipe to be installed.
Retain subparagraph below if applicable.
2. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Cut sleeves to length for mounting flush with both surfaces.
a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

3.7 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

C. Underground, Exterior-Wall, Cast-in-Place Watertight Penetrations. Select sleeve size based on pipe size and material to be inserted, and thickness of wall.
1. Install cast-in-place watertight sleeves for pipes NPS 6 (DN 150) and smaller in diameter.
2. Secure sleeve to the reinforcing steel using tie wire.

3.8 PIPING SYSTEM JOINTS

A. All piping shall be cut squarely, free of rough edges and reamed to full bore. Piping shall be mechanically cleaned prior to make-up of joints and fully inserted into fittings.

B. Provide joints of type indicated in each piping system.

3.9 MECHANICAL SLEEVE SEALS

A. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form a watertight seal.

B. Fire Barrier Penetration Seals: Fill entire opening with sealing compound in compliance approved and listed UL system number. Adhere to manufacturer's installation instructions.

3.10 EXCAVATION AND BACKFILL

A. Underground piping shall be installed in stable, open trench work. Trench excavations shall be a minimum of 16” wide, true to line and grade. Contractor shall exercise all due shoring and safety procedures. No stones larger than 1” may be present in the trench to a minimum depth of 4” below the trench bottom. The trench shall be free of job site debris, and free of corrosive media. Pipe crown shall be not less than 24” below the finished ground surface for metallic pipe, and 30” for non-metallic pipe, unless otherwise indicated on the drawings or directed by the Architect. Trenches shall be kept free of excess moisture, and shall be kept open for only a short a time as necessary for installation, testing and inspection. Dispose of surplus excavation and seepage water as directed by the Architect.

B. Piping shall be properly bedded and backfilled over stable trench bottom to a level of at least 12” above the pipe crown with thin layers of unwashed sand, dampened but not puddle, and free of organic or corrosive materials and excessive moisture. Backfill shall be placed in thin layers not to exceed 6” and tamped by mechanical tampers to a minimum 90% Modified Proctor Density, in accordance with ASTM D-1557-58T. trenches shall be backfilled to a minimum depth of 36” prior to being wheel loaded. Replace to their original condition all turf, plants, concrete, asphalt, or other improvements which constitute landscaping, traffic areas or other improved areas which become disturbed by excavation. In graded and undeveloped areas, in addition to procedures specified above, backfill trenches with crown 8” above the surrounding surface.

C. Excavated and backfill in soils of unstable nature shall be provided as directed by Architect.

3.11 PIPE INSPECTIONS

A. It is the intent of the Contract Documents that systems be inspected at completion of each phase while under tests required for administrative authorities, and prior to concealment, i.e. “Rough-in” “top-out” and final.

B. Inspection – Below Grade: All piping installed below grade shall be inspected prior to burial by the Architect, the Owner’s Representative or the Engineer. Contractor must notify Architect no less than 24 working hours prior to inspection time. Should the piping be buried prior to inspection the contractor may be requested to uncover the piping at no delay to the project and at no additional cost to the Owner.

3.12 CLEANING, FLUSHING, DISINFECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any).

B. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports, and accessory items.

C. Inspect pressure piping in accordance with procedures of ASME B31.

D. Disinfect water mains and water service piping in accordance with Section 220501.

3.13 TESTING

A. Provide all tests specified hereinafter. All tests shall meet or exceed the minimum requirements of applicable codes and local ordinances. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have

been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.

B. Piping: Remove from the system, during testing, all equipment which would be damaged by test pressure. Replace removed equipment when testing has been accomplished. The system may be tested in sections as the work progresses; however, any previously tested portion shall become a part of any latter test of a composite system. Correct leaks by remaking joints with new material.

C. Test time will be accrued only while full test pressure is on the system, unless indicated otherwise. "Tolerance" shall be no pressure drop, except that due to temperature change in a 24-hour period. Inspect and test all work prior to burying or concealing. Test pressure shall be one and one-half times the system operating pressure or the listed test pressure below, whichever is greater:

System	Test Medium	Test Pressure	Tolerance-Test Period
Domestic Water	Water	150 psig	None – 8 hours
Sanitary Sewer (non-plastic)	Water	10 ft head (or 5 psi air)	No leaks – 8 hours
Vent (non-plastic)	Air	5 psi	No leaks – 8 hours
Storm	Water	10 ft head (or 5 psi air)	No leaks – 8 hours
Automatic Fire	Water	200 psig	None – 8 hours

END OF SECTION

PUMPS AND SPECIALTIES

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
1. Sump pumps
2. Sewage ejectors

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods

B. Section 220501: Plumbing

C. Section 224000: Plumbing Fixtures

D. Division 26: Electrical

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide systems that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products.

B. Codes and Standards: Provide pumps which conform to the requirements of:
1. Hydraulic Institute (HI): Manufacturer pumps in accordance with "Standards for Centrifugal Rotary and Reciprocating Pumps."
2. National Electrical Manufacturers Association (NEMA): Provide electrical components which comply with NEMA Standards.
3. National Fire Protection Association (NFPA):
   a. 70: National electrical Code
4. Underwriters Laboratories (UL):
   a. UL-778: Motor Operated Water Pumps

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for units showing dimensions, weights (shipping, installed, and operating), capacities, ratings, performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, and installation instructions.
1. Parallel pump plots: For all parallel and series pump applications submit a combined pump curve showing parallel pump operation and single pump non-overloaded operation verifying that the pump selections operate non-overloading on curve in a single pump operation.
2. Submittal information to verify all scheduled characteristics are met including efficiency.

B. Shop Drawings: Submit manufacturer's shop drawings indicating dimensions, weight (shipping, operating), required clearances, methods of assembly of components, and location and size of each field connection.

C. Maintenance Data:
1. Submit maintenance instructions, including instructions for lubrication, tube replacement, motor and drive replacement, and spare parts lists.
2. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals.

D. Wiring Diagrams:
   1. Submit manufacturer's ladder-type wiring diagrams for power and control wiring required.
   2. Differentiate between factory-installed and field-installed wiring.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver units to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products and units against dirt, water, chemical, and mechanical damage. Do not install damaged units - remove from project site.

C. Rigging: Comply with the manufacturer's rigging and installation instructions.

1.7 WARRANTY

A. Provide general one year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 DUPLEX SUMP PUMP SYSTEM

A. Furnish and install, where shown on the plans, Weil Pump Series 1600 duplex submersible sump pump.
   1. Refer to drawings for capacities and model no.

B. Motors shall be air filled design.
   1. Oil filled motor shells shall not be considered equal.
   2. Motor end bell shall be designed as a terminal box and separated from the motor shell by a combination bearing support and inspection plate.
   3. The inspection plate shall permit viewing and access to the motor from the top side of the motor.
   4. Motors shall be housed in a watertight cast iron shell with extended cooling fins and shall have Class "F: insulation and permanently lubricated double seal ball bearings having a rater life of 17,500 hours.
   5. Motors using sleeve type bearings will not be considered equal. The mating surfaces between the motor end bell, motor shell and seal housing shall be sealed by means of "X" cross section QUAD RINGS.
   6. Motor shaft shall be 300 series stainless steel with keyway for positive positioning of impeller.
   7. Carbon steel shafts are not considered equal.

C. The impeller shall be multi-vane and shall be made of close grained bronze and accurately machined to the proper diameter and to be statically and dynamically balanced.

D. A double mechanical seal system shall be furnished.
   1. The entire double mechanical seal assembly shall be housed in a seal chamber filled with clean dielectric oil. Seal surfaces shall be of solid silicon carbide variety.
   2. Carbon ceramic, tungsten carbide or systems that allow the lower seal mechanism to come in contact with the pumped media, shall not be considered as equal.

E. Each pump shall be computer tested and a report of the test will be kept.
   1. Test data will consist of 6 duty points at various heads and capacities, one of which will be the design point.
   2. Test data will include actual efficiencies; horsepower requirements and amp draw at each point.
   3. This test data will be made available to the engineer and owner upon request.

F. Furnish remote packaged factory pre-wired duplex pump controller, Weil 8101E with the following:
   1. NEMA 4 double door dead front steel lockable enclosure.
   2. Magnetic starter with overload reset through inner door, each pump.
   3. Fused disconnect switch with handle through inner door, each pump.

4. Automatic alternator separately fused.
5. Overload reset buttons, each pump.
6. Running lights, each pump.
7. H-O-A switches, each pump.
8. Control circuit transformer for 120V operation for each pump independently.
9. Output connections for high water annunciation at Simplex system.
10. Alarm silencing switch.
11. Alarm light with flasher.
12. Numbered and wired terminal strip.
13. Alarm output contact for connection to Building Management System
14. Single point electrical connection.
15. All wiring between control panel and pump provided under Division 22.

G. Furnish and install Weil Series 8230 mercury float switches complete with galvanized rod and wall support bracket.
1. Each pump control switch will consist of 2 normally open mercury switches, encapsulated in epoxy resin.
2. The float casing will be polypropylene.
3. The switch cable will be type STO PVC jacket 4 #18 conductor. 41 strand, 600 volt insulation.
4. The cable will be secured to the support rod with a polypropylene composition clamp with stainless steel bolts.
5. Switches used for high water alarm service will be of the same construction as the pump switches, except that 2-conductor cable will be furnished.
6. The switch housing will be color-coded to distinguish between the pump and alarm switches.
7. All wiring between control panel and float switches provided under Division 22.

H. Provide reinforced fiberglass basin with steel anti-flotation ring. Provide with matching gasketed steel cover.
1. Install basin and pour concrete all around to secure in place.

I. Warranty:
1. The pump manufacturer shall warrant the pumps being supplied to the owner against defects in workmanship and materials for a period of five (5) years under normal use, operation and service.
2. All repairs or replacement parts that may be needed on the seventeenth month following final acceptance by owner will be made and the cost (F.O.B. factory) pro rated for the period of time the pump has been in operation.
3. The warranty shall be in published form and apply to all similar units.

J. Manufacturer: Weil, Weimann, Paco, or Enpo-Cornell.

2.2 SIMPLEX SUMP PUMP SYSTEM - ELEVATOR SUMP APPLICATION

A. Provide where indicated on drawings, a Simplex submersible sump pump. Pump to have a 2" I.P.S. discharge, bronze fitted construction with submersible sealed motor, stainless steel shaft, bronze impeller, mechanical seal, and waterproof power cord. Pump to have 50 GPM flowrate minimum. Motors to be as scheduled. Pump shall have a fully submersible float switch for mounting on pump discharge pipe.

B. Provide with differential mercury float switches for (1) on-off operation and (2) high water alarm.

C. Provide check valve and shut-off valve on discharge side of pump.

D. Warranty: One year.

E. Manufacturer: Meyers S-25, Weil, Federal, Liberty or Zoeller.

F. High water alarm: Local alarm with dry contacts for connection to BMS.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment, unless otherwise shown or noted on the Drawings, is to be installed in accordance with industry standards and manufacturer's recommended installation instructions.

B. Provide vibration isolation, inertia bases, seismic snubber, flexible pipe connections, etc, as specified in related specification sections.

C. Contractor to assist testing and balancing contractor in verifying correct pump rotation and system operation.

D. Flush and clean equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls.

E. Isolation for Service: Provide pump installations with a discrete isolation valve on both the supply and intake side of the pump to permit service of the pump and any related strainer, check or balancing valves. Triple duty valves are not equivalent for this shut-off service.

F. Balancing Coordination and Impeller Trimming: Coordinate final pump flow with test and balance contractor. For pumps larger than 5 horsepower, if the system tests and balance indicate that flow exceeds the specified flow by greater than 20%, it is not acceptable to reduce flow merely by adjusting balance valves to create additional head or reducing VFD peak flows. Excess system flow must be reduced by trimming the impeller to match the load.

3.2 MANUFACTURER'S START-UP SERVICES

A. The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, verify pump systems mounting, verify piping installation, verify control wiring, verify power wiring, and check for proper operation. The service technician shall provide final adjustments to meet the specified performance requirements. Fully staffed parts and service personnel shall be within four hours travel from the jobsite.

END OF SECTION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and Division 01 - General Requirements, and shall include all Mechanical Sections specified herein.

1.2 SCOPE OF THIS SECTION

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
1. Compliance with all codes and standards applicable to this jurisdiction
2. Shop Drawings for Equipment
3. Coordination Documents
4. Record Drawings
5. Start-up Service and Building Commissioning
6. Instruction, Maintenance, and O & M Manuals
7. Work associated with Delivery, Storage, and Handling of products
8. Work associated with provision of Temporary Facilities
9. Preparation of Posted Operating Instructions
10. Meeting Project Safety and Indemnity requirements
11. Proper Cleaning and Closing
12. Supplying proper Warranty information
13. Supply specified Guarantee documentation
14. Design and provision of Supports and Anchors
15. Pipe Portals
16. Pipe Supports
17. Equipment Rails
18. Access Panels and Doors
19. Identification Markers
20. Coordination of Electrical requirements for equipment provided

1.3 DESCRIPTION OF WORK

A. The Contract Documents, including Specifications and Construction Drawings, are intended to provide all material and labor to install complete heating, ventilating, air conditioning systems for the building and shall interface with all existing building systems affected by new construction.

B. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the fixtures, equipment, and pipe lines and are not to be scaled; all dimensions and existing conditions shall be checked at the building.

C. The Contractor shall comply with the project closeout requirements as detailed in General Requirements of Division 01.

D. Where project involves interface with existing building and site systems, every effort has been made to note existing utilities and services. However, the Contractor should thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available as to concealed conditions, which exist in portions of the existing building affected by this work.

1.4 DESCRIPTION OF BID DOCUMENTS

A. Specifications:
1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.

B. Drawings:
   1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
   2. Before proceeding with work check and verify all dimensions.
   3. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
   4. Make adjustments that may be necessary or requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
   5. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts. Verify exact location and elevation of existing piping prior to any construction.
   6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible, including during bidding period.

1.5 DEFINITIONS

A. “Above Grade”: Not buried in the ground and not embedded in concrete slab on ground.

B. “Accessible”: Ability to perform recommended maintenance without removal of services or equipment and requiring no special platforms.

C. “Actuating” or “Control” Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

D. “Below Grade”: Buried in the ground or embedded in concrete slab on ground.

E. “Concealed”: Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.

F. “Connect”: Complete hook-up of item with required service.

G. “Exposed”: Not installed underground or “concealed.”

H. “Furnish”: To supply equipment and products as specified.

I. “Indicated,” “Shown” or “Noted”: As indicated, shown or noted on Drawings or Specifications.

J. “Install”: To erect, mount and connect complete with related accessories.

K. “Motor Controllers”: Manual or magnetic starters (with or without switches), individual push buttons or hand-off-automatic (HOA) switches controlling the operation of motors.

L. “Piping”: Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

M. “Provide”: To supply, install and connect as specified for a complete, safe and operationally ready system.

N. “Reviewed,” “Satisfactory” or “Directed”: As reviewed, satisfactory, or directed by or to Architect/Engineer/Owner.

O. “Rough-In”: Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.

P. “Shall”: An exhortation or command to complete the specified task.

Q. “Similar” or “Equal”: Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified products.

R. “Supply”: To purchase, procure, acquire and deliver complete with related accessories.

S. "Typical" or "Typ": Exhibiting the qualities, traits, or characteristics that identify a kind, class, number, group or category. Of or relating to a representative specimen. Application shall apply to all other similarly identified on plan or detail.

T. "Will": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall".

U. "Wiring": Raceway, fittings, wire, boxes and related items.

V. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

1.6 RELATED WORK SPECIFIED ELSEWHERE

A. All Division 23 Mechanical sections included herein.

B. Division 33: Utility Site Work.
   1. Coordination of excavation of trenches and the installation of mechanical systems and piping on site.

C. Division 03: Concrete.
   1. All concrete work for Mechanical Division shall be included in Division 23 under the appropriate Sections and shall include:
      a. Concrete curbs and housekeeping pads for the mechanical equipment.
      b. Thrust blocks, pads, and boxes for mechanical equipment.
      c. Coordination of floor drain and floor sink installations in sloped floors.

D. Division 07: Thermal and Moisture Protection.
   1. Flashing and sheet metal
   2. Sealants and caulking
   3. Firestopping

E. Division 09: Painting:
   1. Division 23 installers shall perform all painting, except where specifically stated otherwise in Division 09.
   2. Painting of all exposed steel, piping, ductwork, insulation, equipment and materials
   3. Paint all exposed gas piping, interior and exterior to the building, yellow.

F. Division 10: Miscellaneous Metals.
   1. Exterior louvers and grilles shall be included in this Section.

G. Division 26: Electrical is related to work of:
   1. Power connections to all mechanical equipment

H. Division 28: Electronic Safety and Security is related to work of:
   1. Fire protection alarms and relays
   2. Smoke detector and monitoring
   3. Life Safety Systems

1.7 CODES AND STANDARDS

A. The Contractor is cautioned that code requirements not explicitly detailed in these specifications or drawings, but which may be reasonably inferred or implied from the nature of the project, must be provided as part of the contract.

B. Perform all tests required by governing authorities and required under all Division 23 Sections. Provide written reports on all tests.

C. Electrical devices and wiring shall conform to the latest standards of NEC; all devices shall be UL listed and labeled.

D. All mechanical work shall comply with the Americans with Disabilities Act (ADA).

E. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

F. Provide in accordance with rules and regulations of the following:
   1. Building Codes enforced by the Authority Having Jurisdiction in Oregon:
      a. 2010 Oregon Structural Specialty Code (OSSC) based on 2009 International Building Code (IBC)
      b. 2007 Oregon Mechanical Specialty Code (OMSC) based on 2009 International Mechanical Code (IMC) and 2009 International Fuel Gas Code (IFGC) with State Amendments
      c. 2008 Oregon Plumbing Code (OPC) based on 2006 Uniform Plumbing Code (UPC) with State Amendments
      d. 2010 Oregon Fire Code (Based on the 2009 International Fire Code)
      e. 2008 Oregon Electric Specialty Code (Based on the 2008 National Electric Code (NEC) with State Amendments
   2. Local, city, county and state codes and ordinances
   3. Local Bureau of Buildings
   4. Local Health Department
   5. Local and State Fire Prevention Districts
   6. State Administrative Codes

G. Provide in accordance with appropriate referenced standards of the following:
   1. NFPA - National Fire Protection Association
   2. AABC - Associated Air Balance Council
   3. ADC - Air Diffuser Council
   4. AMCA - Air Moving and Conditioning Association
   5. ANSI - American National Standards Institute
   6. ARI - Air Conditioning and Refrigeration Institute
   7. ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers
   8. ASME - American Society of Mechanical Engineers
   9. ASTM - American Society for Testing Materials
   10. AWS - American Welding Society
   11. FM - Factory Mutual
   12. MSS - Manufacturer's Standardization Society
   13. NEMA - National Electrical Manufacturer's Association
   14. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
   15. UL - Underwriter's Laboratories
   16. ADA - Americans with Disabilities Act
   17. ETL - Electrical Testing Laboratories

1.8 QUALITY ASSURANCE

A. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or Type 304 stainless steel sheet, not less than 20 USG (0.0375"), riveted or bolted to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.

B. Current Models. All work shall be as follows:
   1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
   2. Replacement parts shall be readily available and stocked in the USA.

C. Experience: Unless more stringent requirements are specified in other sections of Division 23, manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than one year prior to the date of bidding for this project.

1.9 GENERAL REQUIREMENTS

A. Examine all existing conditions at building site.

B. Review contract documents and technical specifications for extent of new work to be provided.

C. Provide and pay for all permits, licenses, fees and inspections.

D. Prepare a Construction IAQ Management Plan meeting the SMACNA IAQ guidelines. See Section 233113 Air Distribution for a summary of requirements.

E. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. This work shall include furnishing and installing all access doors required for mechanical access.

F. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to Equipment Specifications in Divisions 02 through 48 for rough-in requirements.

G. Coordinate mechanical equipment and materials installation with other building components.

H. Verify all dimensions by field measurements.

I. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

J. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

K. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

L. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Contractor to provide for all cutting and patching required for installation of his work unless otherwise noted.

M. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

N. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, without interference with other installations.

O. Coordinate the installation of mechanical materials and equipment above ceilings with ductwork, piping, conduits, suspension system, light fixtures, cable trays, sprinkler piping and heads, and other installations.

P. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

Q. Coordinate with Owner in advance to schedule shutdown of existing systems to make new connections. Provide valves in new piping to allow existing system to be put back in service with minimum down time.

R. All materials (such as insulation, ductwork, piping, wiring, controls, etc.) located within air plenum spaces, air shafts, and occupied spaces shall have a flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing, or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.

S. Coordinate installation of floor drains and floor sinks with work of other trades, such that finished floor slopes to drains and floor sinks are flush with surrounding floor.

T. Products made of or containing lead, asbestos, mercury or other known toxic or hazardous materials are not acceptable for installation under this Division. Any such products installed as part of the work of the Division shall be removed and replaced and all costs for removal and replacement shall be borne solely by the installing Contractor.

1.10 MINOR DEVIATIONS

A. The Drawings are diagrammatic and show the general arrangements of all mechanical work and requirements to be performed. It is not intended to show or indicate all offsets, fittings, and accessories which will be required as a part of the work of this Section.

B. The Contractor shall review the structural and architectural conditions affecting his work. It is the specific intention of this section that the contractor's scope of work shall include:
   1. Proper code complying support systems for all equipment whether or not scheduled or detailed on drawings or in these specifications
   2. Minor deviations from the mechanical plans required by architectural and structural coordination.

C. The Contractor shall study the operational requirements of each system, and shall arrange his work accordingly, and shall furnish such fittings, offsets, supports, accessories, as are required for the proper and efficient installation of all systems from the physical space available for use by this section. This requirement extends to the Contractor's coordination of this section's work with the “Electrical Work”. Should conflicts occur due to lack of coordination, the time delay, cost of rectification, demolition, labor and materials, shall be borne by the Contractor and shall not be at a cost to the Owner.

D. Minor deviations in order to avoid conflict shall be permitted where the design intent is not altered.

E. Advise the Architect, in writing, in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

1.11 PRODUCT SUBSTITUTIONS

A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:
   1. The proposed substitution does not affect dimensions shown on drawings.
   2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
   3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
   4. Maintenance and service parts available locally are readily obtainable for the proposed substitute.

B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.

C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to this proposed substitution.

1.12 SHOP DRAWINGS AND EQUIPMENT SUBMITTALS

A. Prior to construction submit for review all materials and equipment in accordance with Division 01 requirements.

B. After approval of preliminary list of materials, the Contractor shall submit Shop Drawings and manufacturer's Certified Drawings to the Architect for approval.

C. The Contractor shall submit <u>approved</u> Shop Drawings and manufacturer's equipment cuts, of all equipment requiring connection by Division 26, to the Electrical Contractor for final coordination of electrical requirements. Contractor shall bear all additional costs for failure to coordinate with Division 26.

D. Submittals and Shop Drawings:
   1. Submitting contract drawings to demonstrate compliance with the requirement for preparation of shop drawing will not be accepted.
   2. Paper Submittals: Provide submittal as a complete package bound in a 3-ring binder with tabs for each specification section. Submit six (6) typed copies of submittals
   3. Electronic Submittals: Provide electronic submittals as a coordinated package.
   4. The approved submittals shall be converted into Operations & Maintenance Manuals at the completion of the project. Refer to Division 01 for additional requirements.

1.13 COORDINATION DOCUMENTS

A. The Contractors shall prepare coordinated Shop Drawings or electronic versions thereof to coordinate the installation and location of all HVAC equipment, ductwork, grilles, diffusers, piping, fire sprinklers, lights, audio/video systems, electrical services and all system appurtenances. The Drawings shall include all mechanical rooms and floor plans. The Drawings shall be coordinated drawings using either Overlay Drawings showing each discipline on a single sheet or electronic documents intended for the same purpose. The Drawings shall be keyed to the structural column identification system, and shall be progressively numbered. Prior to completion of the Drawings, the Contractor shall coordinate the proposed installation with the Architect and the structural requirements, and all other trades (including HVAC, Plumbing, Fire Protection, Electrical, Ceiling Suspension, and Tile Systems), and provide reasonable maintenance access requirements. When conflicts are identified, modify system layout as necessary to resolve. Do not fabricate, order or install any equipment or materials until coordination documents are approved by the General Contractor, Architect, and Owner. Within thirty (30) days after award of Contract, submit proposed coordination document Shop Drawing schedule, allowing adequate time for review and approval by parties mentioned above. Drawings or electronic coordination should be prepared and submitted for approval on a floor-by-floor basis to phase with building construction.

B. The coordination work shall be prepared as follows:
   1. Two dimensional paper or AutoCAD/Revit based documents:
      a. The Sheet Metal (Mechanical) Contractor shall prepare Drawings to an accurate scale of 1/4" = 1'-0" or larger, on reproducible media sheets or AutoCAD files. Lettering shall be minimum 1/8" high. Provide a “Hold Harmless Release” to obtain paper or AutoCAD files of the HVAC design from the Architect, or Engineer. Drawings are to be same size as Contract Drawings and shall indicate location, size and elevation above finished floor, of all HVAC equipment, ductwork, and piping. Plans shall also indicate proposed ceiling grid and lighting layout, as shown on electrical plans and reflected ceiling plans.
      b. The Plumbing Contractor shall obtain reproducible plans or AutoCAD files from the Mechanical Contractor, and indicate all plumbing lines including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
      c. The Fire Protection Contractor shall obtain reproducible plans or AutoCAD files with the detailed mechanical and plumbing work shown. The Sprinkler Contractor shall indicate location of all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.
      d. Plans are to incorporate all addenda items and change orders.
      e. Distribute plans to all trades and provide additional coordination as needed.
   2. Three dimensional or BIM based documents:
      a. The Sheet Metal (Mechanical) Contractor shall prepare a three dimensional model of the work using the project BIM model. Provide a “Hold Harmless Release” to obtain the BIM model of the project structural, architectural, and HVAC design from the Architect. If a BIM model is not available use the available two-dimensional CAD files to construct a three dimensional model for coordination purposes.
      b. The Plumbing Contractor shall provide BIM input to indicate all major plumbing lines exceeding 3” in diameter including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.

c. The Fire Protection Contractor shall provide BIM input information locating all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.

d. BIM models are to incorporate all addenda items and change orders.

C. Advise the Architect in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

D. Provide means of access to all valves, dampers, controllers, operable devices, and other apparatus that may require adjustment or servicing.

E. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Architect of any discrepancies between those indicated on the Drawings and those existing in the field prior to any installation related thereto.

F. Final Coordination Drawings with all appropriate information added are to be submitted as Record Drawings at completion of project.

G. Provide copy of Record Drawings to Testing and Balancing Contractor for their use when doing their work.

1.14 RECORD DRAWINGS

A. Before commencing installation, obtain an extra set of prints from Architect, marked “Record”. Keep this set of Drawings at the job site at all times, and use it for no other purpose but to mark on it all the changes and revisions to the Contract Drawings resulting from coordination with other trades. At the completion of the project:

1. Obtain a clean set of reproducibles from the Architect or Engineer, at cost plus, and transfer the revisions to these reproducibles in a neat and orderly fashion.

OR

2. Edit project AutoCAD files to incorporate all site markups, changes, and revisions to the Contract Drawings. Submit plots of Record Drawings and six copies CD Roms labeled with all record AutoCAD drawing files.

B. Provide copy of Record Drawings to Testing and Balancing Contractor for use when doing his work.

C. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e. – valves, traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

D. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

E. Refer also to Special Conditions in Division 01 for full scope of requirements.

1.15 START-UP SERVICE AND BUILDING COMMISSIONING

A. Prior to start-up, be assured that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrication, venting, controls, and installed and properly set relief and safety valves.

B. Provide services of factory-trained technicians for start-up of air conditioning units, temperature controls, chillers, boilers, pumps, and other major pieces of equipment. Certify in writing compliance with this Paragraph, stating names of personnel involved and the date work was performed.

C. Provide certificates of calibration for all sensors required for control and monitoring including temperature and pressure.

D. Refer to other Division 23 Sections for additional requirements.

1.16 INSTRUCTION, MAINTENANCE, AND O&M MANUALS

A. O&M Manuals: Upon completion of the work, and prior to training of Owner's personnel, the Contractor shall submit to the Architect complete set of operating instructions, maintenance instructions, part lists, and all other bulletins and brochures pertinent to the operation and maintenance for equipment furnished and installed as specified in this section, bound in a durable binder. Refer to Division 01.

B. Contractor shall be responsible for providing proper instruction of the of Owner's personnel for operation and maintenance of equipment, and apparatus installed as specified in Division 23 to be no less than two hours for each piece of equipment. The Contractor shall develop and submit training materials prior to this training. These materials shall include qualifications of the trainer, training agenda, learning objectives, and a written test to be administered at the end of the training session. Operation and Maintenance manuals must present, incorporated and referenced in the training sessions.

1.17 DELIVERY, STORAGE AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials in an environmentally controlled area at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage. Piping shall be stored in bundles covered with visqueen. Piping showing signs of rust shall be removed from site and replaced.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.18 TEMPORARY FACILITIES

A. Refer to Division 01 for the requirements of temporary water and sewer for construction and safety. Provide temporary heating, air conditioning, ventilation, water, and sewer, etc. services as necessary during the construction period and as required to maintain operation of existing systems.

B. Temporary Heating for Commissioning Tests:
1. Provide temporary heating where needed to provide false load for commissioning tests.
2. Temporary heating may be from the permanent heating system of the project or from a dedicated temporary heating system. If temporary system is necessary, select facilities known to be safe and without deleterious effect upon what work in place or being installed.

C. Temporary Cooling for Commissioning Tests:
1. Provide temporary cooling where needed to provide false load for commissioning tests.
2. Temporary cooling may be from the permanent cooling system of the project or from a dedicated temporary cooling system. If temporary system is necessary, select facilities known to be safe and without deleterious effect upon the work in place or being installed.

1.19 POSTED OPERATING INSTRUCTIONS

A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. Attach or post operating instructions adjacent to each principal system and

equipment including start-up, operating, shutdown, safety precautions and procedure in the event of equipment failure. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal.

1.20 SAFETY AND INDEMNITY

A. The Contractor shall be solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal hours of work.

B. No act, service, Drawing, review, or Construction Review by the Owner, Architect, the Engineers or their consultants, is intended to include the review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify and defend the Owner, the Architect, the Engineers and their consultants, and each of their officers, employees and agents from any and all liability claim, losses or damage arising, or alleged to arise from bodily injury, sickness, or death of a person or persons, and for all damages arising out of injury to or destruction of property arising directly or indirectly out of, or in connection with, the performance of the work under the Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the Construction Contract Documents; but not including the sole negligence of the Owner, the Architect, the Engineers, and their consultants or their officers, employees and agents.

1.21 CLEANING AND CLOSING

A. All work shall be inspected, tested, and approved before being concealed or placed in operation.

B. Upon completion of the work, all equipment installed as specified in this section, and all areas where work was performed, shall be cleaned to provide operating conditions satisfactory to the Architect.

1.22 WARRANTIES

A. All equipment shall be provided with a minimum one-year warranty to include parts and labor. Refer to individual Equipment Specifications for extended or longer-term warranty requirements.

B. Provide complete warranty information for each item, to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.

C. Service during warranty period: Contractor shall provide maintenance as specified elsewhere during the 12-month warranty period.

1.23 GUARANTEE

A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of one (1) year after the Date of Final Acceptance, ordinary wear and tear excepted.

B. Contractor shall be responsible for and pay for any damages caused by or resulting from defects in his work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.

B. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturers' names used herein, unless specifically noted that substitutes are not allowed.

2.2 SUPPORTS AND ANCHORS

A. General: Comply with applicable codes pertaining to product materials and installation of supports and anchors, including, but not limited to, the following:
1. UL and FM Compliance: Provide products, which are UL listed and FM approved.
2. ASCE 7-05: "American Society of Civil Engineers."
3. 2009 International Building Code (IBC)
4. MSS Standard Compliance: Manufacturer's Standardization Society (MSS).
5. SMACNA: "Seismic Restraint Manual: Guidelines for Mechanical Systems."
6. NFPA: Pamphlet number 13 and 14 for fire protection systems.
7. Provide copper plated or plastic coated supports and attachment for copper piping systems. Field applied coatings or tape is unacceptable.
8. Manufacturer: Hilti Inc., B-Line, Anvil International, Michigan, Tolco, Kin-Line, Simpson Strong-Tie Co. Inc., or Superstrut.

B. Horizontal Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated hangers and supports of one of the following MSS types listed.
1. Adjustable Steel Clevis Hangers: MSS Type 1.
2. Adjustable Steel Swivel Band Hangers: MSS Type 10.
3. U-Bolts: MSS Type 24.
4. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
   a. Plate: Unguided type.
   b. Plate: Guided type.
   c. Plate: Hold-down clamp type.
5. Pipe Saddle Supports: MSS Type 36, including steel pipe base support and cast iron floor flange.
6. Pipe Saddle Supports with U-Bolt: MSS Type 37, including steel pipe base support and cast iron floor flange.
7. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast iron floor flange.
8. Single Pipe Roller with Malleable Sockets: MSS Type 41.
9. Adjustable Roller Hangers: MSS Type 43.
10. Pipe Roll Stands: MSS Type 44.
11. Pipe Guides: Provide factory-fabricated guides of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

C. Horizontal Cushioned Pipe Clamp: Where pipe hangers are called out to absorb vibration or shock install a piping clamp with thermoplastic elastomer insert. Cush-A-Clamp or equal.

D. Vertical Piping Clamps: Provide factory-fabricated two-bolt vertical piping riser clamps, MSS Type 8.

E. Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments of one of the following MSS types listed.
1. Steel Turnbuckles: MSS Type 13.
2. Steel Clevises: MSS Type 14.
3. Swivel Turnbuckles: MSS Type 15.
4. Malleable Iron Eye Sockets: MSS Type 16.
5. Steel Weldless Eye Nuts: MSS Type 17.

F. Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments of one of the following types listed.
   1. Concrete Inserts: HCI-MD (for metal deck) or HCI-WF (for wood forms) cast-in anchors by Hilti Inc. or MSS Type 18 or Blue Banger Hanger by Simpson Strong-Tie Co. Inc.
   2. Steel Brackets: One of the following for indicated loading:
      a. Light Duty: MSS Type 31.
      b. Medium Duty: MSS Type 32.
      c. Heavy Duty: MSS Type 33.
   3. Horizontal Travelers: MSS Type 58.
   4. Concrete Screw Anchors: KWIK HUS EZ-I by Hilti Inc., Titen HD (or Rod Hanger version) by Simpson Strong-Tie Co. Inc. or approved equal.
   5. Torque-Controlled Expansion Anchor: KWIK BOLT-TZ by Hilti Inc., Strong-Bolt 2 by Simpson Strong-Tit Co. Inc or approved equal.

G. Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
   1. Pipe Covering Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
   2. Insulation Protection Shields: MSS Type 40, 18" minimum, or of the length recommended by manufacturer to prevent crushing of insulation. High-density insulation insert lengths shall match or exceed shield length.
   3. Thermal Hanger Shields: Constructed of 360° insert of waterproofed calcium silicate (60 psi flexural strength minimum) encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation. Shield length shall match or exceed length of calcium silicate insert. Alternately Polyisocyanurate Urethane with a minimum flexural strength of 60psi, fully encased in 360 PVC (1.524 mm thick)SNAPPITZ. Provide assembly of same thickness as adjoining insulation.
   4. Thermal Hanger Couplings: Constructed of high strength plastic coupling to retain tubing and join insulation at clevis hangers and strut-mounted clamps. Klo-Shure Insulation Coupling or equal.

H. Miscellaneous Materials:
   1. Metal Framing: Provide products complying with NEMA STD ML1.
   2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A36.
   3. Cement Grout: Portland Cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand by volume, with minimum amount of water required for placement and hydration.
   4. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required. Weld steel in accordance with AWS standards.
   5. Pipe Brackets: “HoldRite” copper plated brackets. Insulate brackets attached to metal studs with felt.

2.3 PIPE PORTALS

A. Where pipe portals are not provided by other sections of Specification, provide prefabricated insulated pipe portals as required for piping penetrating through the roof where shown on plans. Field built pipe portals are acceptable alternatives - provide detail of construction for review.

B. Standard pipe portals, unless otherwise noted, shall be constructed as follows:
   1. Curb shall be constructed of heavy gauge galvanized steel with continuous welds on shell seams.
   2. Insulation to be 1-½" thick, 3 lb density rigid fiberglass.
   3. Curb to have a raised 3" (minimum), 45° cant.
   4. Curb to have 1-1/2" x 1-1/2" wood nailer (minimum).
   5. Curb height to be 8" (minimum) above roof deck.
   6. Cant shall be raised to match roof insulation thickness.

7. Cover or flashing to be constructed of galvanized steel or other suitable material to provide sturdy weather tight closure. Provide collars and rubber nipples with draw bands of sizes required by piping. Size curb, cover and nipples per manufacturer's recommendations.
8. Manufacturer: Roof Products Systems or Pate.

2.4 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic or stainless steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:
1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic or stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:
1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

G. Manufacturer: Pate, Roof Products Systems, Portable Pipe Hangers, Roof Top Blox, or Erico Caddy Pyramid.

2.5 ACCESS PANELS AND ACCESS DOORS

A. Provide all access doors and panels to serve equipment under this work, including those which must be installed, in finished architectural surfaces. Frame of 16-gauge steel, door of 20 gauge steel. 1" flange width, continuous piano hinge, key operated, prime coated. Refer to Architectural Specifications for the required product Specification for each surface. Contractor is to submit schedule of access panels for approval. Exact size, number and location of access panels are not shown on Plans. Access doors shall be of a size to permit removal of equipment for servicing. Access door shall have same rating as the wall or ceiling in which it is mounted. Provide access panel for each trap primer or concealed valve, for fire and combination fire/smoke dampers, and for volume dampers. Use no panel smaller than 12" x 12" for simple manual access, or smaller than 24" x 24" where personnel must pass through. Provide cylinder lock for access door serving mixing or critical valves in public areas.

B. Included under this work is the responsibility for verifying the exact location and type of each access panel or door required to serve equipment under this work and in the proper sequence to keep in tune with construction and with prior approval of the Architect. Access doors in fire rated partitions and ceilings shall carry all label ratings as required to maintain the rating of the rated assembly.

C. Acceptable Manufacturers: Milcor, Karp, Nystrom, or Elmdor/Stoneman.

D. Submit markup of architectural plans showing size and location of access panels required for equipment access for approval by Architect.

2.6 IDENTIFICATION MARKERS

A. Mechanical Identification Materials: Provide products of categories and types required for each application as referenced in other Division 23 Sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category. Stencils are not acceptable.

B. Plastic Pipe Markers:
1. Snap-On Type: Provide pre-printed, semi-rigid snap-on, color coded pipe markers, complying with ANSI A13.1.
2. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers, complying with ANSI A13.1. Secure both ends of markers with color coded adhesive vinyl tape.
3. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
4. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

C. Plastic Duct Markers:
1. Provide 4 1/2" x 6" laminated plastic, ANSI A13.1 color coded duct markers with white core lettering.
2. Nomenclature: Include the following:
   a. Direction of air flow
3. Duct service (supply, return, exhaust, etc.).
   a. Duct origin (from)
   b. Duct destination (to)
   c. Design cfm
4. Provide a minimum of every 20 feet on all ducts with a diameter or width greater than 12".

D. Underground-Type Plastic Line Markers: Provide 6" wide x 4 mils thick multi-ply tape, consisting of solid metallic foil core between 2 layers of plastic tape. Markers to be permanent, bright colored, continuous printed, intended for direct burial service.

E. Valve Tags:
1. Brass Valve Tags: Provide 1 1/2" diameter 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Fill tag engraving with black enamel.
2. Plastic Laminate Valve Tags: Provide 3/32" thick engraved plastic laminate valve tags, with piping system abbreviations in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32" hole for fasteners.
3. Valve Tag Fasteners: Provide solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
4. Access Panel Markers: Provide 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.
5. Non-potable Water Tags: 1/16" thick, engraved, plastic tags as indicated on Drawings.

F. Plastic Equipment Signs:
1. Provide 4-1/2" x 6" plastic laminate sign, ANSI A.13 color coded with engraved white core lettering.
2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

3. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters, such as pressure drop, entering and leaving conditions, rpm, etc.

G. Acceptable Manufacturers: Craftmark, Seton, Brady, Marking Services, Inc., or Brimar.

2.7 ELECTRICAL

A. General:
1. All electrical material, equipment, and apparatus specified herein shall conform to the requirements of Division 26.
2. Provide all motors for equipment specified herein. Provide motor starters, controllers, and other electrical apparatus and wiring which are required for the operation of the equipment specified herein.
3. Set and align all motors and drives in equipment specified herein.
4. Provide expanded metal or solid sheet metal guards on all V-belt drives to totally enclose the drive on all sides. Provide holes for tachometer readings. Support guards separately from rotating equipment.
5. Provide for all rotating shafts, couplings, etc., a solid sheet metal, inverted “U” cover over the entire length of the exposed shaft and support separately from rotating equipment. Cover shall extend to below the bottom of the shaft and coupling, and shall meet the requirements of the State Industrial Safety Regulations.
6. Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

B. Quality Assurance:
1. Electrical components and materials shall be UL or ETL listed/labeled as suitable for location and use - no exceptions.

C. Motors:
1. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment Specifications.
2. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
3. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Unless otherwise noted on plans, all motors ½ HP or larger shall be rated for 208 or 460 volt, 3-phase, operation. Unless otherwise noted on plans, all motors less than 1/2 HP shall be rated for 120 volt, single phase operation.
4. Temperature Rating: Motor meets class B rise with class F insulation.
5. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
6. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design “B”, except “C” where required for high starting torque.
   a. Frames: NEMA Standard No. 48 or 56; use driven equipment manufacturer's standards to suit specific application.
   b. VFD driven motors to be provided as inverter ready and equipped with a shaft grounding device, or inverter duty complying with NEMA Standard MG-1, Part 31 as supplied by same manufacturer as VFD.
   c. Bearings:
      1) Ball or roller bearings with inner and outer shaft seals.
      2) Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
      3) Designed to resist thrust loading where belt drives or other drives product lateral or axial thrust in motor.

4) For fractional horsepower, light duty motors, sleeve type bearings are permitted.
5) Enclosure Type:
a) Open drip-proof (ODP) motors for indoor use in clean air environments.
b) Totally enclosed fan cooled (TEFC) motors for outdoor use and indoor application in dirty environments.
c) Totally enclosed air over (TEAO) motors for motors in the airstream of cooling towers and fluid coolers.
d) Guarded drip-proof motors where exposed to contact by employees or building occupants.
e) Weather protected Type I for outdoor use, Type II where not housed.

d. Overload Protection: Built-in thermal overload protection where external overload protection is not provided and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
e. Noise Rating: "Quiet."
f. Efficiency:
1) Motors shall have a minimum efficiency per governing State or Federal codes, whichever is higher.
2) Motors shall meet the NEMA premium efficiency standard
g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

D. Starters and Electrical Devices:
1. Motor Starter Characteristics:
a. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs.
b. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
2. Manual switches shall have pilot lights and all required switch positions for multi-speed motors. Overload Protection: Melting alloy or bi-metallic type thermal overload relays, sized according to actual operating current (field measured).
3. Magnetic Starters:
a. Heavy duty, oil resistant, hand-off-auto (HOA), or as indicated, and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
b. Trip-free thermal overload relays, each phase, sized according to actual operating current (field measured).
c. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division 23 Controls sections.
d. Built-in primary and secondary fused control circuit transformer, supplied from load side of equipment disconnect.
e. Externally operated manual reset.
f. Under-voltage release or protection for all motors over 20 hp.
4. Motor Connections: Liquid tight, flexible conduit, except where plug-in electrical cords are specifically indicated.

E. Low Voltage Control Wiring:
1. General: 14 gauge, Type THHN, color coded, installed in conduit.
2. Manufacturer: General Cable Corp., Alcan Cable, American Insulated Wire Corp., Senator Wire and Cable Co., or Southwire Co.

F. Disconnect Switches:
   1. Fusible Switches: For equipment 1/2 HP or larger, provide fused, each phase; heavy duty; horsepower rated; spring loaded quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the “OPEN” position; arc quenchers; capacity and characteristics as indicated.
   2. Non-Fusible Switches: For equipment less than 1/2 horsepower, switch shall be horsepower rated; toggle switch type with thermal overload quantity of poles and voltage rating as required.

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.

B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.
   1. If the contractor must deviate from the manufacturer’s recommendations provide a letter from the manufacturer indicating the clearance to be provided is acceptable for scheduled performance and maintenance.

3.3 INSTALLATION

A. Coordinate the work between the various Mechanical Sections and with the work specified under other Divisions. If any cooperative work must be altered due to lack of proper supervision or failure to make proper and timely provisions, the alternations shall be made to the satisfaction of the Engineer and at the Contractor’s cost. Coordinate wall and ceiling work with the General Contractor, and his subcontractors in locating ceiling air outlets, wall registers, etc.

B. Inspect all material, equipment, and apparatus upon delivery and do not install any damaged or defected materials.

3.4 SUPPORTS AND HANGERS

A. Prior to installation of hangers, supports, anchors, and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives, (if any), installers of other work with requirements specified.

B. Installation of Building Attachments: Install building attachments at required locations within concrete or on structural steel for proper piping support. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed. Fasten insert securely to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through opening at top of inserts.

C. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors, and other building structural attachments.

D. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by

trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

E. Install hangers within 12 inches of every change in piping direction, end of pipe run or concentrated load, and within 36 inches of every major piece of equipment. Hangers shall be installed on both sides of flexible connections. Where flexible connection connects directly to a piece of equipment only one hanger is required.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

G. Support sprinkler piping and gas independently of other piping.

H. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

I. Hanger Spacing in accordance with following minimum schedules for support of individual pipes (other spacings and rod sizes may be used in accordance with the SMACNA Seismic Restraint Manual using a safety factor of five):

1. Steel Pipe (Water Filled):

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 1 1/4"	5 feet	3/8"
1 ½" to 2"	7 feet	3/8"
2 ½" to 3"	10 feet	1/2"
4" to 12”	12 feet	5/8"

2. Steel Pipe (Gas/Air Filled):

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 1 1/4"	6 feet	3/8"
1 ½" and larger	10 feet	1/2"

3. Copper Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	6 feet	3/8"
2 ½" and larger	8 feet	1/2"

4. Glass Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	6 feet	3/8"
2 ½" and larger	8 feet	1/2"

5. Plastic/Fiberglass Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	4 feet	3/8"
2 ½" and larger	6 feet	1/2"

6. Caulked Bell and Spigot and Glass Pipe: Provide hanger for each section of pipe, located at shoulder of bell. Where an excessive number of fittings are installed between hangers, provide additional reinforcing.
7. Trapeze support: Provide details stamped by a registered structural engineer for the project state indicating trapeze channels, support rod sizes, and spacing.

J. Sloping, Air Venting, and Draining:

1. Steam:
   a. Slope steam piping as specified and as indicated, true to line and grade, and free of traps and air pockets downward a minimum of ¼ inch per 10 ft of run in the direction of flow.
   b. Where horizontal piping must be reduced in size, use eccentric reducers that allow continuous uniform pitch along the bottom of the piping. Avoid concentric reducers in horizontal piping.
   c. Takeoffs from steam mains are to be taken from the top of the main preferably at a 45 degree angle.

d. Where branch takeoffs are less than 10 feet in length, the branch line is to be pitched back ½ inch per 10 feet providing drip legs.

2. Chilled, heating, and condensing water:
   a. Connect all heating and chilled water branch piping to the bottom or side of their respective mains. Where connection must be made to the top of the main piping, make provision for venting of air.
   b. Provide drain valves and hose adapters at all low points in piping.
   c. Provide vents at all high points in water piping.

K. Provisions for Movement:
1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connecting equipment.
3. Insulated Piping: Comply with the following installation requirements:
   a. Clamps: Attach clamps, including spacers, (if any), to piping with clamps projecting through insulation.
   b. Shields: Where low compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install shields or inserts.
   c. Saddles: Where insulation without vapor barrier is indicated install protection saddles.

L. Installation of Anchors:
1. Install anchors at proper locations to prevent excessive stresses and to prevent transfer of loading and stresses to connected equipment.
2. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure.
3. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
4. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends.

M. Equipment Supports:
1. Provide all concrete bases, unless otherwise furnished as work of Division 03. Furnish to Division 03 Contractor scaled layouts of all required bases, with dimensions of bases, and location to column centerlines. Furnish templates, anchor bolts, and accessories necessary for base construction.
2. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks.

N. Adjusting:
1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
3. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 ROOF CURBS, EQUIPMENT RAILS, PIPE PORTALS

A. Install per manufacturer's instructions.

B. Coordinate with other trades so units are installed when roofing is being installed.

C. Verify roof insulation thickness and adjust raise of cant to match.

3.6 ELECTRICAL REQUIREMENTS

A. Mechanical Contractor shall coordinate with Division 26 work to provide complete systems as required to operate all mechanical devices installed under this Division of work.

B. Installation of Electrical Connections: Furnish, install, and wire (except as may be otherwise indicated) all heating, ventilating, air conditioning, etc., motors and controls in accordance with the following schedule and in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC, and NECA's "Standard of Installation" to ensure that products fulfill requirements. Carefully coordinate with work performed under the Mechanical Division of these Specifications.

C. Division 23 has responsibilities for electrically powered or controlled mechanical equipment which is specified in Division 23 Specifications or scheduled on Division 23 Drawings. The specific division of responsibilities between Division 23 and 26 for furnishing or wiring this equipment is as follows:

1. Division 23 Mechanical Responsibilities:
   a. MOTORS: Furnish and install all motors necessary for mechanical equipment.
   b. MAGNETIC STARTERS: Furnish all magnetic starters whether manually or automatically controlled which are necessary for mechanical equipment. Furnish these starters with all control relays or transformers necessary to interface with mechanical controls. If the starter is factory installed on a piece of Division 23 equipment, also furnish and install the power wiring between starter and motor.
   c. VARIABLE FREQUENCY DRIVES: Provide all VFD's associated with mechanical equipment. If the drive is installed on a piece of factory assembled equipment the wiring between motor and drive is to be provided as part of the factory equipment.
   d. DISCONNECTS: Provide the disconnects which are part of factory wired Division 23 equipment. Factory wiring to include wiring between motor and disconnect or combination starter/disconnect.
   e. CONTROLS: Division 23 Contractor (including the temperature controls subcontractor) is responsible for the following equipment in its entirety. This equipment includes but is not limited to the following:
      1) Control relays necessary for controlling Division 23 equipment.
      2) Control transformers necessary for providing power to controls for Division 23 equipment.
      3) Line voltage thermostats.
      4) Low or non-load voltage control components.
      5) Remote bulb thermostats.
      6) Non-life safety related valve or damper actuators.
      7) Float switches.
      8) Solenoid valves, EP and PE switches.
      9) Refrigeration controls. (Division 26 provides power to refrigeration panels.)
   f. FIRE AND LIFE SAFETY EQUIPMENT:
      1) Fire/Smoke Dampers: Division 23 is responsible for providing and physically installing the damper and for installing any required control interface wiring to Division 23 controls.
         a) Where fire/smoke dampers are part of an integrated smoke control system, Division 23 is responsible for providing dampers with necessary end switches for proof of closure. (See Section 233113.)
         b) Where these dampers are not part of an integrated area wide smoke detection system, Division 23 is responsible for providing each fire/smoke damper with a dedicated duct detector installed per the requirements of the building code. (See Section 233113). If not integral with the damper assembly, the detector is to be installed by Div. 23 but wired for damper control by Div. 26.
      2) Fire Sprinkler System: Division 23 is responsible for providing necessary controls including flow switches and alarm bells.

3) Specialized fire suppression systems: Division 23 is responsible for providing necessary system controls and any required control interface wiring to these controls. Division 26 is responsible for bringing power to point of connection with the system.

D. Division 26 has responsibilities for electrically powered or controlled mechanical equipment, which is specified in Division 23 Specifications or scheduled on Division 23 Drawings. The specific division of responsibilities between Division 23 and 26 for furnishing or wiring this equipment is as follows:

1. Division 26 Electrical Responsibilities:
   a. MOTORS: Provide the power wiring for the motors.
   b. MAGNETIC STARTERS: Except where magnetic starters are factory installed on Division 23 factory assembled equipment, Division 26 is to install magnetic starters furnished by Division 23 and install the necessary power wiring to the starter and from the starter to the motor. In the case of factory installed starters, Division 26 is to install the necessary power wiring to the starter.
   c. VARIABLE FREQUENCY DRIVES: Physically mount all VFD's, which are not specified to be installed on Division 23 factory assembled equipment. Provide the necessary power wiring to the VFD and from the VFD to the motor except in the case of factory installed VFD's where wiring between the motor and VFD is to be by Division 23. Where disconnects are installed between a VFD and a motor provide the interlocking wiring between the disconnect and VFD to insure that the drive is shutdown simultaneously with motor.
   d. DISCONNECTS: Provide all disconnects necessary for Division 23 mechanical equipment which are not provided as part of factory wired Division 23 equipment. Provide power wiring to all disconnects. In addition provide power wiring between motor and disconnect when the disconnect is not factory installed. See also Variable Frequency Drive above for special wiring requirements.
   e. CONTROLS: Division 26 Contractor is responsible for providing power to control panels and control circuit outlets.
   f. FIRE AND LIFE SAFETY EQUIPMENT:
      1) Fire/Smoke Dampers: Division 26 is responsible for power wiring to the damper and as follows:
         a) Where these dampers are part of an integrated smoke control system Division 26 is responsible for providing the detectors and for all fire detection system wiring necessary to integrate dampers and related end switches into the system.
         b) Where these dampers are not part of an integrated area wide smoke detection system, Division 23 is responsible for providing each fire/smoke damper with a dedicated duct detector installed per the requirements of the building code. (See Section 233113). If not integral with the damper assembly, the detector is to be installed by Div. 23 but wired for damper control by Div. 26.
      2) Fire Sprinkler System: Division 26 is responsible for providing power wiring to fire protection controls including flow switches and alarm bells.
      3) Specialized fire suppression systems: Division 26 is responsible for providing power wiring to suppression system and its controls.
2. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
3. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
4. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities.

When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.

5. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
6. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

E. Motors and Motor Control Equipment: Conform to the standards of the NEMA. Equip motors with magnetic or manual line starters with overload protection. Motor starters and line voltage controls shall be installed under Electrical Section but located and coordinated as required under this Section of the work. Starters shall be combination type with non-fusible disconnect switches. All single phase fractional horsepower motors shall have built-in overload protection.

3.7 PAINTING

A. All painting shall be provided under this Division work, unless otherwise specified under Section 099100: Painting. Painting schemes shall comply with ANSI A13.1. Paint all exposed materials such as piping, ductwork, equipment, insulation, steel, etc. Exposed gas piping inside and outside the building shall be painted with two coats of "Rust-O-Leum" Yellow. The inside surface of visible ductwork above diffusers/grilles shall be painted flat black. Exposed copper indirect waste piping serving food service equipment shall be painted metallic chrome.

B. All exposed work under Division 23 shall receive either a factory finish or a field prime coat finish, except:
1. Exposed copper piping.
2. Aluminum jacketed outdoor insulated piping.

3.8 IDENTIFICATION MARKERS

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

B. Piping System Identification:
1. Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
2. Locate pipe markers as follows:
   a. Near each valve and control device.
   b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
   c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
   d. At access doors, manholes, and similar access points which permit view of concealed piping.
   e. Near major equipment items and other points of origination and termination.
   f. Spaced horizontally at maximum spacing of 20' along each piping run, with minimum of one in each room. Vertically spaced at each story transversed.

C. Underground Piping Identification: During backfilling/topsoiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

D. Ductwork Identification: A minimum of every 20' for all ductwork 12" or more in diameter or width.

E. Mechanical Equipment Identification: Locate engraved plastic laminate signs on or near each major item of mechanical equipment and each operational device. Provide signs for the following:
   1. Main control and operating valves, including safety devices.
   2. Meters, gauges, thermometers, and similar units.
   3. Pumps, compressors, chillers, and similar motor-driven units.
   4. Hot water system mixing valves and similar equipment.
   5. Boilers, heat exchangers and similar equipment.
   6. Fans, blowers, primary balancing dampers, and mixing boxes.
   7. Packaged HVAC central-station and zone-type units.
   8. Tanks and pressure vessels.
   9. Strainers, filters, treatment systems and similar equipment.
   10. Sprinkler and standpipe equipment.

F. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations. Equipment signs shall include an identification of the area or other equipment served by the equipment being labeled.

3.9 VIBRATION AND DYNAMIC BALANCING

A. Vibration tolerances shall be as specified by the “International Research and Development Corporation”, Worthington, Ohio, measured by the displacement, peak to peak, as follows:
   1. All Fans: Below severity chart labeled “FAIR”, maximum velocity of 0.0786 in/sec, peak.
   2. Pump and Electric Motors: Below severity chart labeled “SLIGHTLY ROUGH”, maximum vibration velocity of 0.157 in/sec, peak.
   3. Compressors: Same as pumps.

B. Correction shall be made to all equipment, which exceeds vibration tolerances specified above. Final vibration levels shall be reported as described above.

3.10 TESTING

A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.

B. Ductwork: Test all air quantities as specified in Section 230593 - Testing, Adjusting and Balancing. Pressure tests per SMACNA.

C. Registers and Diffusers: Test for proper operation of manually operated control feature. Test all air quantities as specified in Section 230593 – Testing, Adjusting and Balancing.

D. Ductwork Specialties: Test all operable ductwork specialties for proper operation. Check all fire, smoke and fire/smoke dampers to ensure that they are 100% open.

E. Temperature Control: Test all control functions to assure that all systems are controlling as specified or as otherwise necessary and that all controls are adjusted to maintain proper room temperatures. The manufacturer's representative shall perform all tests.

END OF SECTION

AIR DISTRIBUTION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this Section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 230500 - Basic Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
1. Ductwork - Rigid, Flexible and Fabric
2. Ductwork Specialties
3. Flexible Connections
4. Sealants, Adhesives and Tapes
5. Flashings
6. Bird Screens
7. Duct Access Panels and Doors
8. Control Dampers
9. Backdraft Dampers
10. Louvers
11. Diffusers, Grilles, and Registers
12. Fire and Smoke Dampers
13. Sound Traps
14. Fan Powered Terminal Units
15. Variable Air Volume (VAV) Terminal Units
16. Elevator Shaft Vents

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230500: Basic Materials and Methods

B. Section 230593: Testing, Adjusting and Balancing

C. Section 230700: Mechanical Insulation

D. Section 230900: Controls and Instrumentation

E. Division 26: Electrical

1.4 QUALITY ASSURANCE

A. Codes and Standards: Provide products conforming to the requirements of the following:
1. ARI 885-98 “Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminal and Air Outlets.”
2. AMCA-210 - Laboratory Methods of Testing Fans for Rating Purposes.
3. ANSI S1.23 - Designation of Sound Power Emitted by Machinery and Equipment.
4. ASC-A7001 - Standard for Duct Sealants.
5. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip. Type 304 or 304 stainless steel.
6. ASTM A525 - Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) Hot-Dip Process. G90 zinc-coated.
7. ASTM A527/A527M - Standard Specification for Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
8. TIMA AAC-101 - Standard for fiberglass duct liner with erosion proof facing.
9. UL 181 - Factory-Made Air Ducts and Connections, Class 1.

B. Conform to NFPA 90A "Standards for the Installation of Air Conditioning and Ventilating Systems".

C. Provide and construct ductwork systems in conformance with the latest editions of the following documents:
   1. SMACNA "HVAC Duct Construction Standards-Metal and Flexible - 2005"
   2. SMACNA "Accepted Industry Practice for Industrial Duct Construction" for duct pressures above +5" W.G. positive pressure or below -5" W.G. negative pressure. Where differences exist between SMACNA and the prevailing building code, the gauge or construction method of the submitted ductwork shall be the more stringent of the two standards
   3. ASHRAE Systems and Equipment Handbook "Duct Construction" chapter
   4. ASHRAE Fundamentals Handbook "Duct Design" chapter

D. Alternatives: The SMACNA standards and publications referenced in this Section of the specifications establish ductwork construction requirements.
   1. Alternatives to these standards and publications may be submitted. Approval will be based on demonstration that such alternatives are equivalent and satisfy the functional requirements described in the referenced standards.
   2. Such demonstration shall include evidence that the alternatives proposed were tested in accordance with SMACNA procedures and with test results certified by an independent testing laboratory.

E. All ductwork and equipment shall be seismically supported and braced per the SMACNA “Seismic Restraint Manual: Guidelines for Mechanical Systems”.

F. Flame/Smoke Rating: All materials, including sealants and adhesives, exposed within plenum shall have a flame-spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.

1.5 SUBMITTALS

A. Prior to construction, submit for approval on all materials and equipment:
   1. Ductwork - Rigid, Flexible and Fabric
   2. Ductwork Specialties
   3. Sealants, Adhesives and Tapes
   4. Flashings
   5. Duct Access Panels and Doors
   6. SMACNA "HVAC Duct Construction Standards - Metal and Flexible"

B. Shop Drawings: Provide shop drawings of sheet metal ductwork and plenums as follows:
   1. Draw to a scale not less than ⅛" to one foot, with sheet sizes equal to Contract Drawings.
   2. Show duct sizes, where possible use even duct sizes.
   3. Show fitting details.
   4. Show coordination with lighting fixtures, fire dampers, smoke dampers, piping, diffusers, grilles, registers, fans, major electrical runs, cable trays and bus ducts.

C. Shop Drawings: Provide shop drawings for field erected mechanical equipment:
   1. Draw to a scale of ½” to one foot, with sheet sizes equal to Contract Drawings.
   2. Show plan, sections, elevations and details of all joints and enclosures.
   3. Detail access doors and hardware.
   4. Detail coil, damper, humidifier, filter and fan installations.
   5. Show access space for electrical components that are part of the equipment provided and/or installed such as power and control panels on humidifiers. This shall be coordinated with Division 26 and NEC.

D. Certifications: Provide a duct schedule, certified by an officer of the sheet metal fabrication subcontractor, that the ductwork conforms to SMACNA standards, and for each sheet metal system furnished on the project include:
   1. System name.
   2. Duct material.
   3. Duct gauge.

4. SMACNA rectangular reinforcement number.
5. SMACNA intermediate reinforcement number.
6. SMACNA transverse reinforcement number.
7. Rod diameter and type.
8. Sealant type.
9. Attachment method.
10. Duct system design pressure.

E. Construction IAQ Management Plan: Collaborate with the general contractor to submit and implement an IAQ Management Plan for the construction process meeting the requirements of the SMACNA IAQ Guidelines. This plan should address the protection of the ventilation system components during construction and cleanup of contaminated components after construction is complete. SMACNA IAQ Guideline recommends control measures in five areas. The IAQ Management Plan should address how compliance has been achieved in these required five areas as follows:

1. HVAC Protection
   a. Shutdown of return side of existing HVAC system in areas affected by heavy construction.
   b. Provision of temporary filters if existing or new systems must remain operational during construction.
   c. Dampering of supply and returns and sealing of openings in areas subject to construction dust.
2. Source Control
   a. How will reduction of contaminants be reduced at the source?
   b. What steps will be taken to employ low emitting products and sealants.
   c. How will air handling equipment be cycled off when not needed?
3. Pathway Interruption
   a. Describe how the construction space will be ventilated as required to dilute contaminants.
   b. Describe how occupied spaces adjacent to construction areas will be kept at positive pressure relative to spaces under construction.
4. Housekeeping: Describe how the following housekeeping objectives will be implemented:
   a. Reduction of dust generated by work will be suppressed.
   b. Maintaining a frequent cleaning frequency for dust and particulates.
   c. Remove spills or excess applications of solvent-containing products as soon as possible.
   d. Remove accumulated water and keep work areas as dry as possible.
   e. Protect insulation materials from exposure to moisture.
5. Scheduling: Describe how overlap of construction activity and ongoing building occupancy activities will be minimized.

F. Field Manual: Submit one copy of the SMACNA "HVAC Duct Construction Standards - Metal and Flexible". Maintain a second copy on the project site.

G. Any ductwork installed without prior approval by the specifier, shall be replaced at the expense of the contractor.

H. The contractor must comply with the enclosed specification in its entirety. If on inspections, the specifier finds changes have been made without prior approval, the contractor will make the applicable changes to comply with this specification, at the contractor's expense.

I. At the discretion of the specifier, sheet metal gauges, and reinforcing may be checked at various times to verify all duct construction is in compliance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged components. Remove damaged products from project site.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. Construct all ducts and plenum of gauges, and with joints, bracing, reinforcing, and other construction details in accordance with the latest construction standards previously listed. Metals shall be manufactured by United States Steel, Kaiser, Rolok or equal.

B. Duct dimensions indicated on drawings are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.

C. Ducts shall be constructed of material gauges and reinforcement per SMACNA pressurization classifications to meet 150% of the pressure requirements for external static pressure scheduled on drawings for the fans serving each system. Where differences exist between SMACNA and the prevailing building code, the gauge or construction method of the submitted ductwork shall be the more stringent of the two standards. See also Part III Execution for matrix of materials and pressure requirements.

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
   a Galvanized Coating Designation: G60 (Z180)
   b Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.
   1. Galvanized Coating Designation: G60 (Z180)
   2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils (0.10 mm) thick
   3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B209 (ASTM B209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Factory- or Shop-Applied Antimicrobial Coating:
   1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
   2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D3363.
   4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
   5. Shop-Applied Coating Color: Black or white.

6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

H. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

I. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 DUCTWORK FABRICATION

A. Joints – Sealing
1. Duct tape is not allowed. Rolled elastomeric duct sealants are not allowed.
2. Solvent-based and oil-based sealants are not allowed indoors.
3. Seal all transverse joints - this includes mechanical joints similar to Ductmate on all supply, return, exhaust and outside air intake ducts.
4. All sealant systems for outdoor application to be suitable for use in exposure to water.
5. All sealant systems for indoor application to be meet VOC limits as specified in South Coast Air Quality Management District (SCAQMD) Rule #1168 limiting VOC's to 80 gram/Liter for ductliner adhesives and 250 grams/Liter for duct sealants.
6. Manufacturers: Tremco, Dure Dyne, Hardcast, Ductmate, Mon-Eco Industries, McGill AirSeal LLC, or equal, as recommended for ductwork application.
7. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, suitable for high velocity and high pressure applications, UL 181B-M listed, UL 723 classified, and complying with NFPA requirements for Class 1 ducts.
   a. Outdoor Application: Not permitted where subject to moisture exposure.
   b. Indoor Application: Hardcast Iron Grip, Ductmate PROseal, Mon-Eco EZ Seal 44-44, or equal.
8. Two-Part Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermally with tape to form hard, durable airtight seal. Hardcast Two Part II, McGill Uni-Cast, or equal.

B. Joints - Rectangular Ducts
1. Slip drive joints, standard seams, flanges or welding as required by SMACNA HVAC Duct Construction Standards for system static pressure. Ductmate, MEZ Industries, or equal are acceptable joint methods, but must be sealed as described previously. Transverse joints shall be constructed per Figure 2-1 for types T-8 through T-25. T-1 and T-5 slip joints are NOT allowed. Joint T-2, T-3, T-6 and T-7 reinforced slip joints are allowed below 2" static pressures.

C. Joints - Round
1. Exposed Ductwork: Slip drive and sheet metal screws.
2. Concealed Ductwork: Sheet metal screws.

D. Elbows
1. Radius: Construct round, oval and rectangular radius elbows with centerline not less than 1.5 times the duct width. Rectangular elbows with inside radius heel are NOT allowed as these create excessive pressure drop and are not per SMACNA.
2. Elbows: Provide single thickness turning vanes on all rectangular elbows less than 25" wide with vane spacing of 1.5". Provide double thickness turning vanes for rectangular radius elbows 25" wide and greater with vane spacing of 2.125" to 2.5". Number of vanes per SMACNA.

E. Transitions
1. Construct transitions with minimum slope of 1 to 5 ratio and in conformance to SMACNA.

F. Branch Connections
   1. Provide 45° entry boots or radius taps for rectangular duct take-offs and conical or bellmouth taps for round duct take-offs. Straight 90° taps are not allowed, except where round take-off duct size equals round branch duct size. Provide volume dampers at take-offs for balancing if not specifically noted as provided at outlet or inlet. Provide insulation guards at transitions to lined ductwork.

2.4 RECTANGULAR DUCTWORK

A. Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" 1995 Edition. This shall be subsequently referred to as the SMACNA Manual. All ductwork must comply with all local, code requirements. Ductwork shall be constructed of galvanized steel. Diagonally cross break all panels on ducts 30 inches wide and larger, or bead using automatic bead machine with beads at 12 inches on center or less. All connections shall utilize 45° boot take-offs. Bullhead tees and straight taps are not permitted.

2.5 ROUND AND OVAL DUCTWORK

A. Round and oval ductwork shall be constructed to SMACNA round ductwork requirements of galvanized sheet steel. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Chapter 3, "Round, Oval, and Flexible Duct", based on indicated static-pressure class unless otherwise indicated. Longitudinal seams shall be spiral lock seams or continuous welded. Flat oval shall be utilized in space-restricted areas. Elbows shall be 5-piece mitered and welded. All elbows shall be long radius type with centerline radius to duct diameter of 1.5, exceptions will only be allowed at restricted space locations.

B. Round or oval duct and fitting manufacturers:
   1. McGill Airflow Corporation
   2. Lindab
   3. Semco
   4. Sheet Metal Connectors
   5. Spiral Manufacturing
   6. Or equal.

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Transverse Joints: Fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 3-1, "Round Duct Transverse Joints", for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All transverse joints to be externally sealed at all joints.
   1. Exception: internal manufactured single or dual EPDM rubber gasket fittings do not require external sealant.
   2. Transverse joints in ducts larger than 50" diameter require flanged joints.
   3. Lap or snap lock seams are not permitted for round ductwork of any size.

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal joints shall be sealed air tight with sealant or continuous welding.
   1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
   2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 3-5, "45 Degree Tees and Laterals", and Figure 3-6, "Conical Tees" and "45 Degree Boot Tees" for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Spin-in type or other types of butt tees, bullhead tees or straight taps are not permitted.

2.6 FRP DUCTWORK FOR UNDERGROUND APPLICATION

A. Code Compliance: All duct and fittings shall be designed and constructed to meet the applicable requirements of the mechanical codes for direct burial application. These requirements include:
   1. Ducts to be approved for underground installation.
   2. Plastic duct and fittings described below shall be utilized in underground installations. The maximum design temperature for systems utilizing plastic duct and fitting shall be 150°F.

B. Underground ductwork, including fittings, shall be constructed of fiberglass reinforced plastic as manufactured by Spunstrand Inc. or approved equal. All ductwork and fittings shall include labels certifying this and shall be installed in strict accordance with the manufacturer's instructions.
   1. Resin - The resin used shall be isophthalic polyester, tested and approved to meet requirements for underground installation and suitable for corrosion against all normal soil and moisture conditions.
   2. Inner Lining - All duct and fittings shall have a UL listed Class 1 inner liner for both flame spread and smoke developed ratings.
   3. Structural Layer - The structural layer shall be filament wound of resin and glass to meet the specified working pressures and depths of burial requirements.
   4. Insulation – Insulation shall be closed cell polyisocyanurate foam that is 5/8" thick, R-5.
   5. Fittings - Fittings shall be fabricated from straight duct and have the same working pressure and will also be corrosion and moisture resistant.
   6. Reducers shall be filament wound as specified for the duct.

C. Joints - Field joints are to be watertight by using an internal aluminum sheet metal sleeve secured with sheet metal screws. The joints shall then be of the wet lay-up type in strict accordance with the manufacturer's instructions. This includes thoroughly cleaning and sanding areas to be joined and using polyester resin and fiberglass mat. See wet lay-up joint instructions.

D. Underground ductwork shall be factory pre-insulated including all fittings. The duct shall be I.C.B.O. listed and installed in strict accordance with the manufacturer's instructions.

2.7 DUCTWORK SPECIALTIES

A. General: Where specifically called for, materials for use in fabricating ductwork specialties shall be identical to that used to fabricate ductwork. See drawings and Part 3, Execution for schedule.

B. Volume and Splitter Dampers: Galvanized sheet metal blade and frame with Ventfabrics Inc., Ventlok operating hardware. For accessible dampers, provide #641 self -locking dial regulators and #644 self-locking dial regulators for insulated ductwork, #637 square end bearing, and #635 spring end bearing, as applicable. For inaccessible dampers, provide #666 or #677 concealed locking damper regulator with bearings as above. For static pressures above 3" W.G., provide #640 HiVel dial regulator and #609 HiVel end bearing for accessible dampers. Regulators shall extend to and through ceiling with neatly installed hardware at the finished ceiling. For inaccessible dampers requiring adjustment through diffusers use Young Regulator, Bowden cable control system.

C. Multi-louver Volume Dampers: 16 gauge galvanized steel frame. Opposed, 6" wide, 16 gauge galvanized steel blades. Concealed linkage in frame. Ruskin #CD35/OBD or equal.

D. Flexible Connections: Provide flexible connectors at the discharge and inlet of fans, air handlers, rotating mechanical equipment, and where shown on the Drawings for proper vibration isolation. Neoprene impregnated glass cloth with 24 gauge galvanized metal frame. Neoprene-only connectors are <u>not</u> allowed. Minimum dimensions - 3" metal, 3" fabric, 3" metal. Ventfabrics

#Ventglas or approved equal by Duro Dyne, Q Industries, consolidated Kinetics, Ductmate Proflex or Elgen.

E. Ducts through roof shall be 16 gauge (or minimum of 2 gauges heavier than attaching ductwork), flashed and counterflashed, and provided with storm collars to secure a watertight construction.

F. Bird Screens: 14 gauge, ½", galvanized wire mesh, set in a galvanized steel frame, screw set.

2.8 DUCT ACCESS PANELS AND DOORS

A. In sheet metal work, hollow core double construction of same or heavier gauge material as duct in which installed. Use no door smaller than 12" by 12" for simple manual access or smaller than 24" by 24" where personnel must pass through infrequently. Use 24" by 60" minimum for filters and more frequent maintenance. Use Ventlok or approved hinges and latches on all doors; 100 Series hinges and latches on low pressure system doors up to 18 " maximum dimension, 200 Series on larger low pressure system doors and 333 Series on high pressure systems. Construct doors up to 18 " maximum dimension with one inch overlap fit and gasket with ¾" by ⅛" sponge rubber, fit larger doors against 1½" by ⅛" flat stock or angle frame and gasket with ¾" by ⅛" sponge rubber or felt. Door swing to be opposite airflow. CESCO, Vent Products, Air Balance, Ductmate Sandwich or equal. Access doors smaller than 12" x 12" can be used for visual inspection of dampers, etc. on small ductwork less than 12" wide but must be of maximum size that will fit on duct with 6" x 6" as minimum size. All access doors smaller than 12" x 12" must be approved by Engineer for the specific application prior to ordering.

PART 3 - EXECUTION

3.1 DUCTWORK MATERIAL APPLICATION SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
   1. Fiber Glass reinforced plastic (FRP) Underground Ducts:
      a. Trenching requirements per manufacturer recommendations and coordination with civil engineering requirements.
      b. The surface at the bottom of the trench should be continuous, smooth and free of rocks to avoid point loading on the duct or as required by Civil Engineering.
      c. Trench width should not be greater than necessary to provide adequate room for joining the duct in the trench and for compacting the backfill in the bedding zone and at the sizes of the duct. The minimum distance between the duct and trench is four (4) inches; maximum recommend trench width is twice the diameter of the duct or as required by Civil Engineering.
      d. Dewatering should be provided when there is risk of flooding the trench during installation. Dewatering shall continue from the time the duct is first placed in the trench, until backfill or encasement is completed. Damage can occur when the duct is floated during a water uplift event.
      e. Trench shall be installed with good drainage provisions and allowance for a minimum of 4” pea gravel or dry silica sand to completely encase the duct or as required by Civil Engineering.
   2. All duct system appurtenances are to be the same material as ductwork including volume dampers and access panels.

3.2 DUCTWORK AND SPECIALTIES INSTALLATION

A. Ductwork is generally diagrammatically indicated and shall be generally installed as indicated. Do not scale Drawings for exact location of ducts. Install ducts to best suit field conditions and cooperate with other trades. Do not penetrate Structural members without consent of Architect or Structural Engineer. Check with Structural drawings prior to locating any penetrations. Duct sizes are indicated as net inside dimensions on the Drawings. The indicated dimensions shall be altered at the job site for the purpose of avoiding interferences and clearance difficulties to other dimensions producing the same air handling characteristics, provided such altered dimensions are

approved by the Architect. Ducts shall be constructed in accordance with the latest edition of codes and standards identified in Part 1 and as shown on the Drawings.

1. Clean and pretreat surfaces before application of sealant. Conform to the manufacturer's cleaning procedures. Install sealants in conformance with manufacturer's instructions.
2. Except where noted, vertical ducts or horizontal ductwork penetrating fire rated ceilings, roofs, walls and floors shall be fire separated with UL listed and labeled fire dampers installed per UL tested assembly including sleeves and retaining angles. Provide additional fire dampers indicated on the Drawings and as otherwise required by the IBC and building inspector. Provide approved firestopping between damper frames and firewalls. Install fire dampers in accordance with NFPA Standards, requirements of the State Fire Marshal, and applicable codes. Ensure that fire dampers are installed in the open position.
3. For penetration of fire rated partitions which meet the IBC Chapter Seven requirements of non-Group H occupancy penetration of tenant separation and corridor walls in buildings with fire sprinklers provide metal sleeves as follows: A minimum 12 inch-long (0.30 m) by 0.060 inch thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1 1/2" inch by 1 ½ inch by 0.060 inch steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 screws. The annualar space between the steel sleeve and wall opening shall be filled with rock wool batting on all sides
4. Grilles, Registers and Diffusers: Install flush, squared, tightly sealed, and entirely covering sheet metal ductwork and gaskets. Thread sheet metal mounting screws tightly into sheet metal. All frames shall be selected to fit the ceiling type. Verify with Architectural Drawing. Each diffuser, grille and register shall be individually capable of balancing via duct mounted balancing dampers or attached opposed blade dampers. Provide unit opposed blade damper only where individual duct mounted balancing dampers are specifically noted as not provided. Duct connections shall fit securely to necks or collars behind face area. Provide all necessary transition pieces and duct collars to make connections from ductwork to neck sizes. Where ducts connect directly to necks or collars provide a minimum straight duct section of two times the duct diameter to the last elbow. Where minimum straight duct sections are not physically possible provide sheet metal plenum sized for approximately 500 fpm air velocity with duct tapped directly to side of plenum. Where building walls, floors and ceilings form portions of duct or plenum, provide gasketed angles or channels at junction points, securely bolted and sealed to building structure.
5. Install turning vanes in all mitered elbows in all ducts, so that tips are parallel with the sides of the ducts. Vanes shall be single thickness type. Tips of acoustical turning vanes on outside radius shall be flush with acoustical lining.
6. Provide flexible connections to completely isolate fans from direct contact with all sheet metal work.
7. Provide access panels or doors, as required, for access to valves, controllers, fire dampers and humidifier dispersion tubes. Access doors required in Product Conveying Vapor/Moisture Ductwork (see applicable paragraph above) shall not be installed in the bottom of the duct or in a manner to allow leaks.
8. Volume Dampers: Provide manual volume dampers in all low pressure supply, return and exhaust branch ductwork to grilles, diffusers, inlet and outlet openings to facilitate balancing of systems. These are to be provided as part of contract whether shown on plans or not. Where ceilings are not accessible, provide access door or remote damper operator.
9. Splitters and splitter dampers shall not be installed in medium or low pressure supply ductwork to VAV systems.

B. Hangers and Supports: Securely fasten all ductwork to the building construction by means of hangers, supports, guides, anchors, and sway braces to maintain duct alignment, to prevent sagging, and to prevent noise and excessive strain on ductwork due to movement under operating conditions.
   1. Maximum spacing between hangers shall not exceed eight (8) feet.
   2. Adequately mount and anchor all material and equipment as required. Include lateral bracing as required to prevent horizontal, seismic movement. Refer to IBC and architectural Drawings for seismic requirements.
   3. Do not support ductwork from fans or any other pieces of equipment.
   4. Powder driver fasteners shall not be used to support rectangular ducts of 40" maximum dimension. Powder driven fasteners shall not be allowed in existing facilities where electronic equipment is located.
   5. Support round duct, 30" and larger, with two hangers at each support point.
   6. Hangers and supports shall conform to SMACNA section "Hangers and Supports". Nail inserts, hangers and supports to formwork before slabs are poured. Cut off or remove nails, strap-ends and other projections, flush with concrete after forms are removed.
   7. Support vertical ducts, passing through floors with two continuous angles screwed to the duct and bearing to the floor and conforming to SMACNA section "Riser Support-From Floor". Blocking or shimming ducts will not be permitted.

C. Other:
   1. Fans: Align fans, motors, and drives. Install fans to render bearings accessible for lubrication without dismantling fans or ducts. Provide extended bearing oilers as required. Mount all fans on vibration isolators as specified.
   2. Insulation: Properly and neatly apply insulation on all material and equipment and apparatus, as specified, including all fittings. Apply insulation over clean, dry surfaces, with adjoining sections firmly butted together and canvas smoothly pasted over. When vapor barriers are specified, install continuous overall external surfaces of the entire system.
   3. Duct Sizing: Where duct sizes are not specifically shown on the plans or must be modified due to physical limitations, supply ducts may be sized at a maximum velocity of 1,500 fpm or 0.08" sp friction per 100 feet, whichever provides the larger duct, and return/exhaust/intake ducts may be sized at a maximum velocity of 1,000 fpm or 0.06" sp friction per 100 feet, whichever provides the larger duct.
   4. Humidifiers: Humidifier installation shall be approved by manufacturer and coordinated with all other systems. Condensate piping shall include p-traps as recommended by the humidifier manufacturer. Insulate exposed piping as required by the code
   5. Access Floor Diffusers: The mounting ring for floor mounted diffusers are to be affixed to the floor tiles using a clamp insert or other method approved for use with the floor diffuser.

3.3 STAINLESS STEEL DUCTWORK

A. For installations serving moisture, vapor, or fume exhaust.
   1. For connections to hoods or equipment provide minimum 12” length flanged and bolted stainless steel spool piece connection.
   2. All fittings shall be long radius. Round elbows shall be minimum 5 gore.
   3. Slope horizontal ductwork back toward source connected equipment minimum 1% slope so that moisture and liquids may drain back toward equipment.
   4. Low point “traps” in the ductwork shall be fitted with a low point drain valve, ½” welded connection, stainless steel piping and valve.
   5. All welding to be completed by certified welders experienced in 316 grade stainless.

3.4 CONSTRUCTION AND SEALING CRITERIA

A. Unless called out otherwise on drawings the pressure classification of ductwork shall be as follows:

Duct system:	Location	Working Pressure	Build to SMACNA Pressure Class	Build to SMACNA Seal Class:
Low press Supply Air	Downstream of air terminal units to grilles, registers or diffusers.	Low pressure	+1" wc	B

B. The default leakage classification of ductwork is as follows:

Duct working press. class:	Low pressure less than +/-0.5"wc	+/-0.5" to +/-2.99"	+/-3" to +/-10" wc
SMACNA Seal Class	C	B	A
Sealing Applicable	Transverse joints only	Transverse and longitudinal Joints	Joints, seams, and all wall penetrations
Rectangular sheet metal SMACNA Leakage Class	24	12	6
Round sheet metal SMACNA Leakage Class	12	6	3

3.5 FIBERGLASS DUCTWORK INSTALLATION

A. Ductwork fabrication and installation to be inspected by a Qualified Fabricator certified by the material manufacturer.

3.6 SEISMIC REQUIREMENTS

A. See Section 230548 for specific requirements.

B. All HVAC equipment and machinery shall be anchored to withstand forces generated by earthquake motions. As a minimum, equipment and equipment frames shall be designed to withstand a force of 100% of the weight of the equipment and frame acting at its center of gravity. Anchorage of the equipment and/or frame to the structure shall be for a force of four times gravity also acting at the center of gravity.

C. The seismic calculations shall be the responsibility of contractor.

3.7 PAINTING

A. Where the interior surfaces of ductwork are visible through the blades of supply outlets, return inlets, and exhaust inlets - paint the interior visible surfaces with one coat of flat black paint.

3.8 FIELD QUALITY CONTROL

A. Do not insulate or conceal ductwork before inspection by Owner's Representative, Architect or Engineer. If ductwork is insulated and concealed prior this inspection the Contractor shall remove insulation and ceiling to permit inspection at no additional cost to the Owner. The Contractor shall replace the insulation and ceiling after final inspection at no additional cost to the Owner.

B. Ductwork Deflection Criteria:
   1. Maximum inward and/or outward deflection at sheet metal panels shall be 3/4" under maximum static pressure operating conditions. Additional intermediate stiffening angles shall be installed where deflections exceed 3/4".

2. Maximum inward and/or outward deflection at sheet metal elbows and joints shall be 1/4" under maximum static pressure operating conditions. Additional stiffening angles shall be installed where deflections exceed 1/4".

C. Acceptance of duct systems shall be contingent upon conformance with the requirements specified in Section 230593 "Testing, Adjusting and Balancing".

3.9 ADJUSTING AND CLEANING

A. Clean the inside of plenums, casings, enclosures, fans, and accessible ductwork before starting fans. Blowout coils and condensate piping with compressed air. Install a clean set of filters in each system prior to testing and balancing. Proceed with testing and balancing. All dampers shall be locked in place.

END OF SECTION

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and Division 01 - General Requirements, and shall include all Mechanical Sections specified herein.

1.2 SCOPE OF THIS SECTION

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
1. Compliance with all codes and standards applicable to this jurisdiction
2. Coordination Documents
3. Work associated with Delivery, Storage, and Handling of products
4. Work associated with provision of Temporary Facilities
5. Meeting Project Safety and Indemnity requirements
6. Proper Cleaning and Closing
7. Design and provision of Supports and Anchors
8. Identification Markers
9. Demolition/Remodel Work

1.3 DESCRIPTION OF WORK

A. The Contract Documents, including Specifications and Construction Drawings, are intended to provide all material and labor to install complete power distribution, auxiliary power production, lighting systems for the building and shall interface with all existing building systems affected by new construction.

B. The Contractor shall refer to the Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of only major items.

1.4 DESCRIPTION OF BID DOCUMENTS

A. Specifications:
1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.

B. Drawings:
1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
2. Before proceeding with work check and verify all dimensions.
3. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
4. Make adjustments that may be necessary or requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
5. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible, including during bidding period.

1.5 RELATED WORK SPECIFIED ELSEWHERE

A. All Division 26 Electrical sections included herein.

B. Division 33: Utility Site Work.

C. Division 21: Plumbing

D. Division 23: HVAC

E. Division 28: Electronic Safety and Security

1.6 CODES AND STANDARDS

A. The Contractor is cautioned that code requirements not explicitly detailed in these specifications or drawings, but which may be reasonably inferred or implied from the nature of the project, must be provided as part of the contract.

B. Perform all tests required by governing authorities and required under all Division 26 Sections.

C. Electrical devices and wiring shall conform to the latest standards of NEC; all devices shall be UL listed and labeled.

D. All electrical work shall comply with the Americans with Disabilities Act (ADA).

E. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

F. Provide in accordance with rules and regulations of the following:
   1. Building Codes enforced by the Authority Having Jurisdiction in Oregon:
      a. 2010 Oregon Structural Specialty Code (OSSC) with amendments based on 2009 International Building Code (IBC)
      b. 2007 Oregon Fire Code (Based on the 2006 International Fire Code)
      c. 2011 National Electric Code (NEC) with 2011 (OESC) State Amendments
   2. Local, city, county and state codes and ordinances
   3. Local Bureau of Buildings
   4. Local Health Department
   5. Local and State Fire Prevention Districts
   6. State Administrative Codes

1.7 GENERAL REQUIREMENTS

A. Examine all existing conditions at building site.

B. Review contract documents and technical specifications for extent of new work to be provided.

C. Provide and pay for all permits, licenses, fees and inspections.

D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. This work shall include furnishing and installing all access doors required for access.

E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to Equipment Specifications in Divisions 02 through 26 for rough-in requirements.

F. Coordinate electrical equipment and materials installation with other building components.

G. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work.

H. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials. Contractor to provide for all cutting and patching required for installation of his work unless otherwise noted.

I. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components.

J. Coordinate connection of electrical systems with exterior underground and overhead services.

1.8 COORDINATION

A. Coordinate project phasing with general contractor and the owner.

B. Coordinate disconnection of all electrical systems that serve areas in the building that are exiting to remain. Coordinate reconnection to make all systems operational that serve areas in the building that are exiting to remain.

C. Coordinate with owner and general contractor for all items that will be salvaged by owner.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver salvaged items to location directed by owner.

B. Store salvaged equipment and materials in an environmentally controlled area at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

1.10 SAFETY AND INDEMNITY

A. The Contractor shall be solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal hours of work.

B. No act, service, drawing, review, or Construction Review by the Owner, Architect, the Engineers or their consultants, is intended to include the review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify and defend the Owner, the Architect, the Engineers and their consultants, and each of their officers, employees and agents from any and all liability claim, losses or damage arising, or alleged to arise from bodily injury, sickness, or death of a person or persons, and for all damages arising out of injury to or destruction of property arising directly or indirectly out of, or in connection with, the performance of the work under the Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the Construction Contract Documents; but not including the sole negligence of the Owner, the Architect, the Engineers, and their consultants or their officers, employees and agents.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all new material, equipment, and apparatus needed to keep existing building in service.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give way to piping systems installed at a required slope.

F. Equipment Dimensions: Provide equipment that fits the available space. Do not exceed dimensions indicated or shown without prior approval.

G. Field verify exact locations, dimensions, and routing of existing equipment.

H. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.

I. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by Architect.

END OF SECTION

SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

C. LEED REQUIREMENTS
   1. LEED Project Goals: See Section 01 81 13 - Building and Site LEED Requirements.
   2. Requirements of the following LEED credits are mandatory for the work of this Section in order to achieve LEED certification:
      a. Materials and Resources Credit 4 - Recycled Content.
   3. Requirements of the following LEED credits contribute cumulatively toward LEED certification:
      a. Materials and Resources Credit 4 - Recycled Content.
   4. Submittals: Submit required LEED documentation for Mandatory and Contributing credits.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 01 70 00.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

C. EXISTING UTILITIES AND BUILT ELEMENTS
   1. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
   2. Tunnels and buried utilities must be located prior to jack-hammering, excavation, etc. If tunnel ceiling damage occurs this must be repaired at Contractor's expense in a manner approved by Owner.
   3. Protect existing utilities to remain from damage.
   4. Do not disrupt public utilities without permit from authority having jurisdiction.
   5. Protect existing structures and other elements that are not to be removed.

D. VEGETATION
   1. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.
   2. Do not begin clearing until vegetation to be relocated has been removed.
   3. Do not remove or damage vegetation beyond the limits indicated on drawings.
   4. Install chainlink fences at least 6 feet high to prevent inadvertent damage to vegetation to remain:
      a. At vegetation removal limits.
      b. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
      c. Around other vegetation to remain within vegetation removal limits.
      d. See Section 01 50 00 for temporary fence construction requirements.
   5. Removed Vegetation: Do not burn, bury, landfill, or leave on site, except as indicated.
      a. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
      b. Trees:
         1) All trees to be removed over 6-inches caliper are to be individually posted for removal at least 2-weeks prior to removal. Postings to include Project Manager information.
         2) Coordinate posting of trees to be removed with Owner's Representative. Trees to be removed within project fencing are to be posted on outside of Construction

Fencing. Trees to be removed outside of project fencing are to be individually posted.

3) Coordinate with Owner's Representative for lumber that should be delivered to UO Facilities Services for milling and salvaging.

c. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.

d. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

6. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

E. DEBRIS

1. Remove debris, junk, and trash from site.
2. Leave site in clean condition, ready for subsequent work.
3. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

EARTH MOVING

PART 1 - GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.2 SECTION INCLUDES

A. Excavation and fills, including compaction, of on-site building, pavement, and landscaped areas.

1.3 RELATED SECTIONS

A. Section 01 23 00 - Alternates

B. Section 00 31 00 - Available Information (Geotechnical Report)

C. Section 31 23 33 - Trenching and Backfill

1.4 REFERENCED SPECIFICATIONS

A. ODOT Standard Specifications (latest revision).

1.5 REFERENCED DOCUMENTS

A. Geotechnical Report: Geotechnical Investigation and Site-Specific Seismic Hazard Study, Erb Memorial Union Expansion and Renovation, University of Oregon, August 16, 2013.

B. All earthwork operations shall comply with the recommendations and requirements of the Geotechnical Report.

1.6 DEFINITIONS

A. Rock: Material that cannot be removed by one-yard shovel, by backhoe with 9,500 lb. digging force, by pick and shovel, or by 200 HP Crawler fitted with normal excavating equipment. Ripper attachment as might be hooked into seam is not considered "normal" excavating equipment.

B. Unstable Soil: Soft, loose, wet, or disturbed ground that is incapable of supporting material, equipment, personnel, or structure.

C. Wet Weather Conditions: Wet Weather Conditions apply to materials placed during dry weather but which are subsequently subjected to rainfall and equipment or construction traffic. The Contractor shall be responsible for the performance of the selected type of material.

D. Design Subgrade: The top of undisturbed excavated earth located immediately below the pavement base material, building slab base material, foundation base material, or landscaping soils, as indicated in the Contract Documents.

E. Overexcavation: Excavation below the bottom of the design subgrade elevation, as required to remove unstable soil at the direction of the Geotechnical Engineer or Owner.

1.7 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise noted.

B. Submittals shall include the specification section number and paragraph for the item being submitted. Submittals with multiple pages shall be numbered for reference.

C. Product Data: Manufacturer's specifications and technical data including performance, construction, and manufacturing information.
   1. Submit for:
      a. Imported material gradation documentation (Stabilization Fill, Structural Fill, Crushed Rock Fill, Open Graded Crushed Rock Fill)
      b. Subgrade Stabilization Geotextile.
      c. Bio-Retention aggregates gradation documentation (bio-retention filter sand, filter pea gravel, drain rock).
      d. Impermeable liner.
      e. Geotextiles.

D. Bio-Retention Soil Submittals
   1. Included with Package 4.

E. Field Quality Control: Submittals as specified in Part 3 of this section.
   1. Testing and observation reports from the Geotechnical Engineer documenting approval of the prepared subgrade.
   2. Material compaction testing reports.
   3. Observation reports from the Geotechnical Engineer documenting compaction of open graded materials.
   4. Observation reports from the Geotechnical Engineer or independent testing agency documenting general compliance with the Earth Moving specifications, as required.

F. Closeout Requirements: Comply with Section 01 77 00 and Section 01 78 00.
   1. Provide record documents.

1.8 QUALITY REQUIREMENTS

A. Manufacturer's Qualifications: Not less than 5 years experience in the actual production of specified products.

B. Installers Qualifications: Firm with not less than 5 years experience in installation of systems similar in complexity to those required for this project.

C. Product/Material Qualifications:
   1. Design Data: Compaction testing shall be in accordance with Section 01 45 00, QUALITY CONTROL.
   2. Test Reports: Provide imported material gradation test reports. Provide material compaction test reports.

D. Regulatory Requirements:
   1. An erosion control permit is required. The Owner shall apply, pay for, and secure the permit. The contractor shall comply with the construction erosion control permit.
   2. Observation and Inspection: Owner will retain a Geotechnical Engineer to monitor earthwork operations.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from damage by the elements and construction procedures.

1.10 ADVANCE NOTICES

A. Notify Engineer at least 48 hours before starting work of this section.

B. Coordinate Geotechnical Engineer’s observation of all prepared subgrade and all compaction efforts.

1.11 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

B. Coordinate with Geotechnical Engineer, Architect, and Civil Engineer.

PART 2 - PRODUCTS

2.1 STABILIZATION FILL FOR CONSTRUCTION HAUL ROADS OR OTHER HIGH DENSITY CONSTRUCTION TRAFFIC AREAS

A. Imported, clean, fragmented quarry rock, up to 6-inch nominal size material, open-gradation.

2.2 STRUCTURAL FILL (FOR BUILDING PAD, WALKWAYS, AND PAVEMENTS)

A. Imported clean crushed rock or crushed gravel, maximum size of 2 inches, free from foreign material and no more than 5% passing the No. 200 sieve.

2.3 CRUSHED ROCK FILL (FOR BUILDING PAD, WALKWAYS, AND PAVEMENTS)

A. Imported clean 3/4" -0 or 1-1/2" - 0 crushed rock or crushed gravel, free from foreign material and conforming to the requirements of ODOT Standard Specification (latest revision) 02630, less than 5% passing the No. 200 sieve.

2.4 OPEN-GRADED CRUSHED ROCK FILL

A. Imported, clean 3/4" - 1/4" angular, crushed rock or crushed gravel, free from foreign material with no more than 2 percent passing the No. 200 sieve.

2.5 NATIVE MATERIAL FOR REUSE IN LANDSCAPE AREAS

A. Excavated, on-site soil, native to project site, free of organics, solids larger than 3 inch diameter, weeds and other deleterious matter and approved by the Geotechnical Engineer for use as fill only during dry weather conditions, and only in landscape areas.

2.6 IMPORTED TOPSOIL

A. Refer to Section 32 90 00 PLANTING.

2.7 GEOTEXTILE

A. Subgrade Stabilization Geotextile: grab tensile strength 200 lb minimum per ASTM D4632 (latest revision) each direction; burst strength 400 psi per ASTM D3786 Mod. (OSHD TM814) (TF 25. Method 3); puncture strength 75 lb per ASTM D4833 (latest revision) or ASTM D3787 Mod. (OSHD TM 816); No. 40 sieve per ASTM D4751 (latest revision) or smaller opening; 0.05 sec water permittivity per ASTM D4491 (latest revision). Propex Geotex 200ST or approved.

B. Filter Fabric for Subdrainage Systems: Type 1 or 2 Drainage Geotextile, per ODOT Specification Section 02320.

2.8 CONDUIT

A. Irrigation sleeves as specified in Section 32 80 00, IRRIGATION.

B. Electrical conduit as specified in Division 26, ELECTRICAL.

2.9 BIO-RETENTION FILTER SAND

A. ASTM C33 Specification Fine Aggregate (Concrete Sand) meeting the following parameters:
   1. D_{15} = 0.3 mm
   2. D_{50} = 0.75 mm
   3. D_{85} = 2 mm
   4. Cu = 4

B. Filter sand gradation may be adjusted depending on the locally available bio-retention soil mix.

2.10 BIO-RETENTION FILTER PEA GRAVEL

A. Imported, washed, No. 8 aggregate per ASTM C33.

2.11 BIO-RETENTION DRAIN ROCK

A. Imported, double washed, No. 57 aggregate per ASTM C33.

2.12 BIO-RETENTION SOIL

A. Included in Package 4.

2.13 BIO-RETENTION MULCH

A. Included in Package 4.

2.14 IMPERMEABLE LINER

A. Manufacturer:
   1. RPE 25 by Layfield or approved equal.

B. Material: Liner shall be UV resistant and shall have the following average properties (values from individual rolls should not vary from these values by more than +/-10%)

Property	test Method	Requirements
Appearance		Black
Nominal Thickness		20 mils
Tensile Strength	ASTM d5034	340 lbs.
Tear Strength	ASTM d2261	125 lbs.
Accelerated Weathering/Uv	ASTM g53-84	More than 80% strength retention after 2,000 hours
Burst Strength	ASTM d3786	551 psi

C. Accessories:
   1. Tape: As approved by the manufacturer
   2. Pipe Adapters: As recommended and approved by the manufacturer.

2.15 ROCK PROTECTION AT OUTFALLS AND SCUPPERS

A. Provide in accordance with Section 32 90 00.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Prior to starting of the work of this section verify that existing grades and field conditions agree with drawings. Notify Engineer of deviations.

B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.2 PROTECTION

A. Monuments: Carefully maintain bench marks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

B. Existing Utilities: Existing utilities shall be field located. Protect active utility lines encountered. Repair or replace utility lines damaged by work of this Section.

C. Pavement Cleaning: Maintain pavements and walkways clean at all times.

D. Dust Control: Protect persons and property against damage and discomfort caused by dust; water as necessary and when directed.

E. Other Work and Adjacent Property: Protect against damage caused by work of this section.

3.3 GENERAL REQUIREMENTS

A. Contractor shall perform all excavation necessary or required for proper construction of the work and placement or installation of materials.

B. Cutting Pavements: Cut vertical, straight-line joints using power saw designed for cutting pavements.

C. Line and Grade: Excavate to lines and grades shown on the drawings or as established by the Engineer.

D. Shoring: Shore excavations when necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, utilities, property, workers, and the public or as required by local, state, or federal agencies. Shoring shall be removed, as the backfilling is done, in a manner that does not damage work or permit voids in the backfill. It shall be the sole responsibility of the Contractor to see that safety requirements are met. Contractor to retain Oregon-licensed professional engineer experienced in the design of temporary shoring systems.

E. Temporary stockpiling of Excavated Materials: Excavated materials may be placed in approved areas. Do not obstruct roadways, bikeways, or pedestrian walkways. Conform to all federal, state and local codes governing the safe loading of excavated materials adjacent to excavations.

F. Excess Excavation: Where excavation, through the Contractor's error, is carried to levels lower than those shown on drawings, backfill with specified bedding material to proper levels at Contractor's expense.

G. Drainage: Except as otherwise permitted, excavation shall be done in a manner as to provide for adequate drainage. In excavation where gravity drainage is not practical, the Contractor shall provide pumps and accessories with which to remove and dispose of all water, including but not limited to, surface water from rainfall entering the excavations, as required to accomplish the work and as required by governing jurisdictions.

H. Backfilling shall not commence until after excavations have been inspected. Backfill shall be placed in such a manner as not to disturb, damage, or subject such facilities to unbalanced loads or forces. Make fills as soon as feasible after Engineer's review and acceptance.

I. Wet Weather Conditions: If construction will extend through wet weather periods, all pavement and building pad cross sections shall be increased to provide a minimum 12"--18" inch crushed

rock working pad for light construction traffic and a 18"-24" crushed rock working pad for heavy construction traffic.

3.4 ROCK EXCAVATION AND OVEREXCAVATION

A. Shallow bedrock, fill, and moisture sensitive soils are present onsite. The CM/GC's GMP will include a contingency / allowance to address rock excavation and mitigation of moisture-sensitive soil based on the information presented in the Geotechnical Report and past experience at nearby project sites. Bids will account for the anticipated rock excavation and measures to address moisture sensitive soils based on the information presented in the Geotechnical Report and the Contract Documents. Refer supplemental information provided in the CM/GC's bid package for additional instructions for bidding and scheduling, as it relates to working in wet weather conditions.

B. Based on the Geotechnical Report, the bedrock is classified as "Extremely Soft to Medium Hard" siltstone and sandstone. Utility trench and building excavations are expected to reach below bedrock levels. Borings showing depth to bedrock throughout the site are included in the Geotechnical Report and shown on the Drawings. Refer to the Drawings and Specifications for elevations of building elements, utilities, and associated excavations.

C. The existing soils onsite are moisture sensitive, and are subject to disturbance by construction traffic. Subgrade soils are not to be directly exposed to construction traffic during wet weather conditions. Include allowances for granular working pads and earthwork methods, described herein and in the Geotechnical Report, to support construction traffic and minimize disturbance to the subgrade. Removal and replacement of subgrade soils damaged by construction traffic will not be considered overexcavation. Overexcavation of existing unforeseen unsuitable material below the design subgrade elevation will be paid as an addition to the contract.

3.5 GEOTEXTILE PLACEMENT

A. Acquisition and Storage: Provide complete rolls of geotextile as furnished by the manufacturer, and protect against damage and deterioration. Store all geotextile rolls in a dry place and off the ground at all times according to ASTM D4873 (latest revision). Cover all rolls and partial rolls with a dark protective covering when received. The geotextile will be rejected for use if the Engineer determines it has defects, deterioration, or has been damaged.

B. Surface Preparation: Prepare the surface receiving the geotextile to a smooth condition free of obstructions, depressions, and debris unless otherwise directed. Do not drag the geotextile on the ground or mishandle it in any way.

C. Loosely place the geotextile without wrinkles so placement of the overlying material will not tear the geotextile. Lap or sew the geotextile at the ends and sides of adjoining sheets as specified.

D. On Slopes: Place the geotextile with the machine direction oriented up-down the slope. Lap the upper sheets over the top of the lower sheets. When the geotextile is placed on a slope steeper than 6:1, securely anchor the laps to the ground surface with pins or stakes as necessary to prevent slippage and tearing of the geotextile. Start placement of fill material on the geotextile at the toe of the slope and proceed upwards.

E. Overlap: Minimum overlap shall be 24 inches.

F. If the Engineer determines the specified overlap is not sufficient, increase the overlap to provide adequate coverage or sew the geotextile together in the field. If field-sewn, the provisions of ODOT 00350.20 and 00350.41(a-3) apply.

G. Protection of Geotextile: Protect the geotextile at all times from ultraviolet (UV) rays, contamination by surface runoff, and construction activities.

H. Traffic or construction equipment will not be permitted directly on the geotextile except as authorized by the Engineer. When placed for construction, cover the geotextile with specified cover material as soon as possible.

I. Place cover material on the geotextile in a manner that the geotextile is not torn, punctured, or shifted. Use a minimum 6-inch-thick cover layer or twice the maximum aggregate size, whichever is thicker. End-dumping cover material directly on the geotextile will not be permitted.

J. Limit construction vehicles in size and weight so rutting in the initial layer above the geotextile is not more than three inches deep or one half the layer thickness, whichever is less. Turning of vehicles on the first layer will not be permitted.

K. Repair of Geotextile: Repair or replace all torn, punctured, or contaminated geotextiles during construction at no cost to the Owner. Repair by placing a patch of the specified geotextile over the affected area. Where geotextile seams are required to be sewn, repair any damaged sheet by sewing unless otherwise indicated on the plans or special provisions or as directed.

3.6 STRIPPING, CLEARING AND GRUBBING

A. Strip, clear and grub site in all building areas, walkways, and other areas to receive structural fill.

B. Stripping and clearing shall be the removal of all existing structures, pavements, brush, grass, shrubs, trees, weeds, rubbish, loose soil, and debris flush with or slightly below original ground surface. Remove willow and blackberry, if any, to not less than 12 inches below original ground surface.

C. Grubbing shall be the removal of all stumps and roots larger than 1-1/2 inches in diameter, rocks larger than 6 inches, and existing structures to the following levels:
   1. To not less than 6 inches below grade or as required to remove brush and tree roots.

D. Refer to Section 31 10 00 SITE CLEARING for disposal of trees and vegetation. Dispose of all material offsite unless otherwise noted.

3.7 EXCAVATION AND FILLS AT PAVEMENT AREAS

A. Excavation equipment and procedures must prevent disturbance and softening of subgrade soils. Site excavation and grading should be completed using a track-mounted hydraulic excavator. Excavation should be finished using a smooth-edged bucket to produce a firm, undisturbed surface.

B. During wet conditions, construction equipment should not traffic fine-grained subgrade (silt) soils. Place 12”-18” depth Stabilization or Structural Fill for a working pad to protect subgrade for lighter construction equipment and limited traffic by dump trucks. Place 18”-24” depth Stabilization Fill for haul roads and other high-density traffic areas with subgrade geotextile.

C. Excavate the existing fill material to the depths of Fill noted in the Geotechnical report and as directed by the Geotechnical Engineer under the direction of the Geotechnical Engineer. Organic fill may be stockpiled on site for later use in landscaped areas with approval of the Geotechnical Engineer and Landscape Architect. Remove all other fill material from site. It may be necessary to excavate several test pits in these areas, especially next to the existing structure to document the extent, thickness, and condition of Fill and determine whether additional overexcavation is necessary to remove soft, loose, deleterious materials.

D. Excavate material in the test pits indicated on the drawings or the Geotechnical Report under the direction of the Engineer and Geotechnical Engineer. Remove material from site. Fill the test pits with Crushed Rock Fill. Place fill in 12-inch maximum loose lifts and compact to a minimum density of 95 percent relative compaction, per a maximum dry density of ASTM D698 (latest revision) at an optimum moisture content of ±2 percent.

E. Excavate any additional existing material to the grades required on the drawings. Remove any additional excavated material from site.

F. Unstable material shall be overexcavated as directed by the Geotechnical Engineer. Overexcavated material shall be removed from site. Use Structural Fill or Crushed Rock Fill to fill the voids left after overexcavation. Place fill in 12-inch maximum loose lifts and compact to a minimum density of 95 percent relative compaction, per a maximum dry density of ASTM D698 (latest revision) at an optimum moisture content of ±2 percent.

G. Increase excavation depth and crushed rock base thickness as required for wet weather working conditions. Strip, replace, and recompact surface of base material if contaminated during construction, as directed by the Geotechnical Engineer.

H. Place Structural Fill or Crushed Rock Fill to raise the grade to the bottom of the pavement section elevation. Place fill in 12-inch maximum loose lifts and compact to a minimum density of 95 percent relative compaction, per a maximum dry density of ASTM D698 (latest revision) at an optimum moisture content of ±2 percent.

I. Place Crushed Rock Pavement Base. Place base material in 12-inch maximum loose lifts and compact to a minimum density of 95 percent relative compaction, per a maximum dry density of ASTM D698 (latest revision).

3.8 EXCAVATION AND FILLS AT BUILDING AREAS

A. Excavation equipment and procedures must prevent disturbance and softening of subgrade soils. Site excavation and grading should be completed using a track-mounted hydraulic excavator. Excavation should be finished using a smooth-edged bucket to produce a firm, undisturbed surface.

B. During wet conditions, construction equipment should not traffic fine-grained subgrade (silt) soils. Place 12”-18” depth Stabilization or Structural Fill for a working pad to protect subgrade for lighter construction equipment and limited traffic by dump trucks. Place 18”-24” depth Stabilization Fill for haul roads and other high-density traffic areas with subgrade geotextile.

C. Excavate the existing fill material to the depths of fill noted in the Geotechnical report and directed by the Geotechnical Engineer under the direction of the Geotechnical Engineer. Organic fill may be stockpiled on site for later use in landscaped areas with approval of the Landscape Architect. Remove all other fill material from site. It may be necessary to excavate several test pits in these areas, especially next to the existing structure to document the extent, thickness, and condition of Fill and determine whether additional overexcavation is necessary to remove soft, loose, deleterious materials.

D. Excavate any additional existing material to the grades required on the drawings. Remove any additional excavated material from site.

E. Unstable material shall be overexcavated as directed Geotechnical Engineer. Overexcavated material shall be removed from site. Use Structural Fill or Crushed Rock Fill to fill the voids left after overexcavation. Place fill in 12-inch maximum loose lifts and compact to a minimum density of 95 percent relative compaction, per a maximum dry density of ASTM D698 (latest revision) at an optimum moisture content of ±2 percent.

F. Increase excavation depth and minimum crushed rock base thickness as required for wet weather working conditions.

G. Building Slab Preparation:
   1. Place a minimum depth of 8 inches of Open Graded Crushed Rock Fill beneath the concrete slab-on-grade. Place fill in one lift and compact under Geotechnical Engineer’s observation

until approved by the Geotechnical Engineer. It shall be the contractor's responsibility to maintain and repair the building slab base after initial testing and approval.

2. Place a minimum depth of 2 inches of 3/4"-0 Crushed Rock Fill over the Open Graded Crushed Rock Fill. Place fill in one lift and compact under Geotechnical Engineer's observation until approved by the Geotechnical Engineer. It shall be the contractor's responsibility to maintain and repair the building slab base after initial testing and approval.
3. Refer to Division 7 for thermal and moisture protection requirements for new slabs on grade and retaining walls.
4. Strip, replace, and recompact surface of base material if contaminated during construction, as directed by the Geotechnical Engineer.

H. Foundation Preparation:
1. Shallow building foundations shall be established in firm, undisturbed native soil or compacted Structural or Crushed Rock Fill. During wet-weather construction, shallow building foundations founded in fine-grained soils should be supported on a minimum of 3- to 4-inches of 3/4 - 0 Crushed Rock Fill placed in the bottom of footing excavations as soon as practical. Compact to a minimum density of 95 percent relative compaction, per a maximum dry density of ASTM D698 (latest revision) at an optimum moisture content of ±2 percent.
2. Embedded walls shall be backfilled with Open Graded Crushed Rock Fill forming a 24-inch drainage blanket from top to bottom against the embedded wall. Fill shall be placed in 9-inch maximum loose lifts and compacted to a minimum density of 93 percent relative compaction, per a maximum dry density of ASTM D698 (latest revision) at an optimum moisture content of ±2 percent. The degree of compaction shall be witnessed by the Geotechnical Engineer to determine the appropriate level of compactive effort if testing cannot be performed. Overcompaction of the backfill shall be avoided. Heavy compactors and large pieces of construction equipment should be kept a minimum distance of 5 feet away from any embedded wall to avoid the buildup of excessive lateral pressures. Compaction close to the walls should be accomplished using hand-operated, vibratory plate compactors.

3.9 EXCAVATION AND FILL AT LANDSCAPED AREAS

A. Refer to landscape drawings and Section 32 90 00, PLANTING.

B. Excavate any additional existing material to the grades required on the drawings. Remove any additional excavated material from site.

C. Prepare grade subgrade per Section 31 22 00 GRADING.

D. place planting soils and provide finish grading per Section 32 90 00 PLANTING.

3.10 GRADING

A. Perform all earthwork to the lines and grades shown on the drawings. Shape and finish slopes to conform to the lines, grades, and cross sections as shown or approved by the Engineer. Provide positive drainage away from buildings and sidewalks.

3.11 BIO-RETENTION MATERIALS AT STORMWATER RAIN GARDENS AND PLANTERS

A. Do not allow stormwater runoff to enter flow-through basin by sheet flow or piped drainage until contributing drainage area has been stabilized and flow-through basin is fully constructed.

B. Do not operate heavy equipment within flow-through basin after beginning backfilling.

C. Excavate to the subgrade elevation required to meet the elevations shown on the drawings.

D. Place impermeable liner around sides and bottom of flow-through basin as shown on drawings.

E. Place bio-retention drain rock, bio-retention filter pea gravel, and bio-retention filter sand to conform to the lines, grades, depth, and cross-section shown on the drawings.

F. Install perforated pipe within bio-retention drain rock layer as indicated on the drawings. Extend impermeable liner around cleanout and upstream end of perforated pipe to prevent perforated pipe from coming in contact with native soil.

G. Seal all pipe penetrations through impermeable liner per manufacturer's recommendations.

H. Cover bio-retention aggregate or filter layers with temporary sheeting if surface is not covered with bio-retention soil within 1-week.

I. Place bio-retention soil loosely with a conveyor belt unless otherwise approved by the Architect.

J. Bio-retention soil placement shall not occur when bio-retention soil is excessively wet, as determined by the Architect.

K. Bio-retention soil shall not be placed until associated submittals have been reviewed and approved.

L. Consolidate bio-retention soil using water-consolidation or other approved methods. Water consolidation shall be performed in a controlled manner, such that no scour, erosion, or soil displacement occurs. Repeat as needed to reach finished grade. Bio-retention soil shall not exceed 80% relative compaction per ASTM D1557.

M. Coordinate planting work and schedule with bio-retention soil placement. Refer to Section 32 90 00 for planting requirements.

N. Where excavations for shrubs or trees extend into bio-retention drain rock zones, lay filter fabric at the interface between drain rock and tree and shrub excavation. Filter fabric shall not extend higher than drain rock layer.

3.12 IMPERMEABLE LINER

A. Place in as detailed on Drawings.

B. Acquisition and Storage: Provide complete rolls of liner as furnished by the manufacturer, and protect against damage and deterioration. Store all liner rolls in a dry place and off ground at all times according to ASTM D4873. Cover all rolls and partial rolls with a dark protective covering when received. The liner will be rejected for use if the Architect determines it has defects, deterioration, or has been damaged.

C. Surface Preparation: Prepare the surface receiving the liner to a smooth condition free of obstructions, depressions, and debris unless otherwise directed. Do not drag the liner on the ground or mishandle it in any way.

D. Installation: The subgrade surface is to be uniform and free of rocks, depressions, voids, and irregularities that might damage liner. Install impermeable liner in accordance with liner manufacturer’s written recommendations.
   1. The liner should be placed in the perimeter trench first. The trench liner should be separate from the liner on the field. Overlap field and trench sections a minimum of 18” in the direction of water flow.
   2. Overlap joints a minimum of 8 inches. All laps shall be overlapped in direction the water flows.
   3. Continuously tape all joints to provide an impermeable liner.
   4. Place a suitable amount of ballast on the liner to prevent movement by wind. The ballast shall be in a form that will not damage liner.

5. Direct loading on the fabric by traffic shall not be allowed. A minimum of 4 inches of material cover must be placed prior to traffic.
6. Repair punctured or torn liner by overlapping additional fabric and joining in accordance with manufacturer's recommendations.
7. The liner must completely line perimeter trench in a continuous manner.

E. Limit construction vehicles in size and weight so rutting in the initial layer above the liner is not more than 3 inches deep or one-half the layer thickness, whichever is less. Turning of vehicles on the first layer will not be permitted.

F. Repair of Liner: Repair or replace all torn, punctured, or contaminated liners during construction at no cost to the Owner. Repair by placing a patch of the specified liner over the affected area. Where liner seams are required to be sewn, repair any damaged sheet by sewing unless otherwise indicated on the plans or special provisions, or as directed.

3.13 MAINTENANCE OF EARTHWORK

A. Contractor shall maintain all earthwork surfaces until all work has been completed and accepted. Such maintenance shall include, but not be limited to, addition of appropriate backfill material to keep backfilled surface smooth, free from ruts and potholes, and suitable for traffic flow.

3.14 DISPOSAL OF WASTE MATERIAL AND EXCESS EXCAVATION

A. Remove from site excess material that is unsuitable for backfilling or stockpiling at the Contractor's expense.

3.15 SETTLEMENT

A. Any settlement in earthwork which occurs during the warranty period and is attributable to construction procedures, such as improper removal of shoring or insufficient compaction, shall be corrected by the Contractor at his own expense. Any piping or facilities damaged by such settlement shall be restored to their original condition at the Contractor's expense.

3.16 FIELD QUALITY CONTROL

A. Refer to Section 01 45 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Field Tests:
1. Testing and observation by the Geotechnical Engineer for the prepared subgrade.
2. Material compaction testing.
3. Imported material gradation testing.

C. Field Inspections: Notify Engineer prior to work of this section.

D. Special Inspections for Code Compliance: Obtain building inspector approvals.

3.17 CLEANING

A. Upon completion of the work of this section promptly remove from the working area all scraps, debris, and surplus material.

3.18 PROTECTION

A. Protect all work installed under this section.

B. Replace at no additional cost to Owner, any damaged work of this Section.

EARTH MOVING

END OF SECTION

TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.2 SECTION INCLUDES

A. Excavation and fills, including compaction, of on-site private storm drain, sanitary sewer, manholes, water distribution, and natural gas distribution systems.

1.3 RELATED SECTIONS

A. Section 01 23 00 - Alternates

B. Section 31 20 00 – Earth Moving

1.4 REFERENCED SPECIFICATIONS

A. ODOT Standard Specifications (current edition).

1.5 DEFINITIONS

A. Rock: Material that cannot be removed by one-yard shovel, by backhoe with 9,500 lb. digging force, by pick and shovel, or by 200 HP Crawler fitted with normal excavating equipment. Ripper attachment as might be hooked into seam is not considered “normal” excavating equipment.

B. Unstable Soil: Soft, loose, wet, or disturbed ground that is incapable of supporting material, equipment, personnel, or structure.

1.6 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Submittals shall include the specification section number and paragraph for the item being submitted. Submittals with multiple pages shall be numbered for reference.

C. Product Data: None Required.

D. Field Quality Control submittals as specified in Part 3 of this Section.
   1. Material compaction testing reports.
   2. Observation reports from the Geotechnical Engineer or independent testing agency documenting general compliance with the specified materials.
   3. Special Inspections for Code Compliance

1.7 QUALITY REQUIREMENTS

A. Manufacturer's Qualifications: Not less than 5 years experience in the actual production of specified products.

B. Installer's Qualifications: Firm with not less than 5 years experience in installation of systems similar in complexity to those required for this project.

C. Product/Material Qualifications:
   1. Design Data: Compaction testing shall be in accordance with Section 01 45 00, QUALITY CONTROL.

2. Test reports: Provide imported material gradation test reports. Provide material compaction test reports.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from damage by the elements and construction procedures.

1.9 ADVANCE NOTICES

A. Notify Engineer at least 48 hours before starting work of this section.

1.10 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

PART 2 - PRODUCTS

2.1 CRUSHED ROCK

A. Imported, clean, 3/4" - 0 crushed rock or crushed gravel, free from foreign material and meeting the requirements of ODOT Standard Specifications (current edition) 02630.

B. To be used for Pipe Base Material, Pipe Zone Material, and Trench Backfill.

2.2 NATIVE MATERIAL

A. Excavated on-site soil, native to project site, free of organics, solids larger than 3 inch diameter, weeds and other deleterious materials and approved by the Geotechnical Engineer for use as on-site backfill in landscape areas, above the pipe zone, only where shown on drawings, and only during dry weather conditions.

2.3 CONTROLLED DENSITY FILL

A. Controlled Density Fill (CDF) shall be a mixture of cement, fly ash, aggregates, water and admixtures proportioned to provide a non-segregating, self-consolidating, free-flowing and excavatable material which will result in a hardened, dense, non-settling fill.

B. Mix Design: Mix design shall conform to the following. The weights shown are only an estimate of the amount to be used per cubic yard of CDF. The actual amounts may vary from those shown if approved by the Engineer. The Contractor shall submit additional data to be approved by the Engineer.

Proportions per Cubic Yard

Maximum Compressive Strength	100 - 250 p.s.i.
Maximum Mixing Water	30 - 50 gals.
Cement	30 - 50 lbs.
Fly Ash	200 - 350 lbs.
Dry Aggregate	2700 - 3200 lbs.

C. CDF used to fill abandoned pipe: The Contractor shall submit certified engineering data, for the proposed mixture to be used, for the following:
   1. 30 and 90 day unconfined compressive strength (C') tests as described in ASTM D4832 with the following exception: cylinders will not be capped.
   2. Yield and dry unit weight additional (ASTM D6103)
   3. Flowability (ASTM D6023)

4. Removability (Removability Modules RE=<1.0)
5. Mixture's components and sources (company and location). Previous test results, on the same mixtures using the same components, will satisfy this requirement.

2.4 TRACER WIRE

A. Electrically conductive tracer wire, 18 - gauge, insulated copper or heavier, green in color, or other approved material. To be placed full length of trench with non - metallic pipe.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Prior to starting work of this section, verify that existing grades and field conditions agree with drawings. Notify Engineer of deviations.

B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.2 PROTECTION

A. Monuments: Carefully maintain bench marks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

B. Existing Utilities: Existing utilities shall be field located. Protect active utility lines encountered. Repair or replace utility lines damaged by work of this section.

C. Pavement Cleaning: Maintain pavements and walkways clean at all times.

D. Dust Control: Protect persons and property against damage and discomfort caused by dust; water as necessary and when directed.

E. Other Work and Adjacent Property: Protect against damage caused by work of this section.

3.3 GENERAL REQUIREMENTS

A. Contractor shall do all trenching and excavating necessary or required for proper construction of the work and placement or installation of materials. Tunneling or jacking shall not be used unless approved in writing by the Engineer.

B. Cutting Pavements: Cut vertical, straight - line joints using power saw designed for cutting pavements. Cut minimum one foot beyond each side of trench.

C. Obstructions: Remove all obstructions encountered within the trench area or adjacent thereto. If requested by Contractor, Engineer may make minor changes in trench alignment to avoid major obstructions, provided such alignment changes can be made without adversely affecting the intended function of the facility. Contractor shall pay any additional costs resulting from such alignment changes.

D. Trenching: Minimum trench width to be 12 inches greater than outside diameter of pipe. Maximum trench width at top of trench shall not be limited except where excess width of excavation would cause damage or create damage to adjacent structures or facilities.

E. Line and Grade: Excavate trench to lines and grades shown on the drawings or as established by the Engineer with proper allowances for pipe thickness and special bedding when required.

F. Shoring: Shore trench when necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public or as required by local, state, or federal agencies. Shoring shall be removed, as the backfilling is done, in a manner that will not damage pipe or permit voids in the backfill. It shall be the sole responsibility of the Contractor to see that safety requirements are met.

G. Temporary Stockpiling of Excavated Material: Locate at least 2 feet from trench edges. Place excavated material only within approved areas. Do not obstruct roadways, bikeways, or pedestrian walkways. Conform to all federal, state and local codes governing the safe loading of excavated materials adjacent to trenches.

H. Excess Excavation: Where excavation, through Contractor's error, is carried to levels lower than those shown on drawings, backfill with specified bedding material to proper levels at Contractor's expense.

I. Drainage: At all times keep trenches dry. Provide and operate pumping equipment necessary to keep excavations free from standing water. Dispose of water in manner to prevent damage to adjacent property and as required by governing jurisdiction.

J. If rock or unstable soil are encountered, notify Engineer. Removal of rock or unstable soil will be paid for as an addition to the contract.

3.4 EXCAVATION

A. Excavate trenches to the line and grades shown on the drawings.

3.5 BACKFILL

A. Backfilling shall not commence until after pipe, conduit, structures, and other equipment and appurtenances placed in trench or similar excavations have been properly constructed or installed, as applicable, and inspected. Backfill shall be placed in such a manner as not to disturb, damage, or subject such facilities to unbalanced loads or forces. Make fills as soon as feasible after Engineer's review and acceptance.

B. Pipe Base: Place required thickness of Pipe Base Material over full width of trench. Provide uniform bearing under entire length of each pipe.

C. Pipe Zone: Place required thickness of Pipe Zone Material over full width of trench.

D. Above Pipe Zone: Backfill full width of trench to paving subgrade elevation or to within depth of loam in landscaped areas with Trench Backfill.

E. Compaction: Trench backfill shall be compacted in maximum 24 inch lifts to:
   1. 95 percent compaction under pavement areas per ASTM D698 at an optimum moisture content of ±2 percent.
   2. 90 percent compaction elsewhere per ASTM D698 at an optimum moisture content of ±2 percent.
   3. Water settling of trench backfill will not be considered an acceptable compaction procedure.

3.6 MAINTENANCE OF TRENCH BACKFILL

A. Contractor shall maintain all backfilled trench surfaces until all work has been completed and accepted. Such maintenance shall include, but not be limited to, addition of appropriate backfill material above the pipe zone to keep backfilled trench surface smooth, free from ruts and potholes, and suitable for traffic flow.

3.7 DISPOSAL OF WASTE MATERIAL AND EXCESS EXCAVATION

A. Remove from site excess material and that unsuitable for backfilling.

3.8 SETTLEMENT

A. Any settlement in trench backfill which occurs during the warranty period and is attributable to construction procedures, such as improper removal of shoring or insufficient compaction, shall be corrected by the contractor at his own expense. Any piping or facilities damaged by such settlement shall be restored to their original condition at the Contractor's expense.

3.9 FIELD QUALITY CONTROL

A. Refer to Section 01 45 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Field Tests:
   1. Material compaction testing:
      a. Trench Compaction: A minimum of one field density test shall be conducted on compacted material for every 100 linear feet, or fraction thereof, of trench and for every 3 feet, or fraction thereof, of fill placed.
   2. Imported material gradation testing.

C. Field Inspections: Notify Engineer prior to work of this section.

D. Special Inspections for Code Compliance: Obtain building inspector approvals.

3.10 CLEANING

A. Upon completion of the work of this section promptly remove from the working area all scraps, debris, and surplus material.

3.11 PROTECTION

A. Protect all work installed under this section.

B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION

EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.2 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventative measures.

D. Compensation of owner fines levied by authorities having jurisdiction due to non-compliance by contractor.

1.3 RELATED SECTIONS

A. Section 02 32 00 - Available Project Information (Refer to Geotechnical Report)

B. Section 31 20 00 - Earth Moving

1.4 REFERENCED SPECIFICATIONS

A. ODOT Standard Specifications (current edition).

1.5 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise noted.

B. Product Data: No Submittals Required.

C. LEED Documentation: Document compliance with LEED Sustainable Sites Prerequisite 1 - Construction Activity Pollution Prevention. Submit documentation in one of the following two forms
   1. Declaration that periodic inspection occurred throughout the construction process and written documentation demonstrating that erosion control plan was carried out appropriately.
   2. Date stamped photos which show the implemented measures and any corrective action that was taken.

D. Closeout Requirements: Comply with Section 01 70 00 and Section 01 78 00.

1.6 QUALITY REQUIREMENTS

A. All measures indicated in this specification may not be required. Contractor responsible for implementing erosion and sediment controls adequate to comply with permit requirements.

B. Manufacturer's Qualifications: Not less than 5 years experience in the actual production of specified products.

C. Installers Qualifications: Firm with not less than 5 years experience in installation of systems similar in complexity to those required for this project.

D. Regulatory Requirements:

EROSION AND SEDIMENT CONTROL

1. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained.
2. An erosion control permit is required from the City of Eugene. The Owner shall apply, pay for, and secure the permit. The contractor shall comply with the construction erosion control permit.
3. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
4. Action Plan: Contractor shall prepare and submit an Action Plan when Erosion and Sediment Control Measures are modified after permit registration is approved. The Action Plan shall identify revisions made to the approved Erosion and Sediment Control Plan, and shall identify corrective actions taken to cease the discharge of sediment into surface waters or stormwater systems. The Action Plan shall be prepared in accordance with the *1200-C Construction Stormwater Permit Registration Guidance* document published by Oregon DEQ in June 2006. An Action Plan shall be required under the following circumstances:
   a. Emergency Situations: Emergency change in erosion control measures due to emergency situations, where immediate corrective action is required to cease the discharge of significant amounts of sediment from entering surface waters or nearby properties. In emergency situations, contractor shall take immediate action to correct the stormwater discharge. Contractor shall submit action plan to Architect within 10 calendar days of the discharge identifying the corrective actions taken to cease the discharge.
   b. Non-Emergency Changes Made Once Project is Underway: Submit Action Plan for changes in the project design affecting stormwater discharges, local conditions, project schedule, weather conditions, or other appropriate reasons. Action Plan shall be required for changes to the Erosion and Sediment Control Measures identified in the Drawings, their location, maintenance required, and any other revisions necessary to prevent and control erosion and sediment runoff. Contractor shall submit action plan to Architect DEQ at least 10 calendar days before implementing the revisions.

E. Stormwater Runoff: Control increased stormwater runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways and storm sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments and relocate on site; comply with requirements of authorities having jurisdiction.

I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments and relocate on site; comply with requirements of authorities having jurisdiction.

J. Open Water: Prevent standing water that could become stagnant.

K. Monitoring and Inspection:
   1. Contractor shall be responsible for monitoring the construction erosion control measures and shall make adjustments to measures, in accordance with the drawings and permit, to accommodate changes in earthwork operations and weather conditions.
   2. Contractor shall be responsible for appointing an Erosion Control Inspector. Inspector shall be a person knowledgeable in the principles and practice of erosion and sediment controls, who possesses the skills to assess conditions at the construction site that could impact stormwater quality, is knowledgeable in the correct installation of the erosion and sediment controls, and is able to assess the effectiveness of any sediment and erosion control measures selected to control the quality of stormwater discharges from the construction activity. Erosion Control Inspector shall submit periodic inspection reports as noted on the Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from damage by the elements and construction procedures.

1.8 ADVANCE NOTICES

A. Notify Architect at least 48 hours before starting work of this section.

1.9 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

PART 2 - PRODUCTS

2.1 MULCH BIO BERM

A. The compost filter berm material consists of compost or a blend of compost and mulch materials according to the specifications as follows.

B. The filter berm material shall meet particle sizing specifications that when used in a filter berm system are tested in conformance with the outlined methods and scope of ASTM D6459 (latest revision), standard test method for determination of Erosion Controlled Blanket (ECB) Performance in Protecting Hill Slopes from Rainfall Erosion.

C. The compost portion of the filter berm shall be derived from well-decomposed organic matter source produced by controlled aerobic (biological) decomposition that has been sanitized through the generation of heat and stabilized to the point that it is appropriate for this particular application. Compost material shall be processed through proper thermophilic composting, meeting the U.S. Environmental Protection Agency’s definition for a ‘process to further reduce pathogens’ (PFRP). The compost portion shall meet the chemical, physical and biological properties outlined below.
   1. The pH shall be between 5.0 and 8.5 for berms to receive vegetation.
   2. Nitrogen Content: 0.5 - 2.0%.
   3. Soluble Salts: Maximum 5 mmhos/cm.

4. Compost shall be weed and pesticide free, with manmade materials comprising less than 1%.

2.2 SEDIMENT FENCE

A. Sediment Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths.

B. Apparent Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751 (latest revision).

C. Permittivity: 0.05 sec^{-1}, minimum, when tested in accordance with ASTM D4491 (latest revision).

D. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355 (latest revision) after 500 hours exposure.

E. Grab Tensile Strength-Supported: 100 lb-f, minimum, in cross-machine direction; 120 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632 (latest revision).

F. Grab Tensile Strength-Unsupported: 90 lb-f, minimum, in cross-machine direction; 100 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632 (latest revision).

G. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

H. Manufacturers:
   1. BP Amoco, Amoco Fabrics and Fibers; www.geotextile.com.
   2. TC Mirafi; www.tcmirafi.com.
   3. Synthetic Industries; www.fixsoil.com.

2.3 BIO-FILTER BAGS

A. Provide minimum size 18" x 6" x 30" plastic mesh bags with 1/2 inch openings filled with approximately 45 pounds of clean, 100% recycled wood-product waste.

2.4 SAND BAGS

A. Provide 24" x 12" x 6" durable, weather-resistant, tightly woven bags sufficient to prevent leakage of filler material. Fill bags with at least 75 lbs. of firmly packed file pcc aggregate 3/8" - 0 or round 3/8" - 3/16" pea gravel.

2.5 CATCH BASIN INSERT BAG / CURB INLET SEDIMENT DAM

A. Provide prefabricated filter inserts manufactured specifically for collecting sediment in drainage inlets. Include handles and/or fasteners sufficient to keep the insert from falling into the inlet during maintenance and removal of the insert from the inlet. Insert bags shall be included on the Oregon Qualified Products List (QPL) for Type 3 Inlet Protection, or approved. Curb Inlet Sediment Dams shall be included on the Oregon QPL for Type 6 Inlet Protection, or approved.

2.6 COMPOST/ORGANIC SOIL MULCH BLANKET

A. The blanket material consists of compost or a blend of compost and mulch materials according to the specifications as follows.

B. The blanket material shall meet particle sizing specifications that when used in an erosion blanket system are tested in conformance with the outlined methods and scope of ASTMA D6459 (latest revision), standard test method for determination of Erosion Controlled Blanket (ECB) Performance in Protecting Hill Slopes from Rainfall Erosion.

C. The compost portion of the blanket material shall be derived from well-decomposed organic matter source produced by controlled aerobic (biological) decomposition that has been sanitized through the generation of heat and stabilized to the point that it is appropriate for this particular application. Compost material shall be processed through proper thermophilic composting, meeting the U.S. Environmental Protection Agency's definition for a 'process to further reduce pathogens' (PFRP). The compost portion shall meet the chemical, physical, and biological properties outlined below:
   1. The pH shall be between 5.0 and 5.5 for blankets to receive vegetation.
   2. Nitrogen Content: 0.5 - 2%.
   3. Soluble Salts: Maximum 5 mmhos/cm.
   4. Compost shall be weed and pesticide free, with manmade materials comprising less than 1%.

2.7 STRAW MULCH COVER

A. Straw mulch for non-hydroseeding applications from bentgrass, bluegrass, fescue or ryegrass, singly or in combination. If grass seed straw is not available within a reasonable distance of the project, straw from barley, oat or wheat may be allowed upon approval of the Agency. Provide straw that is not moldy, caked, decayed, or of otherwise low quality. Submit certification from the supplier that the straw is free of noxious weed seeds or plant parts. Acceptable documentation will show either (1) that the straw source is from an "Oregon Certified Seed" field, or (2) the seed lab test results of the seed harvested from the straw meet minimum Oregon Certified Seed quality for weed seed content. Use a straw binder or tackifier.

2.8 EROSION BLANKET

A. Erosion blanket to be Type 2, straw and coconut. Furnish blanket consisting of undyed, untreated, biodegradable, jute, coconut coir, synthetic polypropylene fibers, or approved yarn woven into a plain weave mesh with 5/8- to 1-inch square openings. Ensure material conforms to the following:

Material	Specification Minimums
Straw 70% *	
Coconut 30%	Straw and Coconut mass to be 0.5 lb/sy (0.25" minimum thickness)
Netting	Photodegradable netting on bottom side.
	5/8 to 1-inch square mesh** with a 0.3 oz/sy weight.

* Moisture content shall not exceed 20%.
** Dimensions are approximate and may vary to meet manufacturer's standards.

Contech's 70% straw / 30% coconut meets these requirements.

2.9 HAY BALES

A. Air dry, rectangular straw bales.

B. Cross Section: 14 by 18 inches, minimum.

C. Bindings: Wire or string, around long dimension.

D. Bale Stakes: Minimum 3 feet long, steel U- or T-section, with minimum mass of 1.33 lb. per linear foot, or wood, 2" x 2" in cross section.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Architect prior to starting work of this section.

3.2 INSTALLATION OF EROSION AND SEDIMENT CONTROL MEASURES

A. Install as shown on drawings, or as directed by Architect, Erosion and Sediment Control Inspector, or Local Authority Having Jurisdiction. All measures included in this specification or details shown on Drawings may not be necessary. Contractor to utilize measures, as needed, to meet the requirements of erosion control permit(s) and the intent of this specification.

3.3 EROSION CONTROL BLANKET

A. Install per manufacturer's specifications. Assure blanket overlap and staple frequency meet manufacturer's application guidelines. Apply seed to cut slope prior to blanket installation.

3.4 PROTECTION

A. Monuments: Carefully maintain bench marks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

B. Existing Utilities: Existing utilities shall be field located. Protect active utility lines encountered. Repair or replace utility lines damaged by work of this Section.

C. Pavement Cleaning: Maintain pavements and walkways clean at all times.

D. Dust Control: Protect persons and property against damage and discomfort caused by dust; water as necessary and when directed.

E. Other Work and Adjacent Property: Protect against damage caused by work of this section.

3.5 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Special Inspections for Code Compliance:
   1. Obtain building approvals from Local Authority Having Jurisdiction.
   2. Provide periodic inspection reports as noted on the Drawings.

3.6 MAINTENANCE

A. Maintain temporary measures until permanent measures have been established.

B. Repair deficiencies immediately.

3.7 CLEANING

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

3.8 PROTECTION

A. Protect all work installed under this section.

B. Replace at no additional cost to Owner, any damaged work of this Section.

END OF SECTION

WATER UTILITIES

PART 1 - GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.2 SECTION INCLUDES

A. Private on-site water distribution system improvements, including domestic system, fire distribution system.

1.3 WORK INCLUDED BUT SPECIFIED IN OTHER SECTIONS

A. Section 31 23 33 - Trenching and Backfill

1.4 REFERENCED SPECIFICATIONS

A. ASTM Standards (current edition)

B. AWWA Standards (current edition)

C. NFPA Standards (current edition)

1.5 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Submittals shall include the specification section number and paragraph for the item being submitted. Submittals with multiple pages shall be numbered for reference.

C. Product Data: Manufacturer's specifications and technical data including performance, construction, and fabrication information:
   1. Pipe materials and fittings, valves, valve boxes, fire department connection and signage, fire hydrants, backflow preventers, backflow preventer vaults and enclosures, and sump pump.
   2. Submit buoyancy calculations for backflow preventer vault. Use a factor of safety of 1.5 and assume groundwater level at 1 ft below finished grade as per Geotechnical Report.
   3. Contractor shall provide the Architect with 6 sets of shop drawings complying with Eugene Fire Department private water system review checklist. After Architect's review, submit three copies of shop drawings to Fire Department for review and approval. Shop drawings shall incorporate all information required by the private water system review checklist including, but not limited to, the following: pipe sizes, materials, locations, depth of bury; fire hydrant types and locations; fire department connection types and locations; indicate pipe restraint type (thrust blocking or mechanical joint restraint), size, and locations.

D. Potholing requirements as shown on the Drawings.

E. Field Quality Control submittals as specified in Part 3 of this Section:
   1. Water system shutdown plan.
   2. Hydrostatic test results.
   3. Disinfection certifications.
   4. Coliform samples.
   5. Plumbing inspector approvals
   6. Fire Marshal approvals.
   7. Special Inspections for Code Compliance

F. Closeout Requirements: Comply with Section 01 77 00 and Section 01 78 00.

1. Provide record documents.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than 5 years experience in the actual production of specified products.

B. Installer's Qualifications: Firm with not less than 5 years experience in installation of systems similar in complexity to those required for this project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver products in original, unopened packaging with legible manufacturer's identification.

B. Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from damage by the elements and construction procedures.

1.8 ADVANCE NOTICES

A. Notify Engineer at least 48 hours before starting work of this section.

1.9 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

1.10 LEAD FREE PRODUCT REQUIREMENTS

A. All products in contact with public water systems or potable water systems shall comply with Standard NSF-372 (<0.25% lead content).

PART 2 - PRODUCTS

2.1 DOMESTIC WATER, FIRE PROTECTION WATER, AND FITTINGS (4 INCH AND LARGER) (UNLESS OTHERWISE NOTED)

A. Polyvinyl Chloride Plastic Pipe:
   1. Pipe: PVC, AWWA C900 (4" to 12"), .AWWA C905 (14" to 16"), DR 18.
   2. Fittings: Gray or Ductile iron, mechanical joint, conforming to AWWA C110 or AWWA C153, with exterior asphaltic seal coat and cement mortar lining per AWWA C104 or Fusion Bonded Epoxy in accordance with AWWA C116.
   3. Joints:
      a. At Fittings and Valves: Restrained mechanical joints per AWWA C110, with gasket joints per AWWA C111.
      b. Pipe Joints: Gasket, push-on joints unless otherwise specified, conforming to ASTM D3139.
      c. Mechanical Joints: AWWA C110, with gasket joints per AWWA C111.
   4. Joint Restraint: Provide as indicated on the drawings according to the following:
      a. Mechanical Joints: UL and FM approved, ductile iron mechanical joint follower gland with restraining wedges secured to pipe by torque limiting twist-off nuts, UL Listed and FM approved, EBBA Iron Sales "Mega Lug" Series 2000 PV or Romac "Romagrip".
      b. Push-On Joints: Clamp ring and bolted restraint harness assembly, UL Listed and FM approved, EBAA Iron Series 1900, or approved.
   5. Pipe Wrap: Wrap all fittings and bolted joint assemblies with polyethylene wrap per manufacturer's recommendations.
   6. Bolts: Bolts for mechanical joints and restraint harnesses shall be corrosion resistant, high-strength low alloy steel conforming to the requirements of AWWA A21.11.

2.2 DUCTILE IRON FIRE PROTECTION WATER PIPE

A. Ductile Iron Pipe:
   1. Pipe: 60-42-10 Ductile Iron meeting the requirements of AWWA C151, with standard exterior asphaltic seal coat and cement mortar lining per AWWA A21.4, minimum Pressure Class 150 or as specified on project plans.
   2. Fittings: Gray or Ductile iron, mechanical joint, conforming to AWWA C110 or AWWA C153, with exterior asphaltic seal coat and cement mortar lining per AWWA C104 or Fusion Bonded Epoxy in accordance with AWWA C116.
   3. Joints:
      a. Mechanical Joints: AWWA C110, with gasket joints per AWWA C111 and corrosion resistant bolts.
      b. Flanged Joints: AWWA C115, with gasket joints per AWWA C111 and corrosion resistant bolts.

B. Restrained Joints: Provide as indicated on the drawings according to the following:
   1. Mechanical Joints: UL and FM approved, ductile iron mechanical joint follower gland with restraining wedges secured to pipe by torque limiting twist-off nuts, EBBA Iron Sales "Mega Lug" Series 2000 PV or Romac "Romagrip".
   2. Flanged Joints: AWWA C115, with gasket joints per AWWA C111 and corrosion resistant bolts.

C. Polyethylene Encasement: Provide 8-mil polyethylene encasement for all buried piping in accordance with AWWA C105, and in accordance with pipe manufacturer's recommendations.

D. Bolts: Mechanical Joint bolts shall be corrosion resistant, high-strength low alloy steel conforming to the requirements of AWWA A21.11

E. Installation shall be in accordance with AWWA C600 and manufacturer's recommendations.

2.3 BUILDING SERVICE DOMESTIC WATER PIPE AND FITTINGS (3 INCH AND SMALLER) (UNLESS OTHERWISE NOTED)

A. Polyvinyl Chloride Plastic Pipe:
   1. Pipe: PVC Schedule 40, ASTM D1784.
   2. Fittings: PVC, ASTM D1784 and D2466.
   3. Joints: Solvent-cemented, in accordance with ASTM D2564.

2.4 DOMESTIC WATER, FIRE PROTECTION WATER, AND MAINLINE IRRIGATION PIPE AND FITTINGS (3 INCH AND SMALLER, BUILDING APPROVED MATERIAL)

A. Conform to Division 22.

2.5 GATE VALVES FOR DOMESTIC AND FIRE PROTECTION SYSTEMS

A. Shall be iron body, class 125, flexible wedge disc, non-rising stem, stuffing box repackable under pressure, UL listed and FM approved fire protection system only, rated working pressure of 150 psi minimum and conforming to AWWA C515-01, and lead free per NSF 372. Crane, Kennedy, or Grinnell.

2.6 CHECK VALVES (3 INCH AND LARGER)

A. Type shall be swing with renewable composition seat and iron disc. Body shall be iron or bronze with bronze trim and bolted bonnet. Class 125, rated working pressure 125 psig steam minimum; 200 psig WOG. UL listed, FM approved. Manufacturer: Crane, Grinnell, Nibco, Powell, or Hammond.

2.7 VALVE BOXES

A. Cast iron conforming to ASTM A48 (latest revision), rated for H20 traffic loading, with a rust protective coating; cover marking "water"; bury depth as required on drawings. Olympic Foundry, Inc. VB910.

2.8 FIRE HYDRANTS

A. Acceptable Manufacturers" Mueller Centurion; Kennedy K-81D; M&H #129.

B. Color: Painted Safety Yellow.

C. Construction: Dry bonnet type with internal operating nut enclosure located above the plane of the nozzles; dry barrel compression type that opens against pressure, with valve in "up" position when closed, high profile design with 30" minimum dimension from top of hydrant to the bury line at approximately 3" below the break flange.

D. Main Valve: 5-1/4"

E. Inlet Flanges: 6" with MJ style connection on the shoe, complying with EWEB standards.

F. Nozzle Section: 3-way design with two 2-1/2" NST hose nozzles and one 5-1/2" NST pumper nozzle. There shall not be any type of cap retainer chains or devices.

G. Operating Nut: one piece design with weather cap or seals with 1-1/2" pentagon, opening left.

H. Provisions for Lubrication: Provide for stem lubrication through either an oil reservoir or pressure lubrication fitting.

I. Main Valve Drain Valve: non-corrosive metal with rubber drain valve facings.

J. Packing Glands and Seals: O-ring type.

K. Applicable Standards: AWWA C502, UL Listed and FM approved, subject to approval of fire department.

2.9 FIRE DEPARTMENT CONNECTION

A. FDC: Shall be double clapper, 2-way, 90 degree Siamese inlet; rough brass; two 2-1/2 inch inlets, one 4 inch outlet; brass caps with chains, National Standard Threads conforming to City of Eugene fire department requirements; UL listed, FM approved, and conforming to City standards. Designated “AUTO SPRINKLER”. Contractor to verify manufacturer with Fire Marshal.

B. Signage: Sign indicating the portion of the building being served, including a map. Refer to Architectural Drawings. Bolt signage to FDC with corrosion resistant U-bolts and hardware.

2.10 BACKFLOW PREVENTERS

A. Fire Protection System:
   1. Backflow Preventer: Double check detector backflow preventer, 6 inch, maximum working pressure of 175 psi, with OS&Y gate valves, flanged joints, UL listed and FM approved, meeting EWEB requirements, lead free per NSF 372, Apollo, or Conbraco. Provide with watertight plugs or caps on test cocks. Provide without detector meter.
   2. Strainer: Wye-strainer, cast iron body, unplugged NPT blowoff connections on cover, recessed screen seats, perforated 304 stainless steel screen, Febco model 758A or approved.

3. Tamper Switch: Provide tamper switch, UL listed as "Extinguishing System Attachment" for the location and type of valve supervised, single pole double throw contacts, connected to each OS&Y gate valve on the backflow preventer assembly, mounted to not interfere with normal valve operation, UL indoor/outdoor rated enclosure, System Sensor Model OSY2, installed per manufacturer recommendations and in accordance with Division 28. Tamper switch operation shall cause a supervisory signal to be transmitted to the Fire Alarm Control Panel upon not more than two complete turns of the valve wheel or a closure of ten percent, whichever is less. Supervisory audible and visible alarms at these locations shall be distinct from either alarm or trouble conditions involving the same or related devices.

B. Domestic System:
1. Backflow Preventer: Double check backflow preventer, 2-inch, maximum working pressure of 175 psi, with full port union ball valves, threaded joints, UL listed and FM approved. Apollo, meeting EWEB requirements, lead free per NSF 372, model 4ALF-118-T2 (basis of design). Provide with watertight plugs or caps on test cocks.
2. Strainer: Wye-strainer, cast copper alloy body, unplugged NPT blowoff connections on cover, recessed screen seats, perforated 304 stainless steel screen, Febco model LF650A or approved.
3. Pipe and Fittings: Pipe within vault and within 1' from vault to be copper, Type K, with soldered joints per Section 22 21 13 (wrap underground joints). Fittings to be wrought copper per Section 22 21 13. Provide transition fittings and reducers as required. Transition fittings from copper to PVC shall be socket by threaded transition fittings with molded -in-place threaded metal insert conforming to ANSI B1.20.1. All threaded fittings to be compatible.
4. Pipe supports: Stand-On or approved, installed per manufacturer recommendations.

C. Irrigation System:
1. Backflow Preventer: Double check backflow preventer, 2-inch, maximum working pressure of 175 psi, with full port union ball valves, threaded joints, UL listed and FM approved. Apollo, meeting EWEB requirements, lead free per NSF 372, model 4ALF-118-T2 (basis of design). Provide with watertight plugs or caps on test cocks.
2. Strainer: Wye-strainer, cast copper alloy body, unplugged NPT blowoff connections on cover, recessed screen seats, perforated 304 stainless steel screen, Febco model LF650A or approved.
3. Pipe and Fittings: Pipe within vault and within 1' from vault to be copper, Type K, with soldered joints per Section 22 21 13 (wrap underground joints). Fittings to be wrought copper per Section 22 21 13. Provide transition fittings and reducers as required. Transition fittings from copper to PVC shall be socket by threaded transition fittings with molded -in-place threaded metal insert conforming to ANSI B1.20.1. All threaded fittings to be compatible.
4. Pipe supports: Stand-On or approved, installed per manufacturer recommendations.

2.11 BACKFLOW PREVENTER VAULTS (BELOW GRADE)

A. Vault:
1. Vault: Precast reinforced concrete vault per ASTM C-875, rated for H20 traffic loading, size appropriate to selected backflow preventer and conforming with details, joints and openings grouted watertight, Utility Vault or approved. Vault dimensions used for basis of design as follows:
   a. Fire Service: 4484 LA
   b. Domestic/Irrigation Service: 506 LA
   Vault size may be modified to meet minimum clearances. Manufacturer to verify dimensions and clearances and provide shop drawings with dimensions and clearance requirements.
2. Hatch, ladder, and BFP configuration shall conform to OSHA requirements.
3. Ladder: Provide galvanized ladder meeting OSHA requirements and capable of extending 42 inches above top of vault. Ladder to be permanently mounted when vault depth exceeds 4 feet.

4. Access Hatch
   a. Fire Service: Galvanized steel hinged access hatch, 3' ± by 6' ± minimum opening size, traffic rated for incidental H20 loading, locking latches, spring assisted doors. Access hatch shall factory-applied, ADA-approved, non-skid coating on all metal surfaces exposed to traffic. Non-skid coating to be galvanized SlipNOT or approved equal.
   b. Domestic/Irrigation Service: Galvanized steel hinged access hatch, 3' ± square minimum opening size, traffic rated for frequent H20 loading (not incidental), locking latches, spring assisted doors. Access hatch shall factory-applied, ADA-approved, non-skid coating on all metal surfaces exposed to traffic. Non-skid coating to be galvanized SlipNOT or approved equal. Hatch to be USF Fabrication Direct Traffic, or approved equal.

B. Permanent Dewatering System - Sump Pump:
1. Sump Pump:
   a. Type: Submersible.
   b. Motor: Oil filled, built-in auto reset overloads.
   c. Bearings: Permanently lubricated.
   d. Impeller: Bronze no-clog.
   e. Seal: Mechanical
   f. Controls: Built-in, internal control system. Set "on" level at 7 to 10 inches above sump floor and one high water alarm float.
   g. Cord: 3-wire with 3-prong grounded plug, 10-foot long.
   h. Power / Power Supply: 1/3 HP, 120 volt, 1-phase.
   i. Capacity: 20 gpm at 22 ft total head
   j. Manufacturer: Hydromatic, Paco, Little Giant, or approved.
   k. Refer to Electrical for power, receptacle, and connections.
2. Discharge Piping:
   a. Routing: Route piping from sump pump discharge through vault, holding tight to sides of vault. Extend piping through vault side through a weep hole to be drilled through the nearest curb on site as detailed on drawings.
   b. Pipe: 2" diameter PVC Schedule 40 per ASTM D1784 with solvent cement joints.
   c. Check Valve / Union: Thermoplastic industrial ball check type manufactured per ASTM F 1970, Spears True Union 2000 or approved. Locate valve 12-18 inches above pump discharge elevation or as recommended by pump manufacturer.

C. Vault High Water Alarm:
1. Float Switch: Corrosion resistant, high impact float switch with normally closed contacts, SJE Signal Master or approved. Set float switch at 18 inches above vault floor. Provide waterproof junction box mounted within vault and provide additional float switch wiring as needed to reach connection points located inside building.
2. Alarm Configuration: Connect high water alarm float switch directly to Building Automation System (BAS). No separate alarm panel required. Alarm signal to trigger "critical" alarm in BAS to signal pump failure and alert maintenance staff. Coordinate with work under Section 23 09 00.
3. Wiring and Connections: Electrical contractor to provide power and connections. All electrical work shall comply with Division 26, and shall be performed by a licensed Electrician.
4. Signs: Provide engraved plastic signs conforming to Section 260553. Location and text of sign as follows:
   a. Backflow Preventer Vault: Mount sign on inside of vault wall above float switch at a location visible from the access hatch. Sign text :
   b. HIGH WATER ALARM FLOAT SWITCH TIED TO CAMPUS B.A.S. AS POINT ___<Controls Contractor to Coordinate Name with UO>. NOTIFY CPS CONTROL ROOM PRIOR TO DISTURBING OR TESTING.

2.12 CHECK VALVE VAULT

A. Precast concrete vaults, size appropriate to selected check valve conforming with details. Utility Vault Company, or approved. Top shall be provided with diamond plate access hatch minimum size, 3' ± by 3'±, hinged access, locking latches.

2.13 BALL DRIP

A. Ball drip shall have brass body, inlet and outlet threads, and have automatic operation.

2.14 CONCRETE

A. Concrete shall be ready-mixed conforming to Section 03 30 00, CAST-IN-PLACE CONCRETE, and shall have a compressive strength of 3,000 psi at 28 days. Maximum size of aggregate shall be 1½ inches.

2.15 OTHER MATERIALS

A. Recommended by Manufacturer and subject to Engineer's review and acceptance. Provide all materials required to complete and make water system operational.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Prior to installation, carefully inspect trench, excavations and base to verify that all such work is complete to the point where this installation may properly commence.

B. Do not install work of this Section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.2 TRENCHING AND BACKFILL

A. Trenching and backfill shall conform to the requirements of Section 31 23 33, TRENCHING AND BACKFILL.

3.3 PIPE INSTALLATION

A. Installation shall be in accordance with the manufacturer's recommendations. All pipe ends and interiors shall be thoroughly cleaned of all foreign matter and shall be kept clean during installation. When work is not in progress, all open ends of pipe and fittings shall be securely closed so that no trench water, earth, animal life or other substance may enter.

B. Cutting of pipe to be done in a neat and workmanlike manner by method which will not damage pipe and as recommended by manufacturer.

C. Install piping within 0.02 feet of indicated grade and location.

D. All ductile iron pipe joints and fittings shall be fully covered with asphaltic coating.

3.4 THRUST BLOCKS AND MECHANICAL JOINT RESTRAINT

A. Install thrust blocks at locations indicated on drawings.

B. Install mechanical joint restraint at fittings and pipe joints where indicated on drawings.

3.5 VALVES, FITTINGS AND CAPS

A. Shall be set and joined to the pipe as shown on the drawings. All pipe shall be supported to prevent stress on valves. All dead ends shall be closed with plugs or caps that are suitably restrained to prevent blowing off under test pressure.

3.6 VALVE BOXES

A. Shall be provided for every valve. Box shall be centered along axis of the operating nut of the valve and shall be set so as not to transmit shock or stress to the valve or valve operator. Keep box free of debris.

B. Set rim flush with adjacent finished surfaces unless otherwise noted.

3.7 FIRE HYDRANTS

A. Conform to referenced specifications AWWA Manual M17 and AWWA C600.

B. Set fire hydrant plumb, and square with adjacent construction.

3.8 FIRE DEPARTMENT CONNECTION

A. Conform to referenced specifications AWWA Manual M17 and AWWA C600.

B. Install fire department connection in cast-in-place bollard as shown on the drawings.

3.9 DOUBLE CHECK BACKFLOW PREVENTER AND VAULT

A. Install on compacted gravel base, level, plumb, square with adjacent construction, with rim flush with adjacent surfaces in accordance with manufacturers recommendations. Chain gate valves in open position with galvanized chain and padlock, at the direction of UO facilities. Comply with EWEB installation requirements.

B. EWEB to provide and install detector meter on backflow preventer and remote reader in vault at property line. Coordinate vault requirements with EWEB. Coordinate work and schedule with EWEB.

C. Construct drain line from vault through adjacent curb or planter wall as a weephole as indicated on drawings. Locate drain so that drain extends level from vault to daylight.

D. Manufactured pipe supports to be installed and adjusted appropriately to support backflow preventer at the required elevations.

3.10 CHECK VALVE AND VAULT

A. Install check valve to allow flow from FDC to sprinkler system.

B. Install vault on compacted gravel base, level, plumb, square with adjacent construction, in accordance with manufacturers recommendations. Set vault rim 3/4" above surrounding grade to limit water infiltration.

C. Construct drain line from vault to adjacent domestic/irrigation backflow preventer vault with positive slope.

3.11 CONNECTIONS TO EXISTING WATER MAINS

A. Prepare shut-down plan and submit to UO EH&S, fire marshal, and Architect for approval.

B. Water mains that are to be cut into for new connections shall be repaired per Oregon DHS Drinking Water Program requirements.

C. Connections to existing mains shall be not result in shut down of water service to existing facilities for more than 6 hours, or as approved by UO EH&S and the fire marshal. Schedule additional crews as needed to complete work within necessary time frame. Conduct work during non-peak hours as directed by Owner.

D. Preparation for Repair:
   1. Turn valve down to reduce mainline flow but maintain positive pressure.
   2. Excavate below the main creating a sump and dewater.
   3. Isolate mainline by shutting other services off providing advance notice to all users as required. Notify Owner 48 hours prior to starting work.

E. Repair process:
   1. Treat exterior of exposed pipe with hypochlorite solution (account for control of residual chlorine in discharge water).
   2. Disinfect all repair items, piping and appurtenances per AWWA C651 Standard.
   3. Conduct the repair with disinfected parts and ensure sump dewatering system is operational.

F. Cut-in process:
   1. Initiate the cut in procedure by removing existing pipe and dewatering the remaining pipe.
   2. Treat exterior of exposed pipe with hypochlorite solution (account for control of residual chlorine in discharge water).
   3. Disinfect all repair items, piping and appurtenances per AWWA C651 Standard. Complete the cut in procedure with disinfected parts.

G. Finalizing connection construction:
   1. Repressurize the main by opening mainline valve and check for leaks.
   2. Flush the line through a fire hydrant or blowoff.
   3. Flush in a direction to best clear the main of any debris/sediment and until air is gone and water flows clear.
   4. For water systems that apply and maintain a chlorine residual, check the chlorine residual at a point downstream of the main break. Residual should be consistent (not lower) with surrounding area.
   5. Collect a coliform bacteria sample per AWWA C651 Standard to provide a record of repair procedure effectiveness. Mark as a “special sample” and retain in records for 2 years.
   6. Restore all valves to their normal operating positions.
   7. Open user services and operate the outdoor hose bib to remove air and turbid water. If no outside bib is accessible, coordinate building access with Owner.
   8. If the post-construction coliform sample result shows the presence of coliforms, resample per coliform sampling procedures. If second sample results show presence of coliforms, contact Architect to consult on corrective action.

3.12 WORK BY UTILITY COMPANY

A. Initiate service, coordinate, and schedule water service, connection, meter installation, detector meter, remote reader, and vault installation by EWEB.

B. Coordinate with EWEB for operation of EWEB valves for temporary shutdown of onsite private main.

C. Owner to pay EWEB costs directly.

3.13 FIELD QUALITY CONTROL

A. Refer to Section 01 45 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Field Tests:
   1. Hydrostatic tests as described below.
   2. Disinfection Tests.

C. Field Inspections: Notify Engineer prior to work of this section.

D. Special Inspections for Code Compliance:
   1. Test hydrostatically. All testing, acceptance, and documentation shall comply with Oregon State Plumbing Specialty Code (current edition) and NFPA and AWWA specifications as applicable.
   2. Prior to testing partially backfill or provide other means of restraint to prevent any movement during the test.
   3. Observance: Plumbing inspector to observe domestic, mainline irrigation, and fire line testing. Fire Department to observe fire line testing. Contractor shall notify plumbing inspector and Fire Department at least 48 hours prior to testing.
   4. Obtain plumbing inspector and fire marshal approvals and submit to Engineer.

3.14 FLUSHING AND DISINFECTION

A. Flushing:
   1. Contractor shall flush and clean all parts of all completed system. All pipe and structures shall be clean and free of all construction debris, rocks, gravel, mud, sand, silt, and other foreign material, and as directed by the Engineer.

B. Disinfection:
   1. Disinfect all domestic water supply piping and appurtenances in accordance with AWWA C651 and Oregon State Health Department requirements.
   2. Provide written certification from a firm specializing in disinfection that the disinfection has been successfully completed.
   3. Dispose of test water in accordance with all governing rules and regulations.

3.15 CLEANING

A. Upon completion of the work of this section promptly remove from the working area all scraps, debris and surplus material.

3.16 PROTECTION

A. Protect all Work installed under this section.

B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.2 SECTION INCLUDES

A. On-site private sanitary sewer system improvements.

1.3 WORK INCLUDED BUT SPECIFIED IN OTHER SECTIONS

A. Section 31 23 33 - Trenching and Backfill

B. Section 33 39 13 - Sanitary Utility Sewerage Manholes, Frames, and Covers

1.4 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Submittals shall include the specification section number and paragraph for the item being submitted. Submittals with multiple pages shall be numbered for reference.

C. Product Data: Manufacturer's specifications and technical data including performance, construction, fabrication, and installation information.
   1. Submit for: Pipe, fittings, and cleanout covers.

D. Potholing requirements as shown on the drawings.

E. TV inspections for existing systems included Package 1.

F. Field Quality Control submittals as specified in Part 3 of this Section:
   1. TV inspections for new systems.
   2. Deflection Tests.
   3. Hydrostatic or air test.
   4. Plumbing Inspector approvals.
   5. Special Inspections for Code Compliance

G. Closeout Requirements: Comply with Section 01 77 00 and Section 01 78 00.
   1. Provide record documents.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than 5 years experience in the actual production of specified products.

B. Installer's Qualifications: Firm with not less than 5 years experience in installation of systems similar in complexity to those required for this project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver products in original, unopened packaging with legible manufacturer's identification.

B. Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from damage by the elements and construction procedures.

1.7 ADVANCE NOTICE

A. Notify Engineer at least 48 hours before starting work of this section.

1.8 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPE AND FITTINGS (6 INCH AND SMALLER)

A. Pipe: PVC, type PSM, SDR 35, ASTM D3034.

B. Fittings: PVC, ASTM D3034. For 90º changes in flow direction, long-sweep bends or combinations of 45º bends shall be used.

C. Joints: Bell and spigot with rubber gaskets, conform to ASTM D3212 and ASTM F477.

2.2 SANITARY SEWER PIPE AND FITTINGS (BUILDING APPROVED MATERIAL, 3”-6”, FOR USE UNDER AND WITHIN 5 FEET OF BUILDINGS)

A. Conform with Division 22.

2.3 FLEXIBLE TRANSITION COUPLING

A. At Connections to Existing Pipes, Structures, and Building Connections: Shielded flexible transition coupling conforming to ASTM C1173, with stainless steel shear ring, clamps and tensioning bands, Fernco Series 5000 or approved.

2.4 CLEANOUTS

A. Shall be constructed from solid wall pipe and fittings specified above with locking traffic grade frame and cover. Frame and cover shall be H20 rated cast iron valve box as detailed on drawings with "sewer" marking. Olympic Foundry 910.

2.5 CONCRETE

A. Concrete shall be ready-mixed conforming to Section 03 30 00, CAST-IN-PLACE CONCRETE, and shall have a compressive strength of 3,000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.6 OTHER MATERIALS

A. Recommended by Manufacturer and subject to Engineer's review and acceptance. Provide all materials required to complete and make drainage system operational.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Prior to starting work of this section, carefully inspect trench, excavations, and pipe bedding to verify that all such work is complete to the point where this installation may properly commence.

B. Do not install work of this section until unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.2 TRENCHING AND BACKFILL

A. Trenching and backfill shall conform to the requirements of Section 31 23 33, TRENCHING AND BACKFILL.

3.3 PIPE INSTALLATION

A. Installation shall be in accordance with the manufacturer's recommendation. All pipe ends and interiors shall be thoroughly cleaned of all foreign matter and shall be kept clean during installation. When work is not in progress, all open ends of pipe and fittings shall be securely closed so that no water, earth, animal life, or other substance may enter.

B. Cutting pipe shall be done in a neat and workmanlike manner by method which will not damage pipe and as recommended by manufacturer.

C. Install piping within 0.02 foot of indicated grade and location.

D. Trim pipe ends flush with manhole interior walls.

E. All ductile iron pipe joints and fitting joints within 5 feet of building and beneath building shall be fully covered with asphaltic coating. Wrap ductile iron pipe and fittings within 5 feet of building and beneath building with polywrap.

F. Connect to existing pipe and pipes of differing materials with shielded flexible transition coupling. Select size and product to accommodate existing / differing pipe material / size and manufacturer recommendations.

3.4 CLEANOUTS

A. Construct on compacted 4" minimum depth 3/4" - 0 crushed rock base level, plumb, and square with adjacent surfaces. Set rim flush with adjacent finished surfaces unless otherwise noted.

3.5 FIELD QUALITY CONTROL

A. Refer to Section 01 45 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Field Tests:
   1. Hydrostatic or air test as described below.
   2. TV Inspections and Reports:
      a. Provide for all sanitary sewer pipe 6 inch diameter and larger.
   3. Deflection Test:
      a. Conduct deflection tests of flexible pipe. The testing shall be conducted by pulling an approved mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the pipe initial inside diameter. Conduct testing on a manhole-to-manhole basis after flushing and cleaning.
      b. The mandrel shall be pulled in front of the camera so the deflection testing is clearly recorded on the video tape unless approved by the Engineer.
      c. A water depth gauge shall be provided, located on the TV camera side of the mandrel. The gauge shall be graduated with marks at 0.50" increments clearly visible during TV inspection. The gauge shall be capable of measuring depth of water in 0.50" increments from 0.50" to 2.5". The gauge shall be designed so it will remain plumb regardless of the rotation of the mandrel or camera.
      d. Deflection testing shall be conducted and accepted prior to any paving being done.

C. Field Inspections: Notify Engineer prior to work of this section.

D. Special Inspections for Code Compliance:
   1. Provide hydrostatic test or air test per State of Oregon Plumbing Specialty Code.
   2. Obtain plumbing inspector approvals and submit to Engineer.

3.6 CLEANING

A. Prior to final acceptance, Contractor shall flush and clean all elements of the completed system. All pipe and structures shall be clean and free of all construction debris, rocks, gravel, mud, sand, silt, and other foreign material, and as directed by the Engineer.

B. Upon completion of work of this section promptly remove from the working area all scraps, debris, and surplus material.

3.7 PROTECTION

A. Protect all work installed under this section.

B. Replace at no additional cost to Owner, any damaged work of this section.

END OF SECTION

SANITARY UTILITY SEWERAGE MANHOLES, FRAMES AND COVERS

PART 1 - GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.2 SECTION INCLUDES

A. Manholes for on-site private sanitary sewer system improvements.

1.3 WORK INCLUDED BUT SPECIFIED IN OTHER SECTIONS

A. Section 31 23 33 - Trenching and Backfill

B. Section 33 30 00 - Sanitary Sewerage Utilities

1.4 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Submittals shall include the specification section number and paragraph for the item being submitted. Submittals with multiple pages shall be numbered for reference.

C. Product Data: Manufacturer's specifications and technical data including performance, construction, and fabrication information.
   1. Submit for manholes, frames, and covers.

D. Field Quality Control submittals as specified in Part 3 of this Section:
   1. Hydrostatic or air test
   2. Plumbing inspector approvals.
   3. Special Inspections for Code Compliance.

E. Closeout Requirements: Comply with Section 01 77 00 and Section 01 78 00.
   1. Provide record documents.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than five years of experience in the actual production of specified products.

B. Installer's Qualifications: Firm with not less than five years of experience in installation of systems similar in complexity to those required for this Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver products in original, unopened packaging with legible manufacturer's identification.

B. Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from damage by the elements and construction procedures.

1.7 ADVANCE NOTICES

A. Notify Engineer at least 48 hours before starting work of this section.

SANITARY UTILITY SEWERAGE MANHOLES, FRAMES AND COVERS

1.8 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

PART 2 - PRODUCTS

2.1 MANHOLE BASES, RISERS, AND CONES

A. Standard precast manhole sections shall conform to ASTM C478 (latest revision) and consist of circular sections in standard nominal diameters. No more than two lift holes shall be cast into each section. Holes shall be located so as to not damage reinforcing or expose it to corrosion. At the manufacturer's option, steel loops may be provided for handling in lieu of lift holes. Standard precast cones shall be eccentric unless otherwise specified and shall conform to ASTM C478 (latest revision). Standard flat-top slabs to be concentric or eccentric, as shown on plans and shall conform to ASTM C478.

2.2 CONCRETE

A. Concrete shall be ready-mixed conforming to Section 03 30 00, CAST-IN-PLACE CONCRETE, and shall have a compressive strength of 3,000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.3 MORTAR

A. Cement mortar in precast manhole joint shall conform to ASTM C387 (latest revision) and consist of one part portland cement and two parts clean, well graded sand which will pass a 1/8" screen with water as necessary to obtain the consistency such that it will readily adhere to the precast concrete. Mortar shall be used within 30 minutes after it is prepared.

2.4 MANHOLE JOINT SEALANT

A. Preformed plastic gaskets, such as Kent Seal, or approved.

2.5 PLASTIC PIPE SEALANT

A. At PVC pipe penetrations: KOR-N-SEAL Boot or approved.

2.6 MANHOLE FRAMES AND COVERS

A. Manhole frames shall have a 24" clear frame opening. Bearing and wedging surface shall be machined to ensure a tight fit of the cover and to prevent rocking.

B. Covers, grates, and frames shall be cast iron conforming to ASTM A48 (latest revision), Class 30.

C. Cover shall be diamond patterned with "SEWER" marking, Olympic Foundry Model A-2107-S17 or equal.

D. University of Oregon sanitary manhole number/ID shall be marked on the cover and inside the collar. Contractor to coordinate with UO Cartography to determine numbering and mark record drawings accordingly. Contact Eric Grape.

SANITARY UTILITY SEWERAGE MANHOLES, FRAMES AND COVERS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work of this section, carefully inspect trench, excavations, and base to verify that all such work is complete to the point where this installation may properly commence.

B. Do not install work of this section until unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.2 EXCAVATION AND BACKFILL

A. Excavation and backfill shall conform to the requirements of Section 31 23 33, TRENCHING AND BACKFILL.

3.3 MANHOLE BASES (WITHOUT SUMP)

A. Manhole bases shall be precast or cast-in-place concrete. Placement of cast-in-place concrete shall conform to Section 03 30 00, CAST-IN-PLACE CONCRETE. If a precast manhole is used, the channels shall be poured and shaped after manhole is in place as indicated on drawings. Base sections shall be constructed to form a watertight structure.

B. Where indicated on drawings, the invert shall be constructed to a section identical with that of the sewer pipe. Where the size of sewer pipe is changed at the manhole, the invert shall be constructed to form a smooth transition without abrupt breaks or unevenness of the invert surfaces. Where a full section of concrete sewer pipe is laid through the manhole, the top shall be broken out to the spring line of the pipe for the full width of the manhole, and the exposed edge of the pipe completely covered with mortar. During construction, the Contractor shall divert existing flows of water or sewage from new concrete or mortar surfaces to prevent damage to the fresh concrete or mortar until the initial set has been achieved.

C. Construct on 4" minimum depth, 3/4"-0 crushed rock base; level and plumb.

3.4 PIPE OPENINGS

A. Openings to receive pipe shall be circular, tapered in toward the inside of the section and held to the minimum size possible to accommodate the pipe to be inserted and to effectively seal the joints.

B. For PVC pipe make manhole connections using KOR-N-SEAL Boot.

C. Trim pipe ends flush with manhole interior wall. Grout between pipe and manhole for a smooth transition.

3.5 JOINT SEALING

A. Pipe gaskets shall be installed in conformance with the manufacturer's recommendations. All mortar joints shall be clean and wet before setting risers and tops in a full bed of Portland cement mortar. Joints shall be watertight, grouted inside and have a smooth finish. Outside joints shall be grouted before backfilling.

SANITARY UTILITY SEWERAGE MANHOLES, FRAMES AND COVERS

3.6 GRADE RINGS

A. Grade rings shall be laid in mortar with the sides plumb and the top level. The joints shall be sealed with mortar. The extensions shall be watertight.

3.7 MANHOLE FRAMES AND COVERS

A. Frames shall be set in a bed of mortar. Frames shall be set so the rim is flush with adjacent surfaces unless otherwise noted on drawings. Frames and covers shall be installed in such a manner as to prevent infiltration of surface or ground water between the frame and the concrete of the manhole section.

3.8 FIELD QUALITY CONTROL

A. Refer to Section 01 45 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Field Tests:
   1. Hydrostatic or air test as described below.

C. Field Inspections: Notify Engineer prior to backfilling.

D. Special Inspections for Code Compliance:
   1. Obtain plumbing inspector approvals and submit to Engineer.
   2. Provide hydrostatic test or air test of sanitary sewer manholes per State of Oregon Plumbing Specialty Code (current edition).

3.9 CLEANING

A. Prior to final acceptance, Contractor shall flush and clean all elements of the completed systems. All manholes shall be clean and free of all construction debris, rocks, gravel, mud, sand, silt, and other foreign material, and as directed by the Engineer.

B. Upon completion of work of this section, promptly remove from the working area all scraps, debris, and surplus material.

3.10 PROTECTION

A. Protect all work installed under this section.

B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.2 SECTION INCLUDES

A. On-site private storm drain system improvements.

1.3 RELATED SECTIONS

A. Section 31 23 33 - Trenching and Backfill

B. Section 33 49 13 - Storm Drainage Manholes, Frames, and Covers

1.4 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Submittals shall include the specification section number and paragraph for the item being submitted. Submittals with multiple pages shall be numbered for reference.

C. Potholing requirements as shown on the drawings.

D. TV inspections for existing systems included in Package 1.

E. Product Data: Manufacturer's specifications and technical data including performance, construction, fabrication, and installation information.
   1. Submit for: Pipe and fittings, catch basins, overflow catch basins, area drains, cleanout covers, trench drains, backwater valves

F. Field Quality Control submittals as specified in Part 3 of this Section:
   1. TV inspections for new systems.
   2. Deflection tests.
   3. Plumbing Inspector approvals.
   4. Special Inspections for Code Compliance

G. Closeout Requirements: Comply with Section 01 77 00 and Section 01 78 00.
   1. Provide record documents.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than 5 years experience in the actual production of specified products.

B. Installer's Qualifications: Firm with not less than 5 years experience in installation of systems similar in complexity to those required for this project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver products in original, unopened packing with legible manufacturer's identification.

B. Storage and Protection: Comply with manufacturer's recommendations.

1. Protect from damage by the elements and construction procedures.

1.7 ADVANCE NOTICES

A. Notify Engineer at least 48 hours before starting work of this section.

1.8 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

PART 2 - PRODUCTS

2.1 STORM DRAIN PIPE AND FITTINGS (UNLESS OTHERWISE NOTED)

A. Either of the following pipe materials may be used.
   1. Option #1:
      a. Pipe: PVC solid wall, type PSM, SDR 35, ASTM D3034 (4”-15”) and ASTM DF679 (18”-24”). T-1 wall thickness.
      b. Fittings: PVC, ASTM D3034.
      c. Joints: Bell and spigot with rubber gaskets, conform to ASTM D3212 and ASTM F477.
   2. Option #2:
      a. Pipe: Corrugated polyethylene, type S, AASHTO M252 (3”-10”) and AASHTO M294 (12” and larger). Hancor or ADS.
      b. Fittings: Polyethylene, AASHTO M252 or AASHTO M294. Fittings shall be welded to the interior and exterior at all junctions.
      c. Joints: Bell and spigot with polyisoprene gaskets, conform to ASTM F477 and water tight per ASTM D3212. Gaskets shall not have any visible cracking when tested according to ASTM D1149 after 72 hour exposure in 50 PPHM ozone at 104° F. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. Joints shall remain water tight when subjected to a 1.5° axial misalignment. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.

2.2 STORM DRAIN PIPE AND FITTINGS (BUILDING APPROVED MATERIAL, FOR USE UNDER AND WITHIN 2 FEET OF BUILDING)

A. Conform to Division 22.

2.3 STORM DRAIN PIPE AND FITTINGS (DUCTILE IRON) (BUILDING APPROVED MATERIAL, FOR USE UNDER AND WITHIN 2 FEET OF BUILDING, WHERE SHOWN ON DRAWINGS)

A. Shall be cement-lined ductile iron pipe, Class 52, conforming to AWWA C151. Fittings shall be Class 52, conforming to AWWA C153 for mechanical joints pressure rating of 350 psi and AWWA C110 for flange joints pressure rating of 250 psi. Provide with manufactured fittings unless otherwise noted on drawings.

B. Provide pipe wrap, 8 mil polywrap meeting pipe manufacturer's recommendations.

2.4 PERFORATED PIPE AND FITTINGS

A. Shall be smooth interior perforated corrugated polyethylene pipe with AASHTO Type ‘S’ designation meeting the requirements of AASHTO M252 (pipe sizes 4” – 10”) and AASHTO M294 (pipe sizes 12” – 60”). Provide with manufactured fittings unless otherwise noted on drawings.

2.5 CATCH BASINS

A. Shall be prefabricated steel, 24 inches square by 36 (minimum) inches deep, 10 gauge minimum, asphalt paint inside and out, 6 inch minimum water seal with hinged lid on trap, outlet size as specified on drawings. Cast iron ADA-approved grate. Gibson or Beko.

B. Use any of the following pipe materials from the catch basin to lateral where cover is less than one foot as detailed on drawings: Ductile Iron pipe and fittings (cement-lined), Class 52, AWWA C151; PVC, AWWA C900, CL150; Schedule 40 PVC, ASTM D2665, F891, or D1785 (latest revision).

2.6 OVERFLOW CATCH BASINS

A. Shall be prefabricated steel, 24 inches square by 36 (minimum) inches deep, 10 gauge minimum, asphalt paint inside and out, 6 inch minimum water seal with hinged lid on trap (where shown on drawings), welded interior baffle and orifice pipe with threaded plugs, outlet size as specified on drawings. Cast iron or steel grate. Gibson or Beko.

B. Shall have prefabricated sloped frame and grate as detailed on drawings.

C. Use any of the following pipe materials from the catch basin to lateral where cover is less than one foot as detailed on drawings: Ductile Iron pipe and fittings (cement-lined), Class 52, AWWA C151; PVC, AWWA C900, CL150; Schedule 40 PVC, ASTM D2665, F891, or D1785 (latest revision).

2.7 AREA DRAINS

A. Shall be prefabricated steel, 12 inches square by 24 (minimum) inches deep, 10 gauge minimum, asphalt paint inside and out, 6 inch minimum water seal with hinged lid on trap, outlet size as specified on drawings. Cast iron ADA-approved grate. Gibson or Beko.

2.8 FLEXIBLE TRANSITION COUPLING

A. At Connections to Inlet Structures: Non-Shielded flexible transition coupling conforming to ASTM C1173, Fernco, 1000 series. Use fittings manufactured for the specific pipe size and material types being connected.

B. At Connections to Existing Pipes and Building Connections: Shielded flexible transition coupling conforming to ASTM C1173, with stainless steel shear ring, clamps and tensioning bands, Fernco Series 5000 or approved.

2.9 CLEANOUTS

A. Shall be constructed from solid wall pipe and fittings specified above with traffic grade frame and cover. Frame and cover shall be H20 rated cast iron valve box with flange top as detailed on drawings with "storm" marking. **Olympic Foundry** VB910 Valve Box.

2.10 TRENCH DRAIN

A. Trench Drain Channel Section:
   1. Precast polymer concrete pre-sloped channel sections with interlocking joints and horizontal cast-in anchoring features to ensure maximum mechanical bond to the surrounding concrete, ACO model K100S.
   2. 4” nominal clear opening width, 5.1” overall width, 0.6% channel slope. Provide with end-caps at upstream end of channel per manufacturer recommendations. Provide with non-standard 811 type bolt-down locking system to accommodate grate per manufacturer recommendations. Provide outfall to trench drain sediment trap as shown on Drawings.

B. Trench Drain Sediment Trap:
   1. In-Line Catch Basin, 24” overall depth, 4” wide grate section, matching horizontal dimensions of adjacent channel sections, ACO model K900 outlet F. Provide with non-standard 811 type bolt-down locking system to accommodate grate per manufacturer recommendations. Provide with removable trash basket, ACO series 900.

C. Trench Drain Grate:
   1. 4.9” wide “Viper” grate by Urban Accessories
   2. Ductile Iron per ASTM A536, Class 65-45-12

2.11 TERMINAL BACKWATER VALVE

A. Terminal Valve, coated cast iron body and bronze valve seat with hub-inlet for installation at the end of drainage line. Jay R. Smith 7070, Zurn Z1091 or approved equal.

2.12 FILTRATION RAIN GARDENS AND PLANTERS

A. Construct as shown on the drawings and per Section 31 20 00.

2.13 CONCRETE

A. Concrete shall be ready-mixed conforming to Section 03 30 00, CAST-IN-PLACE CONCRETE, and shall have a compressive strength of 3,000 psi at 28 days. Maximum size of aggregate shall be 1½ inches.

2.14 OTHER MATERIALS

A. Recommended by Manufacturer and subject to Engineer's review and acceptance. Provide all materials required to complete and make drainage system operational.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Prior to starting work of this section, carefully inspect trench, excavations, and pipe bedding to verify that all such work is complete to the point where this installation may properly commence.

B. Do not install work of this section until unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.2 TRENCHING AND BACKFILL

A. Trenching and backfill shall conform to the requirements of Section 31 23 33, TRENCHING AND BACKFILL.

3.3 PIPE INSTALLATION

A. Installation shall be in accordance with the manufacturer's recommendation. All pipe ends and interiors shall be thoroughly cleaned of all foreign matter and shall be kept clean during installation. When work is not in progress, all open ends of pipe and fittings shall be securely closed so that no water, earth, animal life, or other substance may enter.

B. Cutting pipe shall be done in a neat and workmanlike manner by method which will not damage pipe and as recommended by manufacturer.

C. Install piping within 0.02 foot of indicated grade and location.

D. Trim pipe ends flush with manhole and catch basin interior walls.

E. All ductile iron pipe joints and fitting joints within 5 feet of building and beneath building shall be fully covered with asphaltic coating. Wrap ductile iron pipe and fittings within 5 feet of building and beneath building with Polywrap.

F. Connect to existing pipe and pipes of differing materials with shielded flexible transition coupling. Select size and product to accommodate existing / differing pipe material / size and manufacturer recommendations.

3.4 CATCH BASINS, AREA DRAINS, AND OVERFLOW CATCH BASINS

A. Construct on compacted 4" minimum depth, 3/4" - 0 crushed rock base level, plumb, and square with adjacent construction. Set rim flush with adjacent finished surfaces unless otherwise noted.

3.5 CLEANOUTS

A. Construct on compacted 4" minimum depth 3/4" - 0 crushed rock base level, plumb, and square with adjacent surfaces. Set rim flush with adjacent finished surfaces unless otherwise noted.

3.6 TRENCH DRAIN

A. Install in accordance with manufacturer's recommendations as detailed on drawings.

B. Construct level, plumb, and square with adjacent construction. Set trench drain channel completely in place, and test flow from both directions of flow prior to pouring concrete. Set rim flush with adjacent finished surfaces unless otherwise noted.

C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other devices and materials recommended by system manufacturer.

D. Embed channel sections in 6" minimum concrete collar, as shown on the drawings.

E. Assemble channel sections with flanged or interlocking joints.

F. Install trench drain sediment trap at end of trench drain per manufacturer recommendations.

G. Core holes for pipe penetrations at elevations shown on the plans. Seal pipe penetrations per manufacturer recommendations.

3.7 BACKWATER VALVE

A. Install backwater valve with face of backwater valve as close to manhole wall as boot and coupling will permit. Roughen inside of manhole around penetration and grout around sides of backwater valve, to provide smooth transition from manhole wall to face of backwater valve. Install in accordance with manufacturer recommendations.

3.8 FIELD QUALITY CONTROL

A. Refer to Section 01 45 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Field Tests:

1. TV Inspections and Reports:
   a. Provide for all storm drain pipe 8 inch diameter and larger.
2. Deflection Test:
   a. Conduct deflection tests of flexible pipe. The testing shall be conducted by pulling an approved mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the pipe initial inside diameter. Conduct testing on a manhole-to-manhole basis after flushing and cleaning.
   b. The mandrel shall be pulled in front of the camera so the deflection testing is clearly recorded on the video tape unless approved by the Engineer.
   c. A water depth gauge shall be provided, located on the TV camera side of the mandrel. The gauge shall be graduated with marks at 0.50" increments clearly visible during TV inspection. The gauge shall be capable of measuring depth of water in 0.50" increments from 0.50" to 2.5". The gauge shall be designed so it will remain plumb regardless of the rotation of the mandrel or camera.
   d. Deflection testing shall be conducted and accepted prior to any paving being done.

C. Field Inspections: Notify Engineer prior to work of this section.

D. Special Inspections for Code Compliance: Obtain plumbing inspector approvals.

3.9 CLEANING

A. Prior to final acceptance, Contractor shall flush and clean all elements of the completed system. All pipe and structures shall be clean and free of all construction debris, rocks, gravel, mud, sand, silt, and other foreign material, and as directed by the Engineer.

B. Upon completion of work of this section promptly remove from the working area all scraps, debris, and surplus material.

3.10 PROTECTION

A. Protect all work installed under this section.

B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION

STORM DRAINAGE MANHOLES, FRAMES AND COVERS

PART 1 - GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.2 SECTION INCLUDES

A. Manholes for on-site private storm drain system improvements.

1.3 RELATED SECTIONS

A. Section 31 23 33 - Trenching and Backfill

B. Section 33 40 00 - Storm Drainage Utilities

1.4 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Submittals shall include the specification section number and paragraph for the item being submitted. Submittals with multiple pages shall be numbered for reference.

C. Product Data: Manufacturer's specifications and technical data including performance, construction and fabrication information.
   1. Submit for manholes, frames, and covers.

D. Field Quality Control submittals as specified in Part 3 of this Section:
   1. Hydrostatic or air testing (for one manhole).
   2. Plumbing inspector approvals.
   3. Special Inspections for Code Compliance.

E. Closeout Requirements: Comply with Section 01 77 00 and Section 01 78 00.
   1. Provide record documents.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than five years of experience in the actual production of specified products.

B. Installer's Qualifications: Firm with not less than five years of experience in installation of systems similar in complexity to those required for this Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver products in original, unopened packaging with legible manufacturer's identification.

B. Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from damage by the elements and construction procedures.

1.7 ADVANCE NOTICES

A. Notify Engineer at least 48 hours before starting work of this section.

1.8 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

PART 2 - PRODUCTS

2.1 MANHOLE BASES, RISERS, AND CONES

A. Standard precast manhole sections shall conform to ASTM C478 (latest revision) and consist of circular sections in standard nominal diameters. No more than two lift holes shall be cast into each section. Holes shall be located so as to not damage reinforcing or expose it to corrosion. At the manufacturer's option, steel loops may be provided for handling in lieu of lift holes. Standard precast cones shall be eccentric unless otherwise specified and shall conform to ASTM C478 (latest revision). Standard flat-top slabs to be concentric or eccentric, as shown on plans and shall conform to ASTM C478.

2.2 CONCRETE

A. Concrete shall be ready-mixed conforming to Section 03 30 00, CAST-IN-PLACE CONCRETE, and shall have a compressive strength of 4,000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.3 MORTAR

A. Cement mortar in precast manhole joint shall conform to ASTM C387 (latest revision) and consist of one part portland cement and two parts clean, well graded sand which will pass a 1/8" screen with water as necessary to obtain the consistency such that it will readily adhere to the precast concrete. Mortar shall be used within 30 minutes after it is prepared.

2.4 MANHOLE JOINT SEALANT

A. Preformed plastic gaskets, such as Kent Seal, or approved.

2.5 PLASTIC PIPE SEALANT

A. At PVC pipe penetrations: KOR-N-SEAL Boot or approved.

2.6 MANHOLE FRAMES AND COVERS

A. Manhole frames shall have a 24" clear frame opening. Bearing and wedging surface shall be machined to ensure a tight fit of the cover and to prevent rocking.

B. Covers, grates, and frames shall be cast iron conforming to ASTM A48 (latest revision), Class 30.

C. Cover shall be diamond patterned with "STORM" marking, Olympic Foundry Model A-2107-S17 or equal.

D. University of Oregon sanitary manhole number/ID shall be marked on the cover and inside the collar. Contractor to coordinate with UO Cartography to determine numbering and mark record drawings accordingly. Contact Eric Grape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work of this section, carefully inspect trench, excavations, and base to verify that all such work is complete to the point where this installation may properly commence.

B. Do not install work of this section until unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.2 EXCAVATION AND BACKFILL

A. Excavation and backfill shall conform to the requirements of Section 31 23 33, TRENCHING AND BACKFILL.

3.3 MANHOLE BASES (WITHOUT SUMP)

A. Manhole bases shall be precast or cast-in-place concrete. Placement of cast-in-place concrete shall conform to Section 03 30 00, CAST-IN-PLACE CONCRETE. If a precast manhole is used, the channels shall be poured and shaped after manhole is in place as indicated on drawings. Base sections shall be constructed to form a watertight structure.

B. Where indicated on drawings, the invert shall be constructed to a section identical with that of the sewer pipe. Where the size of sewer pipe is changed at the manhole, the invert shall be constructed to form a smooth transition without abrupt breaks or unevenness of the invert surfaces. Where a full section of concrete sewer pipe is laid through the manhole, the top shall be broken out to the spring line of the pipe for the full width of the manhole, and the exposed edge of the pipe completely covered with mortar. During construction, the Contractor shall divert existing flows of water or sewage from new concrete or mortar surfaces to prevent damage to the fresh concrete or mortar until the initial set has been achieved.

C. Construct on 4" minimum depth, 3/4"-0 crushed rock base; level and plumb.

3.4 MANHOLE BASES (WITH SUMP)

A. Manhole bases shall be precast. Base sections shall be constructed to form a watertight structure.

B. Construct on 4" minimum depth, 3/4"-0 crushed rock base; level and plumb.

3.5 PIPE OPENINGS

A. Openings to receive pipe shall be circular, tapered in toward the inside of the section and held to the minimum size possible to accommodate the pipe to be inserted and to effectively seal the joints.

B. For PVC pipe make manhole connections using KOR-N-SEAL Boot.

C. Trim pipe ends flush with manhole interior wall. Grout between pipe and manhole for a smooth transition.

3.6 JOINT SEALING

A. Pipe gaskets shall be installed in conformance with the manufacturer's recommendations. All mortar joints shall be clean and wet before setting risers and tops in a full bed of Portland cement mortar. Joints shall be watertight, grouted inside and have a smooth finish. Outside joints shall be grouted before backfilling.

3.7 GRADE RINGS

A. Grade rings shall be laid in mortar with the sides plumb and the top level. The joints shall be sealed with mortar. The extensions shall be watertight.

3.8 MANHOLE FRAMES AND COVERS

A. Frames shall be set in a bed of mortar. Frames shall be set so the rim is flush with adjacent surfaces unless otherwise noted on drawings. Frames and covers shall be installed in such a manner as to prevent infiltration of surface or ground water between the frame and the concrete of the manhole section.

3.9 FIELD QUALITY CONTROL

A. Refer to Section 01 45 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Field Inspections: Notify Engineer prior to backfilling.

C. Perform hydrostatic or air test for manhole located above tunnel in accordance with Section 33 39 13.

D. Special Inspections for Code Compliance:
   1. Obtain plumbing inspector approvals and submit to Engineer.

3.10 CLEANING

A. Prior to final acceptance, Contractor shall flush and clean all elements of the completed systems. All manholes shall be clean and free of all construction debris, rocks, gravel, mud, sand, silt, and other foreign material, and as directed by the Engineer.

B. Upon completion of work of this section, promptly remove from the working area all scraps, debris, and surplus material.

3.11 PROTECTION

A. Protect all work installed under this section.

B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION

NATURAL GAS DISTRIBUTION

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

1.02 SECTION INCLUDES

A. Private on-site natural gas distribution system improvements.

1.03 WORK INCLUDED BUT SPECIFIED IN OTHER SECTIONS

A. Section 31 23 33 - Trenching and Backfill.

1.04 WORK PROVIDED BY OTHERS

A. Natural gas distribution system piping, meters, and connections by Northwest Natural Gas Co.

1.05 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Submittals shall include the specification section number and paragraph for the item being submitted. Submittals with multiple pages shall be numbered for reference.

C. Northwest Natural Commercial Service Application. Submit as soon as possible for processing.

D. Product Data: None.

E. Closeout Requirements: Comply with Section 01 77 00 and Section 01 78 00.
   1. Provide record documents.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than 5 years experience in the actual production of specified products.

B. Installers Qualifications: Firm with not less than 5 years experience in installation of systems similar in complexity to those required for this project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from damage by the elements and construction procedures.

1.08 ADVANCE NOTICES

A. Notify Engineer at least 48 hours before starting work of this section.

1.09 COORDINATION

A. Coordinate with other trades affecting or affected by work of this section.

NATURAL GAS DISTRIBUTION

PART 2 - PRODUCTS

2.01 GAS DISTRIBUTION PIPE AND FITTINGS

A. Provided by NW Natural

2.02 OTHER MATERIALS

A. Recommended by manufacturer and subject to Engineer's review and acceptance. Provide all materials required to complete and make natural gas system operational.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

A. Prior to starting of the work of this section carefully inspect trench, excavations, and pipe bedding to verify that all such work is complete to the point where this installation may properly commence.

B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

3.02 TRENCHING AND BACKFILL

A. Trenching and backfill shall conform to the requirements of Section 31 23 33, TRENCHING AND BACKFILL.

B. Coordinate with NW Natural to relocate existing natural gas line and reconnect services.

C. Provide open trench for natural gas installation. Natural Gas trenching and backfill to comply with the Drawings and with NW Natural standards.

D. Complete and submit Commercial Service Application to NW Natural prior to service installation, and as soon as possible to begin processing. Refer to Plumbing plans for natural gas fixtures and loads.

E. Notify NW Natural at least 7 days before open trench is available for service line installation.

3.03 FIELD QUALITY CONTROL

A. Refer to Section 01 45 00 for responsibilities for arranging, supervising, and payment of field quality control requirements.

B. Field Tests:
   1. Trench backfill compaction testing.
   2. Special tests or inspections required by NW Natural.

C. Field Inspections: Notify Engineer prior to work of this Section.

3.04 CLEANING

A. Prior to final acceptance, contractor shall flush and clean all elements of the completed system. All pipe structures shall be clean and free of all construction debris, rocks, gravel, mud, sand, silt, and other foreign material, and as directed by the general contractor.

B. Upon completion of work of this section promptly remove from the working area all scraps, debris and surplus material.

3.05 PROTECTION

A. Protect all work installed under this section.

B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION