

SPECIFICATIONS

PROJECT:

**53 DANFORTH STREET
PORTLAND, MAINE**

OWNER:

**53 DANFORTH STREET, LP
C/O THE SZANTON COMPANY
ONE CITY CENTER – 4TH FLOOR
PORTLAND, MAINE 04101**

DEVELOPER:

**MAINE WORKFORCE HOUSING, LLC
C/O THE SZANTON COMPANY
ONE CITY CENTER – 4TH FLOOR
PORTLAND, MAINE 04101**

ARCHITECT:

**ARCHETYPE, P. A.
48 UNION WHARF
PORTLAND, MAINE 04101**

25 JULY 2008

100%

Issued to MaineHousing

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53 DANFORTH STREET – PORTLAND MAINE

SECTION 00400

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ALTERNATES

4.01 GENERAL DESCRIPTION

- A. Alternate #1 is an add alternate to provide and install solar preheating of domestic hot water. See section 15400, 'PLUMBING'.
- B. Alternate #2 is an add alternate pertaining to the ATC system.

Add Alternate #1 \$ _____

- A. Provide an install a Direct Digital Control (DDC) system to limit the temperature range of all thermostats connected to finned radiation and convectors.
- B. System shall be networked and include a Master Controller with a password protected, web based solution to permit the Owner to access the system via the internet and adjust the maximum and minimum temperature set points of the all thermostats at the same time.
- C. Thermostats shall be digital, backlit, heating only with no switches for accessories which do not apply. Thermostats shall provide a fixed space temperature limit of 75 degrees on the high side and 66 degrees on the low side (adjustable via the web based software). Thermostats shall not have the ability to show any other set points settings outside these ranges. The back lit display shall indicate the existing temperature in the space. The controller attached to the thermostats shall open the heating valve on a call for heat within the fixed temperature setting. There shall not be a need for a master panel. The fixed set point limits shall be programmed into the controller(s) only.

Add Alternate #2 \$ _____

Add paddle fans in units as shown on Electrical Plans.

Add Alternate #3 \$ _____

Add 1x4 oak chair rail at 29" off floor and vinyl wall covering above to ceiling in all public corridors. NOTE: Ceiling at 8'-10" off finish floor. Vinyl to be WC-1 Fascination, width 54", type II, total weight 21 oz, backing "Osnaburgh", repeat random. Manufacturer "Wolf Gordon" Rep. Felicia (718) 391-4844.

Add Alternate #4

- Change all base in public corridors to Oak. \$ _____

Contractor to carry the following unit costs:

- \$1,200 Pre Blast Survey \$ _____
- \$35/YD Open Rock Blasting \$ _____
- Trench Rock \$ _____
- Hoe Ram \$ _____



AIA DOCUMENT A201-1997**General Conditions of the Contract for Construction**

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document has been approved and endorsed by The Associated General Contractors of America.

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 GENERAL CONDITIONS
 OF THE CONTRACT FOR
 CONSTRUCTION

The American Institute
 of Architects
 1735 New York Avenue, N.W.
 Washington, D.C. 20006-5292

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2.3, 2.4, 3.3.1, 3.9, 3.12.9, 3.12.10, 4.3, 4.4.8, 4.6.5,
5.2.1, 8.2.2, 9.7, 9.10, 10.2.2, 10.3, 11.1.3, 11.4.6,
12.2.2, 12.2.4, **13.3**, 14

Written Orders
1.1.1, 2.3, 3.9, 4.3.6, 7, 8.2.2, 11.4.9, 12.1, 12.2, 13.5.2,
14.3.1



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GENERAL CONDITIONS
OF THE CONTRACT FOR
CONSTRUCTION

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1735 New York Avenue, N.W.
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ARTICLE 1 GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the Agreement), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents such as bidding requirements (advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of Addenda relating to bidding requirements).

1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Architect and Contractor, (2) between the Owner and a Subcontractor or Sub-subcontractor, (3) between the Owner and Architect or (4) between any persons or entities other than the Owner and Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

1.1.7 THE PROJECT MANUAL

The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are



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complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

1.2.3 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.3 CAPITALIZATION

1.3.1 Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document or (3) the titles of other documents published by the American Institute of Architects.

1.4 INTERPRETATION

1.4.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.5 EXECUTION OF CONTRACT DOCUMENTS

1.5.1 The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

1.5.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

1.6 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

1.6.1 The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants, and unless otherwise indicated the Architect and the Architect's consultants shall be deemed the authors of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights. All copies of Instruments of Service, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in



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the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' copyrights or other reserved rights.

ARTICLE 2 OWNER

2.1 GENERAL

2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Subparagraph 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.1 The Owner shall, at the written request of the Contractor, prior to commencement of the Work and thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Furnishing of such evidence shall be a condition precedent to commencement or continuation of the Work. After such evidence has been furnished, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

2.2.2 Except for permits and fees, including those required under Subparagraph 3.7.1, which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

2.2.4 Information or services required of the Owner by the Contract Documents shall be furnished by the Owner with reasonable promptness. Any other information or services relevant to the Contractor's performance of the Work under the Owner's control shall be furnished by the Owner after receipt from the Contractor of a written request for such information or services.

2.2.5 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work.

2.3 OWNER'S RIGHT TO STOP THE WORK

2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Paragraph 12.2 or persistently fails to carry out Work in



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accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Subparagraph 6.1.3.

2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a three-day period. If the Contractor within such three-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

3.1 GENERAL

3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.

3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.1 Since the Contract Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Subparagraph 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Architect as a request for information in such form as the Architect may require.

3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect.



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3.2.3 If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Architect in response to the Contractor's notices or requests for information pursuant to Subparagraphs 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Subparagraphs 4.3.6 and 4.3.7. If the Contractor fails to perform the obligations of Subparagraphs 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Architect.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage.

3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

3.4 LABOR AND MATERIALS

3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.4.2 The Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order.

3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.5 WARRANTY

3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract



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Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

3.6 TAXES

3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

3.7 PERMITS, FEES AND NOTICES

3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to performance of the Work.

3.7.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

3.7.4 If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

3.8 ALLOWANCES

3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

3.8.2 Unless otherwise provided in the Contract Documents:

- 1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- 2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances;
- 3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Clause 3.8.2.1 and (2) changes in Contractor's costs under Clause 3.8.2.2.

3.8.3 Materials and equipment under an allowance shall be selected by the Owner in sufficient time to avoid delay in the Work.



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3.9 SUPERINTENDENT

3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

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

3.10.2 The Contractor shall prepare and keep current, for the Architect's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Architect reasonable time to review submittals.

3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

3.11.1 The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record field changes and selections made during construction, and one record copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.12.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect is subject to the limitations of Subparagraph 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect without action.

3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by



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the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action.

3.12.6 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice the Architect's approval of a resubmission shall not apply to such revisions.

3.12.10 The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Subparagraph 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.



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3.13 USE OF SITE

3.13.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

3.14 CUTTING AND PATCHING

3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

3.15 CLEANING UP

3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

3.16 ACCESS TO WORK

3.16.1 The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

3.17 ROYALTIES, PATENTS AND COPYRIGHTS

3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

3.18 INDEMNIFICATION

3.18.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Paragraph 11.3, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor; a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be



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construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph 3.18.

3.18.2 In claims against any person or entity indemnified under this Paragraph 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Subparagraph 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

4.1 ARCHITECT

4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

4.1.3 If the employment of the Architect is terminated, the Owner shall employ a new Architect against whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the former Architect.

4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Paragraph 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if the Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will neither have control over or charge of, nor be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Subparagraph 3.3.1.

4.2.3 The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.



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4.2.4 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

4.2.6 The Architect will have authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Subparagraphs 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

4.2.7 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Paragraphs 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Paragraph 7.4.

4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion, will receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor.



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The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Paragraph 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

4.3 CLAIMS AND DISPUTES

4.3.1 **Definition.** A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

4.3.2 **Time Limits on Claims.** Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Architect and the other party.

4.3.3 **Continuing Contract Performance.** Pending final resolution of a Claim except as otherwise agreed in writing or as provided in Subparagraph 9.7.1 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

4.3.4 **Claims for Concealed or Unknown Conditions.** If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 days after the Architect has given notice of the decision. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Paragraph 4.4.



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4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Paragraph 10.6.

4.3.6 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with this Paragraph 4.3.

4.3.7 CLAIMS FOR ADDITIONAL TIME

4.3.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

4.3.7.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

4.3.8 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

4.3.9 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

4.3.10 Claims for Consequential Damages. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Subparagraph 4.3.10 shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

4.4 RESOLUTION OF CLAIMS AND DISPUTES

4.4.1 Decision of Architect. Claims, including those alleging an error or omission by the Architect but excluding those arising under Paragraphs 10.3 through 10.5, shall be referred initially to the Architect for decision. An initial decision by the Architect shall be required as a



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condition precedent to mediation, arbitration or litigation of all Claims between the Contractor and Owner arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered by the Architect. The Architect will not decide disputes between the Contractor and persons or entities other than the Owner.

4.4.2 The Architect will review Claims and within ten days of the receipt of the Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Architect is unable to resolve the Claim if the Architect lacks sufficient information to evaluate the merits of the Claim or if the Architect concludes that, in the Architect's sole discretion, it would be inappropriate for the Architect to resolve the Claim.

4.4.3 In evaluating Claims, the Architect may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Architect in rendering a decision. The Architect may request the Owner to authorize retention of such persons at the Owner's expense.

4.4.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either provide a response on the requested supporting data, advise the Architect when the response or supporting data will be furnished or advise the Architect that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part.

4.4.5 The Architect will approve or reject Claims by written decision, which shall state the reasons therefor and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be final and binding on the parties but subject to mediation and arbitration.

4.4.6 When a written decision of the Architect states that (1) the decision is final but subject to mediation and arbitration and (2) a demand for arbitration of a Claim covered by such decision must be made within 30 days after the date on which the party making the demand receives the final written decision, then failure to demand arbitration within said 30 days' period shall result in the Architect's decision becoming final and binding upon the Owner and Contractor. If the Architect renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence, but shall not supersede arbitration proceedings unless the decision is acceptable to all parties concerned.

4.4.7 Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect or the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Architect or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

4.4.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines prior to resolution of the Claim by the Architect, by mediation or by arbitration.

4.5 MEDIATION

4.5.1 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Subparagraphs 4.3.10, 9.10.4 and 9.10.5 shall, after initial decision by the Architect or 30 days after submission of the Claim to the Architect, be



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subject to mediation as a condition precedent to arbitration or the institution of legal or equitable proceedings by either party.

4.5.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract and with the American Arbitration Association. The request may be made concurrently with the filing of a demand for arbitration but, in such event, mediation shall proceed in advance of arbitration or legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order.

4.5.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

4.6 ARBITRATION

4.6.1 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Subparagraphs 4.3.10, 9.10.4 and 9.10.5, shall, after decision by the Architect or 30 days after submission of the Claim to the Architect, be subject to arbitration. Prior to arbitration, the parties shall endeavor to resolve disputes by mediation in accordance with the provisions of Paragraph 4.5.

4.6.2 Claims not resolved by mediation shall be decided by arbitration which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect. The demand for arbitration shall be filed in writing with the other party to the Contract and with the American Arbitration Association, and a copy shall be filed with the Architect.

4.6.3 A demand for arbitration shall be made within the time limits specified in Subparagraphs 4.4.6 and 4.6.1 as applicable, and in other cases within a reasonable time after the Claim has arisen, and in no event shall it be made after the date when institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations as determined pursuant to Paragraph 13.7.

4.6.4 Limitation on Consolidation or Joinder. No arbitration arising out of or relating to the Contract shall include, by consolidation or joinder or in any other manner, the Architect, the Architect's employees or consultants, except by written consent containing specific reference to the Agreement and signed by the Architect, Owner, Contractor and any other person or entity sought to be joined. No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the Owner, Contractor, a separate contractor as described in Article 6 and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in arbitration. No person or entity other than the Owner, Contractor or a separate contractor as described in Article 6 shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a Claim not described therein or with a person or entity not named or described therein. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.



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4.6.5 Claims and Timely Assertion of Claims. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

4.6.6 Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

ARTICLE 5 SUBCONTRACTORS

5.1 DEFINITIONS

5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection.

5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitute.

5.3 SUBCONTRACTUAL RELATIONS

5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the



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Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

- 1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Paragraph 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- 2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

5.4.2 - Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Paragraph 4.3.

6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the



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Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

6.2 MUTUAL RESPONSIBILITY

6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

6.2.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work or defective construction of a separate contractor.

6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors as provided in Subparagraph 10.2.5.

6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Subparagraph 3.14.

6.3 OWNER'S RIGHT TO CLEAN UP

6.3.1 If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

7.1 GENERAL

7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.



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7.2 CHANGE ORDERS

7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect, stating their agreement upon all of the following:

- 1 change in the Work;
- 2 the amount of the adjustment, if any, in the Contract Sum; and
- 3 the extent of the adjustment, if any, in the Contract Time.

7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Subparagraph 7.3.3.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- 1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- 2 unit prices stated in the Contract Documents or subsequently agreed upon;
- 3 cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- 4 as provided in Subparagraph 7.3.6.

7.3.4 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

7.3.5 A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

7.3.6 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. In such case, and also under Clause 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph 7.3.6 shall be limited to the following:

- 1 costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- 2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- 3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;



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- .4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 additional costs of supervision and field office personnel directly attributable to the change.

7.3.7. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

7.3.8 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs. That determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a claim in accordance with Article 4.

7.3.9 When the Owner and Contractor agree with the determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

7.4 MINOR CHANGES IN THE WORK

7.4.1 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME

8.1 DEFINITIONS

8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

8.1.2 The date of commencement of the Work is the date established in the Agreement.

8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Paragraph 9.8.

8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

8.2 PROGRESS AND COMPLETION

8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents or a notice to proceed given



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by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner pending mediation and arbitration, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Paragraph 4.3.

8.3.3 This Paragraph 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

9.2 SCHEDULE OF VALUES

9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents.

9.3.1.1 As provided in Subparagraph 7.3.8, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

9.3.1.2 Such applications may not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.



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9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

9.4 CERTIFICATES FOR PAYMENT

9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Subparagraph 9.5.1.

9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Subparagraph 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Subparagraph 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's



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opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Subparagraph 3.3.2, because of:

- 1 defective Work not remedied;
- 2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- 3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- 4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- 5 damage to the Owner or another contractor;
- 6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- 7 persistent failure to carry out the Work in accordance with the Contract Documents.

9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.6 PROGRESS PAYMENTS

9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

9.6.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work; the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

9.6.4 Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

9.6.5 Payment to material suppliers shall be treated in a manner similar to that provided in Subparagraphs 9.6.2, 9.6.3 and 9.6.4.

9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.



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9.7 FAILURE OF PAYMENT

9.7.1 If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by arbitration, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

9.8 SUBSTANTIAL COMPLETION

9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Clause 11.4.1.5 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and



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have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Subparagraph 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Subparagraph 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that



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portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Clauses 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Clauses 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.



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10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

10.3 HAZARDOUS MATERIALS

10.3.1 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

10.3.2 The Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. The Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up, which adjustments shall be accomplished as provided in Article 7.

10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Subparagraph 10.3.1 and has not been rendered harmless; provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) and provided that such damage, loss or expense is not due to the sole negligence of a party seeking indemnity.

10.4 The Owner shall not be responsible under Paragraph 10.3 for materials and substances brought to the site by the Contractor unless such materials or substances were required by the Contract Documents.

10.5 If, without negligence on the part of the Contractor, the Contractor is held liable for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

10.6 EMERGENCIES

10.6.1 In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or



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extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Paragraph 4.3 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- .2 claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 claims for damages insured by usual personal injury liability coverage;
- .5 claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 claims for bodily injury or property damage arising out of completed operations; and
- .8 claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18.

11.1.2 The insurance required by Subparagraph 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Paragraph 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Subparagraph 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

11.2 OWNER'S LIABILITY INSURANCE

11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

11.3 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE

11.3.1 Optionally, the Owner may require the Contractor to purchase and maintain Project Management Protective Liability insurance from the Contractor's usual sources as primary coverage for the Owner's, Contractor's and Architect's vicarious liability for construction operations under the Contract. Unless otherwise required by the Contract Documents, the Owner



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shall reimburse the Contractor by increasing the Contract Sum to pay the cost of purchasing and maintaining such optional insurance coverage, and the Contractor shall not be responsible for purchasing any other liability insurance on behalf of the Owner. The minimum limits of liability purchased with such coverage shall be equal to the aggregate of the limits required for Contractor's Liability Insurance under Clauses 11.1.1.2 through 11.1.1.5.

11.3.2 To the extent damages are covered by Project Management Protective Liability insurance, the Owner, Contractor and Architect waive all rights against each other for damages, except such rights as they may have to the proceeds of such insurance. The policy shall provide for such waivers of subrogation by endorsement or otherwise.

11.3.3 The Owner shall not require the Contractor to include the Owner, Architect or other persons or entities as additional insureds on the Contractor's Liability Insurance coverage under Paragraph 11.1.

11.4 PROPERTY INSURANCE

11.4.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Paragraph 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Paragraph 11.4 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

11.4.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

11.4.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance which will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

11.4.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

11.4.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

11.4.1.5 Partial occupancy or use in accordance with Paragraph 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial



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occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

11.4.2 Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

11.4.3 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

11.4.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

11.4.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Subparagraph 11.4.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

11.4.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Paragraph 11.4. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

11.4.7 Waivers of Subrogation. The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Paragraph 11.4 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.



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11.4.8 A loss insured under Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Subparagraph 11.4.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

11.4.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or in accordance with an arbitration award in which case the procedure shall be as provided in Paragraph 4.6. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

11.4.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved as provided in Paragraphs 4.5 and 4.6. The Owner as fiduciary shall, in the case of arbitration, make settlement with insurers in accordance with directions of the arbitrators. If distribution of insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

11.5 PERFORMANCE BOND AND PAYMENT BOND

11.5.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

11.5.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING OF WORK

12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

12.1.2 If a portion of the Work has been covered which the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.



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12.2 CORRECTION OF WORK

12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

12.2.1.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

12.2.2 AFTER SUBSTANTIAL COMPLETION

12.2.2.1 In addition to the Contractor's obligations under Paragraph 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Subparagraph 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Paragraph 2.4.

12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work.

12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Paragraph 12.2.

12.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

12.2.5 Nothing contained in this Paragraph 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the one-year period for correction of Work as described in Subparagraph 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

12.3 ACCEPTANCE OF NONCONFORMING WORK

12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.



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ARTICLE 13 MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

13.1.1 The Contract shall be governed by the law of the place where the Project is located.

13.2 SUCCESSORS AND ASSIGNS

13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Subparagraph 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

13.2.2 The Owner may, without consent of the Contractor, assign the Contract to an institutional lender providing construction financing for the Project. In such event, the lender shall assume the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

13.3 WRITTEN NOTICE

13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

13.4 RIGHTS AND REMEDIES

13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

13.5 TESTS AND INSPECTIONS

13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Subparagraph 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Subparagraph 13.5.3, shall be at the Owner's expense.



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13.5.3 If such procedures for testing, inspection or approval under Subparagraphs 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

13.6 INTEREST

13.6.1 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1 As between the Owner and Contractor:

- 1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
- 2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
- 3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Paragraph 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Paragraph 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.



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ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- 1 issuance of an order of a court or other public authority having jurisdiction which requires all Work to be stopped;
- 2 an act of government, such as a declaration of national emergency which requires all Work to be stopped;

- 3 because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Subparagraph 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- 4 the Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Subparagraph 2.2.1.

14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Paragraph 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

14.1.3 If one of the reasons described in Subparagraph 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages.

14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Subparagraph 14.1.3.

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1 The Owner may terminate the Contract if the Contractor:

- 1 persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- 2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- 3 persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or
- 4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

14.2.2 When any of the above reasons exist, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- 1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- 2 accept assignment of subcontracts pursuant to Paragraph 5.4; and
- 3 finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

14.2.3 When the Owner terminates the Contract for one of the reasons stated in Subparagraph 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.



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14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Subparagraph 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

- 1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- 2 that an equitable adjustment is made or denied under another provision of the Contract.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

- 1 cease operations as directed by the Owner in the notice;
- 2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- 3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.



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AIA Document A311

Performance Bond

KNOW ALL MEN BY THESE PRESENTS: that

(Here insert full name and address or legal title of Contractor)

as Principal, hereinafter called Contractor, and,

(Here insert full name and address or legal title of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto

(Here insert full name and address or legal title of Owner)

as Obligee, hereinafter called Owner, in the amount of

Dollars (\$ _____),

for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Contractor has by written agreement dated _____
(Here insert full name, address and description of project)

19____, entered into a contract with Owner for

in accordance with Drawings and Specifications prepared by

(Here insert full name and address or legal title of Architect)

which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

PERFORMANCE BOND

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the Owner.

Whenever Contractor shall be, and declared by Owner to be in default under the Contract, the Owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly

1) Complete the Contract in accordance with its terms and conditions, or

2) Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or, if the Owner elects, upon determination by the Owner and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as Work progresses (even though there should be a default or a succession of

defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by Owner to Contractor under the Contract and any amendments thereto, less the amount properly paid by Owner to Contractor.

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of the Owner.

Signed and sealed this

day of

19

(Witness)

_____ (Principal) (Seal)
_____ (Title)

(Witness)

_____ (Surety) (Seal)
_____ (Title)

THE AMERICAN INSTITUTE OF ARCHITECTS



AIA Document A311

Labor and Material Payment Bond

THIS BOND IS ISSUED SIMULTANEOUSLY WITH PERFORMANCE BOND IN FAVOR OF THE OWNER CONDITIONED ON THE FULL AND FAITHFUL PERFORMANCE OF THE CONTRACT

KNOW ALL MEN BY THESE PRESENTS: that

(Here insert full name and address or legal title of Contractor)

as Principal, hereinafter called Principal, and,

(Here insert full name and address or legal title of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto

(Here insert full name and address or legal title of Owner)

as Obligee, hereinafter called Owner, for the use and benefit of claimants as hereinbelow defined, in the

amount of

(Here insert a sum equal to at least one-half of the contract price)

Dollars (\$ _____),

for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Principal has by written agreement dated _____

(Here insert full name, address and description of project)

19____, entered into a contract with Owner for

in accordance with Drawings and Specifications prepared by

(Here insert full name and address or legal title of Architect)

which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

LABOR AND MATERIAL PAYMENT BOND

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as one having a direct contract with the Principal or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:

a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: the Principal, the Owner, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial

accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Owner or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

b) After the expiration of one (1) year following the date on which Principal ceased Work on said Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

c) Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the Project, or any part thereof, is situated, or in the United States District Court for the district in which the Project, or any part thereof, is situated, and not elsewhere.

4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

Signed and sealed this _____ day of _____ 19____

(Witness)

(Principal) (Seal)

(Title)

(Witness)

(Surety) (Seal)

(Title)



AIA[®] Document A701[™] – 1997

Instructions to Bidders

for the following PROJECT:
(Name and location or address):

THE OWNER:
(Name and address):

THE ARCHITECT:
(Name and address):

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

TABLE OF ARTICLES

- 1 DEFINITIONS
- 2 BIDDER'S REPRESENTATIONS
- 3 BIDDING DOCUMENTS
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- 5 CONSIDERATION OF BIDS
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- 7 PERFORMANCE BOND AND PAYMENT BOND
- 8 ~~FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR~~

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.3 SUBSTITUTIONS

§ 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.2 OWNER'S FINANCIAL CAPABILITY

The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 SUBMITTALS

§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder's usual sources.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

~~Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.~~

SUPPLEMENTARY CONDITION
OF THE CONTRACT FOR CONSTRUCTION

1. GENERAL

1.1 CHANGE ORDERS

A. Delete Subparagraph 7.2.2 and substitute the following, add 7.2.3, 7.2.4 and 7.2.5:

- 7.2.2 Refer to CM Agreement.
- 7.2.3 Refer to CM Agreement.
- 7.2.4 Change Orders require MaineHousing signature.
- 7.2.5 Liquidated damages required per CM contract.
- 9.3.1 Lien Waivers will be required to accompany requisitions for payment.

1.2 INSURANCE

A. Refer to General Conditions, Article 11, Insurance and Bonds for general provisions concerning insurance.

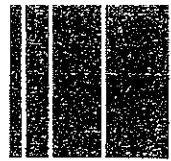
B. Amend, General Conditions, Article 11, as follows:

1. Add to Sub-sub-paragraph 11.1.1.7 the following: Liability insurance shall include all major divisions of coverage, and be on a comprehensive basis including:
 - a. Premises operations (including XCU as applicable).
 - b. Independent contractors' protective.
 - c. Products and completed operations.
 - d. Personal injury liability with employment exclusion deleted.
 - e. Contractual, including specified provisions for Contractor's obligation under Paragraph 4.18.
 - f. Owned, non-owned, and hired motor vehicles.
 - g. Broad form property damage, including completed operations.
 - h. Umbrella excess liability.
2. Sub-paragraph 11.1.2, add Sub-sub-paragraph 11.1.2.1 as follows: "11.1.2.1: Insurance required by Sub-paragraph 11.1.1 shall be written for not less than following, or greater if required by law:
 - a. Statutory Workman's Compensation and Employer's Liability.
 - b. Comprehensive General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations' Broad Form Property Damage):
 - i. Bodily Injury:

\$1,000,000 each person
\$3,000,000 annual aggregate

- ii. Property Damage
 - \$1,000,000 each occurrence
 - \$3,000,000 annual aggregate
- iii. Products and Completed Operations shall be maintained for two years after final payment.
- iv. Property Damage Liability Insurance shall provide X, C, and U coverage (explosion, collapse, underground utilities) as applicable.
- c. Contractual Liability:
 - i. Property Injury:
 - \$1,000,000 each occurrence
 - ii. Property Damage:
 - \$1,000,000 each occurrence
 - \$3,000,000 annual aggregate
- d. Personal Injury, with Employment Exclusion deleted:
 - \$1,000,000 annual aggregate
- e. Comprehensive Automobile Liability:
 - i. Bodily Injury:
 - \$1,000,000 each occurrence
 - \$3,000,000 annual aggregate
 - ii. Property Damage:
 - \$1,000,000 each occurrence
- f. Umbrella Excess Liability
 - i. \$1,000,000 over primary insurance
 - \$ 3,000 retention for self-insured hazards, each occurrence

END OF SECTION



**Report on Subsurface and
Foundation Investigation**

**Proposed 53 Danforth Street
Portland, Maine**

for

Maine Workforce Housing LLC
c/o The Szanton Company
One City Center
Portland, ME 04101

February 12, 2008

February 12, 2008
08013

Mr. Nathan Szanton
Maine Workforce Housing LLC
c/o The Szanton Company
One City Center
Portland, ME 04101

Report on Subsurface and Foundation Investigation
Proposed 53 Danforth Street, Portland, Maine

Dear Nathan:

This report presents the results of our subsurface and foundation investigation for the proposed 53 Danforth Street project in Portland, Maine. These services are provided in accordance with our proposal dated January 14, 2008.

In summary, it is our opinion that the proposed building may be supported on spread and continuous footings bearing on undisturbed, naturally deposited sand, or on compacted structural fill placed after removal of unsuitable soil. In addition, an earth-supported slab-on-grade may be used for the lowest (ground) floor. Specific recommendations regarding foundation design and construction considerations are presented below.

Introduction

The approximately 0.4-acre site is located at 53 Danforth Street and is presently occupied by a single-story building housing New England Imports. The remainder of the site is primarily parking. Ground surface elevations within the building limits vary from approximately El. 43 to El. 46. The northwest corner of the site is adjacent to a steep slope up to an at-grade parking lot on Pleasant Street.

We understand that the lowest level will consist of a steel deck garage with parking for approximately 40 vehicles and entrance, lobby and elevator. The lowest level elevation is not yet established, but we anticipate that it will be near existing grade. There will be four stories of wood-framed apartments above the garage level.

It is our experience that many parcels in this area of Portland were once occupied by other structures. Therefore, there may be existing foundations or other construction below the ground surface that were not identified in the borings.

Subsurface Explorations

On January 31, 2008, Maine Test Borings, Inc. (MTB) of Brewer, Maine drilled four borings, B1 to B4, at the site at locations shown on Sheet 1, Boring Plan. MTB drilled the borings to depths below ground surface varying from 7.8 feet to 21.5 feet. Sebago Technics, Inc. monitored the borings and prepared the logs included in Appendix A. Table I summarizes the results of borings. MTB backfilled the borings with the drilled material.

Borings were drilled using 2.5-inch inside diameter hollow stem augers. Samples were generally recovered at 5-foot intervals except in the upper 6.0 feet where continuous samples were recovered. Standard Penetration Resistance (N) was measured at each sample interval in accordance with ASTM Test D1586.

Sebago Technics, Inc. determined the locations of borings by taping from existing site features. It was necessary to adjust boring locations in the field from the proposed building corners due to the presence of the steep slope and abandoned cars.

The boring logs and related information depict subsurface conditions and water levels only at their specific locations at the time of excavation. Soil conditions at other locations may differ from conditions at these locations. Also, the passage of time may result in a change in groundwater conditions at exploration locations.

Subsurface Conditions

The borings encountered five principal soil units: fill, marine sand, marine silt, marine clay and glacial till. Encountered thickness and generalized descriptions of these units are presented below in order of increasing depth below ground surface. Due to the complexity of the deposition process, strata thickness will vary and may be absent at specific locations.

Fill - Fill consists of loose to dense, brown silty SAND with gravel (SM); to well-graded SAND with gravel (SW); to BRICKS, MORTAR, ASH, GRAVEL and BURNT WOOD. Encountered thickness varies from 0.2 foot to 7.0 feet.

Marine Sand - The marine sand deposit consists of loose, gray brown to gray silty SAND (SM) with frequent silt and clay varves. Boring B2 encountered 6.0 feet of sand.

Marine Silt - Marine silt consists of stiff, gray brown mottled SILT (ML). Boring B1 encountered 0.2 foot of silt.

Marine Clay - Marine clay consists of medium stiff gray lean CLAY (CL) with frequent sand seams. Boring B2 encountered 4.0 feet of clay.

Glacial Till - Glacial till consists of medium dense to very dense, brown to gray brown to gray silty SAND with gravel (SM) with cobbles and boulders. Borings penetrated up to 16.8 feet into glacial till.

Groundwater was observed in the borings at depths below ground surface varying from 2.6 feet to 16.9 feet. Observations of groundwater were made over a relatively short period of time and may not reflect the stabilized groundwater level. In addition, water levels at the site will vary with season, precipitation, temperature and construction activity in the area. Therefore, water levels during and following construction will vary from those observed in the borings.

Recommendations for Foundation Design

Recommended Foundation Type and Design Criteria

The existing fill is not considered suitable for support of the building. In addition, there could be portions of existing foundations buried below the ground surface. All existing fill should be removed from within the limits of the building foundations. We recommend that the building be supported on spread and continuous footings bearing on the undisturbed marine deposits (sand and silt) or on compacted structural fill placed after removal of the existing fill. For ease of construction, we recommend that the footings bear on 6 inches of 3/4-inch crushed stone with a non-woven geotextile fabric separating the stone from the subgrade.

Footings should be proportioned for an allowable bearing stress in pounds per square foot (psf) equal to 1,000 multiplied by the least lateral dimension of the footing in feet, up to a maximum of 3,000 psf. All footings should be at least 1.5 feet wide.

Footings should be founded at least 4.5 feet below the lowest adjacent ground surface exposed to freezing.

Crushed stone supporting footings should extend laterally from the footings to at least the limits defined by 1 horizontal to 1 vertical lines sloped outward and downward from points located at least 1 foot horizontally beyond the bottom edges of the footings.

At the recommended bearing stress, we anticipate that settlement for foundations will be less than 1 inch. We estimate that more than 50 percent of this settlement will occur during the construction period. We anticipate that settlement of this magnitude is acceptable. However, the structural engineer should determine final acceptability of settlement.

Lowest Level Floor

We understand that most of the lowest level floor will consist of bituminous concrete for parking. The remainder of the lowest level will consist of a lobby, elevator, mechanical room, storage and stairs. We recommend that the lowest level floor slabs in these areas be designed as earth-supported slabs-on-grade bearing on a minimum 12-inch thickness of compacted structural fill. All existing fill containing debris and existing foundations, if present, should be removed from within the slab limits prior to placing fill. The subgrade should be improved by compacting with vibratory compaction equipment. All fill placed below the floor slabs for raise-in-grade should consist of compacted structural fill. Normal dampproofing and vapor barriers should be provided below the slabs.

We recommend the following pavement section for the lowest level parking:

3 inches bituminous concrete, placed in two layers
15 inches sand or gravel subbase course

Subbase course materials should conform to the following gradation:

Sand or Gravel (Maine DOT Standard Specification, Highways and Bridges; Section 703.06b, Type D)

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
4 inches	100
¼ inch	25-70
No. 40	0-30
No. 200	0-7

(Note: Type D aggregate should be modified to a maximum 4 inch size. Compacted structural fill may be substituted for gravel subbase course.)

As noted above, all unsuitable material should be removed from within the limits of the building. Existing foundations, if present, should be removed to a minimum depth of 2 feet below final grade and replaced with compacted structural fill. Fill required below the pavement section should consist of compacted structural fill. The subgrade should be compacted with vibratory compaction equipment prior to placing fill and subbase. Compacted structural fill and pavement subbase should be placed in layers not exceeding 8 inches in thickness and compacted to a dry density of at least 95 percent of maximum dry density, as determined in accordance with ASTM Test Designation D1557.

It should be noted that the subgrade soils may be frost-susceptible. Therefore, pavement roughness due to non-uniform frost movement may occur. To eliminate such non-uniform frost movement would require approximately 4.5 feet of structural fill subbase. However, it is common practice to tolerate seasonal movement to avoid the high cost of the added thickness of subbase.

Seismic Design Considerations

We recommend that the building be designed in accordance with the seismic requirements of the latest edition of the International Building Code, the site classification is Class D; the site response coefficient F_a is 1.5 for a short period spectral response acceleration S_s of 0.37g; the site response coefficient F_v is 2.4 for the 1-second period spectral response acceleration S_1 of 0.10g. The subgrade soils are not considered liquefaction susceptible.

Lateral Foundation Loads

We recommend that lateral loads be resisted by bottom friction on footings. We recommend that a coefficient of friction equal to 0.40 be used for footings bearing on soil or crushed stone. If this does not provide sufficient resistance, we will study the problem in more detail to take into account other factors.

Backfill Materials

Structural fill used below foundations and floor slabs and for backfill adjacent to walls should consist of sandy gravel to gravelly sand. It should be free of organic material, loam, trash, snow, ice, frozen soil and other objectionable material, and should conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
3 inches	100
No. 4	30 to 90
No. 40	10 to 50
No. 200	0 to 8

Compacted structural fill should be placed in layers not exceeding 8 inches in loose measure and compacted by self-propelled vibratory equipment at the approximate optimum moisture content to a dry density of at least 95 percent of the maximum dry density, as determined in accordance with ASTM Test Designation D1557. In confined areas, the loose layer thickness should be reduced to 6 inches and compaction performed by hand-guided vibratory equipment.

Retaining Wall

We understand that a retaining wall is required adjacent to the northwest corner of the building next to the steep slope up to the adjacent at-grade parking. Due to the presence of the steep slope, we anticipate that the retaining wall will likely consist of a cantilevered steel sheet pile or soldier beam and lagging wall or a soil nail wall if an easement can be acquired for the soil nails to penetrate onto the adjacent property. Recommendations for the retaining wall will be provided under separate cover when the type of wall has been determined.

Construction ConsiderationsGeneral

The primary purpose of this section of the report is to comment on items related to excavation, earthwork and related geotechnical aspects of proposed construction. It is written primarily for the engineer having responsibility for preparation of plans and specifications. Since it identifies potential construction problems related to foundations and earthwork, it will also aid personnel who monitor the construction activity. Prospective contractors for this project must evaluate the construction problems on the basis of their own knowledge and experience in the Portland, Maine area and on the basis of similar projects in other localities, taking into account their proposed construction methods, procedures, equipment and personnel.

Excavation, Lateral Support and Control of Water

We anticipate that foundation excavation can be accomplished with sloped open excavation through the overburden soils provided safe side slopes can be maintained. Some sloughing and raveling should be anticipated in temporary slopes. Temporary excavations should be made in accordance with all OSHA and other applicable regulatory agency requirements.

Existing foundations, if present within the limits of proposed foundations and floor slab, should be completely removed and the excavation to bearing level backfilled with compacted structural fill or crushed stone, as appropriate. Existing foundations below the parking area should be removed to at least 2 feet below the top of pavement. The borings encountered ash in the existing fill which may require special treatment for disposal.

We anticipate that groundwater may be encountered at proposed subgrade level or bearing level of footings. If encountered, open pumping from sumps can likely control groundwater. In general, the contractor should control groundwater and water from runoff and other sources by methods which prevent disturbance of bearing surfaces or adjacent soils and allow construction in-the-dry.

Subgrade Preparation

The subgrade soil is susceptible to disturbance from construction traffic. Equipment and personnel should not be permitted to travel across exposed footing bearing surfaces or exposed slab subgrades. Any subgrade areas that are disturbed should be recompacted or excavated and replaced with compacted structural fill prior to placing concrete. Subgrades should be protected against freezing temperatures if exposed during construction. Final excavation to subgrade should be performed using equipment with smooth-edge buckets.

Construction Monitoring

The foundation recommendations contained herein are based on the known and predictable behavior of a properly engineered and constructed foundation. Monitoring of the foundation construction is required to enable the geotechnical engineer to keep in contact with procedures and techniques used in construction. Therefore, we recommend that a person qualified by training and experience be present to provide monitoring at the site during preparation of foundation bearing surfaces, rock blasting, and placement of compacted structural fill.

Limitations of Recommendations

This report has been prepared for specific application to the subject project in accordance with generally accepted geotechnical engineering practices. In the event that any changes in the nature, design or location of the building are planned, the conclusions and recommendations contained in this report should not be considered valid, unless the changes are reviewed and the conclusions of this report modified or verified in writing.

The recommendations presented herein are based in part on the data obtained from the referenced test borings. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

We request that we be provided the opportunity for a general review of final design and specifications in order to determine that our earthwork and foundation recommendations have been interpreted and implemented in the design and specifications as they were intended.

It has been a pleasure to work with you on this project. Please do not hesitate to contact us if you have any questions or need additional information.

Sincerely,

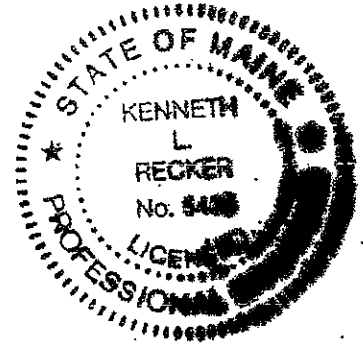
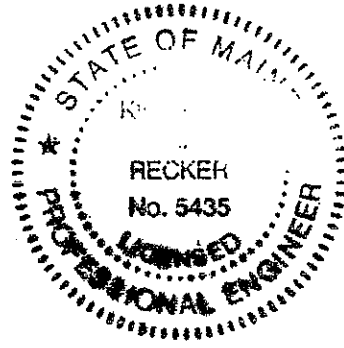
SEBAGO TECHNICS, INC.



Kenneth L. Recker, P.E.
Geotechnical Engineering Manager

KLR:klr/jc
Enclosures:

- Table I - Summary of Borings
- Sheet 1 - Boring Plan
- Appendix A - Logs of Test Borings



08013

**TABLE I
SUMMARY OF BORINGS
53 DANFORTH STREET
PORTLAND, MAINE**

Boring No.	Depth (Ft)	Depth to Water (Ft)	Strata Thickness (Ft)				
			Fill	Sand	Silt	Clay	Glacial Till
B1	17.0	3.5	3.8	--	0.2	--	13.0*
B2	21.5	16.9	5.0	6.0	--	4.0	6.5*
B3	17.0	7.6	0.2	--	--	--	16.8*
B4	7.8	2.6	7.0	--	--	--	0.8*

NOTES:

1. -- INDICATES STRATUM NOT ENCOUNTERED WITHIN DEPTH OF BORING.
2. * INDICATES DEPTH OF PENETRATION INTO STRATUM.

Appendix A

Logs of Test Borings

PROJECT	53 DANFORTH STREET	STI JOB NO.	08013
LOCATION	53 DANFORTH STREET, PORTLAND, MAINE	PROJECT MGR.	K. RECKER
CLIENT	MAINE WORKFORCE HOUSING, LLC	FIELD REP.	K. B. STEPHENSON
CONTRACTOR	MAINE TEST BORINGS, INC.	DATE STARTED	1/31/2008
DRILLER	M. PORTER	DATE FINISHED	1/31/2008

Elevation	ft. Datum	Boring Location	See Plan
Item	Casing	Sampler	Core Barrel
Type	HSA	SS	
Inside Diameter (in.)	2.5	3.0/1.375	
Hammer Weight (lb.)		300/140	
Hammer Fall (in.)		30	

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel					Sand					Field Test		
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fine	Dilatancy	Toughness	Plasticity	Strength			
0	1	S1	0.0			SM	Loose, brown silty SAND (SM), mps = 1.0 in., organics, wet	5	5	10	20	40	20							
	2						-FILL-													
	4				2.0															
	6	S2	2.0			SM	Loose, brown silty SAND with gravel (SM), mps = 2.5 in., wet	10	10	15	30	20	15							
	4						-FILL-													
	5				2.8															
	6	S3	4.0		4.0	ML	Stiff, gray-brown mottled sandy SILT (ML), damp -MARINE DEPOSITS-							40	160					
	7																			
	14	S4	4.0			SM	Medium dense, brown mottled silty SAND with gravel (SM), frequent rusty discolorations, mps = 2.0 in., wet	15	15	25	10	20	15							
5	10																			
	11	S5	6.0																	
							-GLACIAL TILL DEPOSITS-													
10	3	S4	10.0			SM	Medium dense, gray to gray-brown silty SAND with gravel (SM), mps = 1.0 in., wet	10	15	30	10	20	15							
	3																			
	11																			
	10	S4	12.0																	
							-GLACIAL TILL DEPOSITS-													
15	19	S5	15.0			SM	Very dense, gray-brown silty SAND with gravel (SM), mps = 1.0 in., wet	10	15	30	30	15								
	27																			
	19																			
	19	S5	17.0																	
							Bottom of exploration at 17.0 ft. below ground surface													
							No refusal													

Water Level Data					Sample ID		Well Diagram		Summary										
Date	Time	Elapsed Time (hr.)	Depth in feet to:			O	T	U	S	G	Overburden (Linear ft.)		Rock Core (Linear ft.)		Number of Samples				
			Bottom of Casing	Bottom of Hole	Water	Open End Rod	Thin Wall Tube	Undisturbed Sample	Split Spoon Sample	Geoprobe	Riser Pipe	Screen	Filter Sand	Cuttings	Grout	Concrete	Bentonite Seal		
1/31/2008	1450		-	4.0	3.5														
Field Tests											BORING NO.		B1						
Dilatancy: R - Rapid S - Slow N - None					Plasticity: N - Nonplastic L - Low M - Medium H - High					Toughness: L - Low M - Medium H - High					Dry Strength: N - None L - Low M - Medium H - High V - Very High				
*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.																			
NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.																			

PROJECT: 53 DANFORTH STREET STI JOB NO. 08013
 LOCATION: 53 DANFORTH STREET, PORTLAND, MAINE PROJECT MGR. K. RECKER
 CLIENT: MAINE WORKFORCE HOUSING, LLC FIELD REP. K. B. STEPHENSON
 CONTRACTOR: MAINE TEST BORINGS, INC. DATE STARTED: 1/31/2008
 DRILLER: M. PORTER DATE FINISHED: 1/31/2008

Elevation	ft.	Datum	Boring Location	See Plan
Item	Casing	Sampler	Core Barrel	Rig Make & Model
Type	HSA	SS		B47 Mobile
Inside Diameter (in.)	2.5	3.0/1.375		<input type="checkbox"/> Truck <input type="checkbox"/> Tripod <input type="checkbox"/> Cat-Head <input type="checkbox"/> ATV <input type="checkbox"/> Geoprobe <input type="checkbox"/> Winch <input type="checkbox"/> Track <input type="checkbox"/> Air Track <input type="checkbox"/> Roller Bit <input type="checkbox"/> Skid <input checked="" type="checkbox"/> Trailer <input checked="" type="checkbox"/> Cutting Head
Hammer Weight (lb.)		300/140		Hammer Type: <input type="checkbox"/> Safety <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic Drilling Mud: <input type="checkbox"/> Bentonite <input type="checkbox"/> Polymer <input checked="" type="checkbox"/> None Casing Advance: <input type="checkbox"/> Type Method Depth HSA/Spin/IS.0
Hammer Fall (in.)		30		Drilling Notes: Continuous 3 in. diameter split spoon 0-4 ft.

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel					Sand					Field Test		
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Clayiness	Toughness	Plasticity	Strength			
0	9	S1	0.0		0.2	SW	Medium dense, brown well-graded SAND with gravel (SW), mps = 1.0 in., wet	10	10	30	20	25	5							
	15						-FILL-													
	7					SM	Medium dense, brown silty SAND with gravel (SM), brick, ash, glass, mps = 2.0 in., damp	10	10	30	20	10	20							
	6	S2	2.0			SM	Loose, brown silty SAND with gravel (SM), ash, brick, mps = 2.0 in., damp	10	10	30	20	10	20							
	3						-FILL-													
	2																			
	4	S3	4.0			SM	Loose, brown silty SAND with gravel (SM), ash, brick, mps = 2.0 in., musty discolorations, wet	10	10	30	20	10	20							
	2				5.0		-FILL-													
5	4					SM	Loose, gray-brown silty SAND (SM), frequent silt and clay varves, mps = 0.02 in., damp						70	30						
	6	S2	6.0																	
							-MARINE DEPOSITS-													
					8.5															
							-MARINE DEPOSITS-													
10	6	S4	10.5		11.0	SM	Loose, gray silty SAND with gravel (SM), mps = 1.0 in., damp	5	10	5	30	30								
	2					CL	Medium stiff, gray lean CLAY with gravel (CL), frequent sand seams, mps = 1.0 in., damp	10	15		20	165	N	M	M					
	2																			
	2																			
	2	S4	12.5																	
							-MARINE DEPOSITS-													
					15.0															
15	14	S5	15.0			SM	Medium dense, gray silty SAND with gravel (SM), mps = 1.0 in., wet	5	10	30	15	20	20							
	4																			
	7																			
	11	S5	17.0																	
							-GLACIAL TILL DEPOSITS-													
					18.9															
20	41	S6	20.0			SM	Very dense, brown silty SAND with gravel (SM), mps = 1.3 in., wet	20	20	15	5	20	20							
	53																			
	28	S6	21.5																	
							-GLACIAL TILL DEPOSITS-													
							Bottom of exploration at 21.5 ft. below ground surface													
							No refusal													
25																				
50																				

Water Level Data				Sample ID		Well Diagram		Summary					
Date	Time	Elapsed Time (hr.)	Depth in feet to:			O	T	U	S	G	<input type="checkbox"/> Riser Pipe <input type="checkbox"/> Screen <input type="checkbox"/> Filter Sand <input checked="" type="checkbox"/> Cuttings <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Concrete <input checked="" type="checkbox"/> Bentonite Seal	Overburden (Linear ft.)	
			Bottom of Casing	Bottom of Hole	Water							Number of Samples	21.5
1/31/2008	1700		--	17.7	16.9							65	

Field Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.
 NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.

TEST BORING REPORT

PROJECT LOCATION: 53 DANFORTH STREET, PORTLAND, MAINE
 CLIENT: MAINE WORKFORCE HOUSING, LLC
 CONTRACTOR: MAINE TEST BORINGS, INC.
 DRILLER: M. PORTER

STI JOB NO. 08015
 PROJECT MGR. K. RECKER
 FIELD REP. K. B. STEPHENSON
 DATE STARTED 1/31/2008
 DATE FINISHED 1/31/2008

Elevation	ft. Datum		Boring Location			See Plan	Hammer Type	Drilling Mud	Casing Advance
	Item	Casing	Sampler	Core Barrel	Rig Make & Model	B47 Mobile			
Type	HSA	SS		<input type="checkbox"/> Truck <input type="checkbox"/> ATV <input type="checkbox"/> Skid	<input type="checkbox"/> Tripod <input type="checkbox"/> Geoprobe <input type="checkbox"/> Air Track <input type="checkbox"/> Trailer	<input type="checkbox"/> Cat-Head <input type="checkbox"/> Winch <input type="checkbox"/> Roller Bit <input checked="" type="checkbox"/> Cutting Head	<input type="checkbox"/> Safety <input checked="" type="checkbox"/> Doughnut <input type="checkbox"/> Automatic	<input type="checkbox"/> Bentonite <input type="checkbox"/> Polymer <input checked="" type="checkbox"/> None	Type Method Depth HSA/Spin/15.0
Inside Diameter (in.)	2.5	3.0/1.375							
Hammer Weight (lb.)		300/140							
Hammer Fall (in.)		30							

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYM/BOL, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel					Sand					Field Test		
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Finer	Dilatancy	Toughness	Plasticity	Strength			
0	25	S1	0.0		0.2	SM	Medium dense, brown silty SAND with gravel (SM), mps = 2.0 in., wet	20	20	10	25	10	15							
	12						-FILL-													
	8					SM	Medium dense, olive-brown silty SAND with gravel (SM), rock fragments, mps = 1.0 in., rusty discolorations, wet -GLACIAL TILL DEPOSITS-	10	10	25	20	20	15							
	8	S2	2.0			SM	Medium dense, olive-brown silty SAND with gravel (SM), mps = 3.0 in., rusty discolorations, wet	10	10	20	15	30	15							
	10						-GLACIAL TILL DEPOSITS-													
	18	S3	4.0		4.0	SM	Dense, olive-brown silty SAND with gravel (SM), mps = 2.0 in., rusty discolorations, wet	10	10	15	10	40	15							
5	22						-GLACIAL TILL DEPOSITS-													
	22	S4	6.0				-GLACIAL TILL DEPOSITS-													
10	113	S4	10.0			SM	Very dense, olive-brown silty SAND with gravel (SM), mps = 1.5 in., wet	20	15	20	20	10	15							
	100/3	S	10.8				-GLACIAL TILL DEPOSITS-													
15	47	S5	15.0			SM	Very dense, brown silty SAND (SM), mps = 0.75 in., wet	10	30	20	25	15								
	56						-GLACIAL TILL DEPOSITS-													
	69						-GLACIAL TILL DEPOSITS-													
	59	S3	17.0				Bottom of exploration at 17.0 ft. below ground surface No refusal													

Water Level Data						Sample ID		Well Diagram		Summary										
Date	Time	Elapsed Time (hr.)	Depth in feet to:			O	T	U	S	G	Riser Pipe	Screen	Filter Sand	Cuttings	Grout	Concrete	Bentonite Seal	Overburden (Linear ft.)	Rock Cored (Linear ft.)	Number of Samples
			Bottom of Casing	Bottom of Hole	Water															
1/31/2008	1310		--	5.6	4.4													17.0	--	SS
1/31/2008	1400		--	9.6	7.6															

Field Tests Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High
 *NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.
 NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.

PROJECT: 53 DANFORTH STREET STI JOB NO. 08013
 LOCATION: 53 DANFORTH STREET, PORTLAND, MAINE PROJECT MGR. K. RECKER
 CLIENT: MAINE WORKFORCE HOUSING, LLC FIELD REP. K. B. STEPHENSON
 CONTRACTOR: MAINE TEST BORINGS, INC. DATE STARTED: 1/31/2008
 DRILLER: M. PORTER DATE FINISHED: 1/31/2008

Elevation	ft.	Datum	Boring Location	See Plan
Item	Casing	Sampler	Core Barrel	Rig Make & Model
Type	HSA	SS		B47 Mobile
Inside Diameter (in.)	2.5	3.0/1.375		<input type="checkbox"/> Tripod <input type="checkbox"/> Cat-Head <input type="checkbox"/> Safety <input type="checkbox"/> Bentonite <input type="checkbox"/> Type Method Depth
Hammer Weight (lb.)	300/140			<input type="checkbox"/> ATV <input type="checkbox"/> Geoprobe <input checked="" type="checkbox"/> Doughnut <input type="checkbox"/> Polymer <input type="checkbox"/> HSA/Spin/7.8
Hammer Fall (in.)	30			<input type="checkbox"/> Track <input type="checkbox"/> Air Track <input type="checkbox"/> Trailer <input checked="" type="checkbox"/> Skid <input checked="" type="checkbox"/> Cutting Head Drilling Notes: Continuous 3 in. diameter split spoon 0-6 ft.

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel					Sand					Field Test		
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength			
0	18	S1	0.0			SM	Dense, brown silty SAND with gravel (SM), mps = 1.5 in., brick, frozen, wet	20	20	20	20	5	15							
	24						-FILL-													
	12						-FILL-													
	9	7	2.0				No recovery from 2.0 to 4.0 ft. Bricks visible in bore hole.													
	9	NR	2.0				-FILL-													
	8						-FILL-													
	10						-FILL-													
	8		4.0				-FILL-													
	3	S2	4.0				Loose, BRICK, MORTAR, ASH, GRAVEL, BURNT WOOD, mps = 3.0 in., wet													
5	5						-FILL-													
	4				5.5		-FILL-													
	2	16	6.0			SM	Loose, gray-brown silty SAND (SM), trace brick and gravel, mps = 0.4 in., wet	10	10	10	10	50	20							
					7.0		-FILL-													
					7.8		-Probable GLACIAL TILL DEPOSITS-													
							HSA refusal at 7.8 ft.													
							Bottom of exploration at 7.8 ft. below ground surface													

Water Level Data						Sample ID		Well Diagram		Summary			
Date	Time	Elapsed Time (hr.)	Depth in feet to:			O - Open End Rod	T - Thin Wall Tube	U - Undisturbed Sample	S - Split Spoon Sample	G - Geoprobe	<input type="checkbox"/> Riser Pipe <input type="checkbox"/> Screen <input type="checkbox"/> Filter Sand <input checked="" type="checkbox"/> Cuttings <input checked="" type="checkbox"/> Grout <input checked="" type="checkbox"/> Concrete <input checked="" type="checkbox"/> Bentonite Seal	Overburden (Linear ft.)	7.8
			Bottom of Casing	Bottom of Hole	Water							Rock Cored (Linear ft.)	-
1/31/2008	1150		--	4.0	2.0						Number of Samples	25	
1/31/2008	1228		--	4.3	2.6						BORING NO.	B4	
Field Tests		Dilatancy: R - Rapid S - Slow N - None			Plasticity: N - Nonplastic L - Low M - Medium H - High			Toughness: L - Low M - Medium H - High					
		Dry Strength: N - None L - Low M - Medium H - High V - Very High			*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size. NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Sebago Technics, Inc.								

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Construction Standards

MaineHousing *Financed Multi-Family Housing*

On-the-Job Training

The developer/owner, general contractor and subcontractors engaged in a MaineHousing Financed Project will be responsible for achieving the On-the-Job Training goals for *women and minorities* in the skilled crafts. The hourly goal is based on 700 hours per \$1, 000, 00.00 dollars of the total construction cost. Each 700 hours will require the enrollment of a trainee to the project.

Contractor Responsibilities:

To provide a "good faith effort" toward On-the-Job Training:

- **Actively recruit from new and non-traditional resources.** Create a training plan for the project. Document outreach efforts to community agencies. Consider experienced workers with transferable skills. Contractors and sub-contractors recruiting workers shall notify the Career Centers of equal opportunity employment training positions available. This is a pre-apprenticeship training.
- **The OJT trainee is selected by the contractor and is considered a regular hire.** Trainees will be subject to all employee policies and expectations of the job description. Clearly communicate job duties and allow for early adjustments.
- **You may enroll a current women or minority employee, working in a skilled craft, to upgrade skills.** The intent of the program is to demonstrate a continued career path in construction. A trainee may be upgraded and registered three times.
- **A trainee may work at any job site location.** Trainees registered on a MaineHousing project may work off site and be credited training hours. All work hours related to the skill craft registered may count as training hours.
Only hours worked on the project site will be reimbursed.
- **Payroll records must be submitted monthly to verify training hours.** These may be submitted electronically or by mail to the program manager.

Wage Support Fund

A person receiving on-the-job training shall be paid wages equal to 75% of the wage rate for the trade in which the person is receiving the training as established annually by the Maine Department of Labor pursuant to the *State Minimum Wage Rates on State Construction Projects*, 26 MRSA 1304 et seq. and associated regulations. An amount equal to Five and No/100 Dollars (\$5.00) per hour of the wages paid to the person receiving on-the-job training must be included as an allowance in the project development budget. The owner will pay this allowance as a reimbursement to the contractor or the subcontractor providing the on-the-job training upon notice from MaineHousing's OJT Compliance Monitor that the contractor or subcontractor satisfied its on-the-job training obligations. The owner shall not release the allowance to reimburse the contractor or subcontractor until it receives such notice.

A contractor (including construction managers and subcontractors) will be exempt from the above OJT requirement if the percentage of all hours worked by its employees during the prior calendar year is 6.9% for women and 0.5% for minorities.

On-the-Job Training (OJT) Program Manager Role:

- Survey contractors and subcontractors for recruitment needs
- Provide recruitment resources and community links.
- Approve enrollments into the program. Track training hours toward the project goal.
- Notify the contractor in advance of a site visit/interview. Interviews will be conducted monthly with the trainee and the direct supervisor.
- Provide field support.
- Measure skill building and document OJT hours and completions.
- Distribute an OJT Manual. Specific craft training outlines are included.
- Provide progress reports to the Project Superintendent and MaineHousing.

On-the-Job Training Program Manager

Maureen Murray

TradesWorks

P.O. Box 52

Mount Vernon, ME. 04352

(207) 293-4958



MaineHousing
Maine State Housing Authority

353 Water Street
Augusta, Maine 04330-4633

**GROUP HEALTHCARE
COVERAGE PROPOSAL**
for MaineHousing-Financed
Multi-Family Housing Projects

1. Project Name:

3. Total Construction Bid: Price:

2. Pledged Coverage Level
(as chosen by developer):

4. Coverage Goals (Pick one – must match Pledge amount in #2.):

____%

____% of Total Construction Cost or

____ % of All Contractors

Column A	Column B	Column C	Column D		Column E
Contractor, Subcontractor or Vendor	Trade	Material and/or Labor Cost (\$)	Is an Eligible Health Insurance Plan Offered?		Eligible Construction Cost (If checked "Yes" in Column D, then enter the \$ amount from Column C)
			Yes	No	

Totals:		\$	-		\$ -
5. Actual Coverage		6. Coverage Requirements Satisfied (For MaineHousing Use Only)			
_____ % of Total Construction Cost or		<input type="checkbox"/> Yes <input type="checkbox"/> No			
_____ % of All Contractors					

Notes:

An Eligible Health Insurance Plan is a plan that either (a) provides coverage for employees and the contractor pays at least 60% of the premium for employee coverage or, in the alternative, (b) provides family coverage for employees and the contractor pays at least 50% of the premium for employee coverage plus some portion of the premium for the family coverage.

At the time of bidding and upon submitting a formal proposal to perform the construction work, the bidder shall include this form, filled out to the best of the bidder's ability, understanding that not all materials vendors and/or subcontractors may be fully known at the time of bid. In the case of an unknown resource, please indicate "UNKNOWN" in the Contractor/Subcontractor/Vendor column along with its assigned value in the form and suggest to the best of the bidders ability if the work will be performed by a contractor or the materials will be provided by a supplier that has an Eligible Health Insurance Plan.

Once the developer selects the winning bids, the developer shall forward the details of all bids received, including without limitation, the Group Healthcare Coverage Proposal forms submitted by all bidders, to MaineHousing. MaineHousing will review the bids to determine whether the developer satisfied its obligation or, if not, made a good faith effort to comply.

If compliance is being provided by the % of contract value method (total value of the construction work that is being provided by contractor or construction manager, subcontractors, and vendors that have an Eligible Health Insurance Plan, divided by the total bid for the work expressed as a percent), it may be possible to demonstrate compliance (i.e. meet the minimum requirement) without selecting all proposed project team members.

In the case where compliance is being provided by the % of the number of construction team members (contractor or construction manager, subcontractors, vendors) who provide an Eligible Health Insurance Plan, divided by the total number of construction team members, compliance can only be properly demonstrated by disclosing all entities that will be providing goods and/or services throughout the duration of the project. For the purposes of identifying entities who will be providing a meaningful contribution to the cost of the work, a value of the goods and/or services provided shall be in excess of \$5,000. Any difference between the total costs and the sum of the costs of the team members shall be considered negligible and not be used to evaluate compliance.

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Contractor Standards
for
MaineHousing-Financed Multi-Family Housing

PROJECT: 53 Danforth Street

LOCATION: 53 Danforth St., Portland, Maine

The following standards apply for this project:

1. Prevailing Wage Rates
2. Employee Classification
3. Workers Compensation
4. Group Healthcare Coverage (60% Level)



MaineHousing
Maine State Housing Authority

Maine State Housing Authority
353 Water Street
Augusta, Maine 04330-4633

General

Maine State Housing Authority (*MaineHousing*) has adopted the Contractor Standards for MaineHousing-Financed Multi-Family Housing (*MaineHousing Contractor Standards*). In general, these standards apply to projects financed under MaineHousing multifamily programs. The Contractor Standards applicable to a particular project are dependent on the requirements of the specific MaineHousing financing program.

This document summarizes the Contractor Standards for this project. A complete description of the Standards can be found in the *Contractor Standards Compliance Guide*. This guide can be downloaded from the MaineHousing web site at the link shown below.

<http://www.mainehousing.org/HOUSINGDEVContractorStandards.aspx>

The Contractor Standards applicable for this project include the following components of the MaineHousing Contractor Standards.

1. Prevailing Wage Rates
2. Proper Classification of Employees
3. Workers' Compensation Insurance
4. Group Healthcare Coverage

The contractors (including general contractors, construction managers, subcontractors, tier subcontractors, independent contractors and sole proprietors) are responsible for ensuring compliance with the MaineHousing Contractor Standards throughout the duration of the project. Contractors are independently responsible for complying with the MaineHousing Contractor Standards. The contractors shall cooperate with MaineHousing, its agents and employees, in monitoring and facilitating compliance with the MaineHousing Contractor Standards during the construction of the project.

The Contractor Standards Compliance Officer (CSCO) represents MaineHousing. The primary role of the CSCO is to monitor and facilitate compliance with the MaineHousing Contractor Standards. The CSCO will investigate potential violations and complaints and facilitate their resolution. The CSCO will cooperate fully with government agencies in resolving any issues concerning MaineHousing's contractor standards, either during the contract term or after construction.

Summary of Contractor Responsibilities During Construction

Prevailing Wage Rates

This project is subject to following wage rate schedule developed by the State of Maine, Department of Labor - Bureau of Labor Standards.

**2008 Fair Minimum Wages Rates
Building 2 Cumberland County
(other than 1 or 2 family homes)**

The wage rate schedule is presented at the end of this section.

(Note: On MaineHousing projects only the minimum wage portion of the Maine DOL rate schedule applies. The "Minimum Benefit" and the "Total" columns shown on the wage rate schedule on the Maine DOL web site do not apply. The wage rate schedule shown in this specification has been modified to include only the "Minimum Wage" column.)

Contractor responsibilities during construction regarding the Prevailing Wage Rate standard are summarized below.

- Payrolls or other acceptable documentation showing compliance with the prevailing wage rates shall be submitted by all contractors (general contractor, subcontractors and tier subcontractors) who have employees working at the site. Payrolls are not required for salaried administration and management personnel.
- The payrolls can be in any format but must show as a minimum the employee, classification, hourly wage, regular hours and overtime hours. The payrolls do not need to be certified.
- Each contractor is responsible for his own payroll submittals. The general contractor is not responsible for subcontractor or tier subcontractor payroll submittals.
- Payrolls shall be submitted within one month after work begins at the site. Payrolls can be submitted weekly, bimonthly or monthly.
- Contractors shall cooperate with the CSCO during scheduled and unscheduled site inspections and on-site interviews with workers.
- Contractors shall participate in the investigation of violations and complaints relating to prevailing wage rates.

Proper Classification of Employees

Contractor responsibilities during construction regarding the Proper Classification of Employees standard are summarized below.

- Contractors who hire independent contractors (IC's) shall submit a list of all IC's working at the site.
- Contractors who have applied to the State of Maine Workers Compensation Board for a predetermination of IC status shall submit a copy of the application. Copies of predetermination of IC status or waivers received from other agencies shall also be submitted.
- Contractors shall cooperate with the CSCO during unscheduled site inspections and on-site interviews with IC's.

Workers' Compensation Insurance

Contractor responsibilities during construction regarding the Workers' Compensation Insurance standard are summarized below.

- The general contractor shall submit copies of the certificates of coverage or other proof of workers' compensation insurance for all contractors working at the site.
- Contractors who are excluded from having workers compensation insurance shall submit the reason for their exclusion.

- Contractors shall cooperate fully if referred by the CSCCO to the Workers' Compensation Board for information or assistance.

Group Healthcare Coverage

Contractor responsibilities during construction regarding the Group Healthcare Coverage standard are summarized below.

- The GC (or the Owner) should provide the CSCCO with the list of contractors that pledged enrollment in an eligible group health insurance plan.
- All contractors enrolled in the group health coverage plan should submit documentation showing the terms of coverage for employees and dependents and the period the coverage will remain in effect.
- Contractors on the project not enrolled in the group healthcare coverage plan shall submit documentation showing the terms of coverage for employees and dependents.

Contractor Standards Compliance Officer

All submittals shall be sent to the CSCCO. Questions relating to the MaineHousing Contractor Standards can be directed to the CSCCO. The contact information is presented below.

Larsen Consulting
Homeplace Five
Topsham, ME 04086

Bob Larsen
rlarsen@blazenetme.net
(207) 650-3129
eFax 207-221-1116

State of Maine
 Department of Labor
 Bureau of Labor Standards
 Technical Services Division
 Augusta, Maine 04333-0045
 Telephone (207) 623-7906

Wage Determination - In accordance with 26 MRSA §1301 et. seq., this is a determination by the Bureau of Labor Standards, of the fair minimum wage rate to be paid laborers and workers employed on the below titled project.

Title of Project: 53 Danforth Street

Location of Project: 53 Danforth St., Portland, Maine

**2008 Fair Minimum Wage Rates
 Building 2 Cumberland County
 (other than 1 or 2 family homes)**

Occupation Title	Minimum Wage	Occupation Title	Minimum Wage
Asbestos Abatement Wrkr	\$16.00	Ironworker - Reinforcing	\$20.15
Assembler - Metal Bldg	\$17.00	Ironworker - Structural	\$20.15
Backhoe Loader Operator	\$13.25	Laborers/Helper/Tender	\$13.12
Boom Truck Operator	\$27.22	Laborer - Skilled	\$15.67
Bricklayer	\$23.50	Loader Op - Front End	\$15.00
Bulldozer Operator	\$16.00	Mechanic - Maintenance	\$21.00
Carpenter	\$18.50	Mechanic - Refrigeration	\$19.88
Carpenter - Acoustical	\$13.13	Millwright	\$19.95
Carpenter - Rough	\$14.50	Oil/Fuel Burner Serv & Instr	\$19.84
Cement Mason/Finisher	\$16.00	Painter	\$12.50
Commun Equip Installer	\$23.00	Paperhanger	\$13.25
Concrete Mixing Plant Op	\$15.85	Paver - Bituminous	\$15.50
Concrete Pump Operator	\$19.00	Pile Driver Operator	\$20.41
Crane Operator <15 Tons	\$18.00	Pipe/Stm/Sprkler Fitter	\$20.50
Crane Operator =>15 Tons	\$22.05	Plumber (Licensed)	\$21.38
Crusher Plant Operator	\$14.06	Plumber Hlpr/Trainee (Lic)	\$16.00
Driller - Well	\$13.50	Pump Installer	\$16.00
Dry-Wall Applicator	\$22.00	Roller Operator - Earth	\$13.25
Dry-Wall Taper & Finisher	\$20.00	Roller Operator - Pavement	\$15.75
Electrician	\$22.50	Roofer	\$16.00
Electrician Hlpr (Licensed)	\$15.00	Sheet Metal Worker	\$15.70
Elevator Constrctr/Installer	\$44.10	Sider	\$16.00
Excavator Operator	\$16.25	Tile Setter	\$21.00
Fence Setter	\$12.00	Truck Driver - Light	\$14.50
Floor Layer	\$15.00	Truck Driver - Medium	\$13.30
Glazier	\$17.13	Truck Driver - Heavy	\$12.38
Insulation Installer	\$16.00	Truck Driver - Tractor Trailer	\$14.00

If there is no wage rate listed for a particular trade, the wage agreed upon by the employer and the employee will apply, provided it is higher than the State minimum wage.

SECTION 01045

CUTTING AND PATCHING

1. GENERAL

1.1 REFERENCES

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. Divisions 2 through 16.

1.2 DESCRIPTION OF WORK

- A. Definition: "Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition. This section does not apply to new work that has been installed as part of the Work.
- B. Structural Work: Do not cut-and-patch structural work in a manner resulting in a reduction of load-carrying capacity or load/deflection ratio.
- C. Operational/Safety Limitations: Do not cut-and-patch operational elements and safety components in a manner resulting in decreased performance, shortened useful life, or increased maintenance.
- D. Visual/Quality Limitations: Do not cut-and-patch work exposed to view (exterior and interior) in a manner resulting in noticeable reduction of aesthetic qualities and similar qualities, as judged by the Architect/Engineer.
- E. Limitation on Approvals: The Architect/Engineer's approval to proceed with cutting and patching does not waive right to later require removal/replacement of work found to be cut-and-patched in an unsatisfactory manner, as judged by the Architect/Engineer.
- F. Materials marked to be removed and reused shall be repaired as necessary to maintain their existing condition. When repair is not sufficient, existing materials shall be disposed of and new materials installed to match existing materials.
- G. Refer to other sections of these specifications for specific cutting and patching requirements and limitations applicable to individual units of work.

- H. Unless otherwise specified, requirements of this Section apply to Mechanical and Electrical work. Refer to Divisions 15 and 16 for additional requirements and limitations on cutting and patching of mechanical and electrical work.

1.3 QUALITY ASSURANCE

- A. Refer to Section 01631, Products and Substitutions, for general provisions covering product selection, substitutions, material storage and installation.
- B. Refer to Section 01400, Quality Control Services, for provisions for testing and inspections.
- C. Refer to specific Specification Section covering subject in question for quality assurance requirements.

1.4 SUBMITTALS

- A. Issue submittals in accordance with Section 01300, Submittals.
- B. Refer to specific Specification Section covering subject in question for submittal requirements.

2. PRODUCTS

2.1 GENERAL

- A. Use materials for cutting and patching that are identical to existing materials. If identical materials are not available, or cannot be used, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials for cutting and patching that will result in equal-or-better performance characteristics.
- B. Fire-stopping:
 - 1. Seal openings in fire-rated walls and floors to make a tight fit with penetrating items, using appropriate non-combustible filler material. to provide a rating equivalent to wall/floor assemble.
 - 2. Acceptable filler materials include:
 - a. Concrete
 - b. Cementitious proprietary product: Zonolite Firestop ZF-1
 - c. Blanket-type mineral-fiber or ceramic-fiber insulation (glass-fiber insulation is not acceptable)
 - d. Fire-resistant sealant: Domtar Fire-Halt, Dow Corning Fire Stop, Hilti CS 240 Firestop, or Nelson CLK or CMP

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- e. Fire-resistant silicone foam: Dow Corning RTV Foam Penetration Seal System, Hilti CB 120 Adhesive Filling and Sealing Foam, Tremco Fyre-Sil
- f. Flexible intumescent strip wrapped around pipe penetrations: Dow Corning Fire Stop Intumescent Wrap, Hilti CS 24720 Intumescent Wrap, Nelson RSW, Tremco TREMstop WS
- g. Intumescent fibrous material enclosed in a polyethylene envelope: Nelson PLW, Tremco TREMstop PS
- h. Pliable intumescent putty: Nelson FSP Flameseal, Tremco TREMstop WBM
- i. Water-based intumescent fire-protective coating for electrical cables: Nelson CTG

- 3. Neatly patch and seal exposed-to-view openings, using sealants, tooled mortar joints, escutcheons, or flanged collars, as appropriate.

3. EXECUTION

3.1 INSPECTION

- A. Before cutting, examine surfaces to be cut and patched and conditions under which the work is to be performed. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the work.

3.2 TEMPORARY SUPPORT

- A. To prevent failure provide temporary support of work to be cut.

3.3 PROTECTION

- A. Protect other work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.4 PERFORMANCE

- A. Employ skilled workmen to perform cutting and patching work. Except as otherwise indicated or as approved by the Architect/Engineer, proceed with cutting and patching at the earliest feasible time and complete work without delay.
- B. Cutting:
 - 1. Cut the work using methods that are least likely to damage work to be retained or adjoining work. Provide dust barriers to prevent dust from entering existing building beyond immediate work area. Where possible, review proposed procedures with the original installer; comply with original installer's recommendations.

2. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut through concrete and masonry using a cutting machine such as a carborundum saw or core drill to insure a neat hole. Cut holes and slots neatly to size required with minimum disturbance of adjacent work. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces. Temporarily cover openings when not in use.
3. Comply with requirements of applicable sections of Division 2 where cutting and patching requires excavating and backfilling.
4. By-pass utility services such as pipe and conduit, before cutting, where such utility services are shown or required to be removed, relocated or abandoned. Cut-off conduit and pipe in walls or partitions to be removed. After by-pass and cutting, cap, valve or plug and seal tight remaining portion of pipe and conduit to prevent entrance of moisture or other foreign matter.

C. Patching:

1. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.
2. Where feasible, inspect and test patched areas to demonstrate integrity of work.
3. Restore exposed finishes of patched areas and where necessary extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and refinishing.
4. Where removal of walls or partitions extends one finished area into another finished area, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. If necessary to achieve uniform color and appearance, remove existing floor and wall coverings and replace with new materials.
5. Where patch occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime and base coat.
6. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

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3.5 MAINTENANCE OF TRAFFIC, ACCESS, AND UTILITIES

- A. Maintain accessibility from street at all times to any fire hydrants within construction area. Ensure that utilities serving adjacent buildings remain in service.

END OF SECTION

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SECTION 01300

SUBMITTALS, MEETINGS AND RECORD DOCUMENTS

1. GENERAL

1.1 PRE-CONSTRUCTION MEETING

A. Architect Owner and MaineHousing representative will schedule a pre-construction meeting within 15 days of issuance of Notice to Proceed, to be attended by the owner, all project managers, Contractor's field superintendent, and representatives of major sub-contractors. At this time, Contractor shall make specified pre-construction submittals including following:

1. Typed list of sub-contractors with addresses and telephone numbers.
2. Certificates of insurance.
3. Approved construction schedule. See General Conditions, Paragraph 3.10.
4. Schedule of values.
5. Start-up authorization or certificates.

B. Pre-construction meeting agenda will include following:

1. Processing application for payment.
2. Processing and distribution of submittals.
3. Maintenance of record documents.
4. Procedure for field changes, change estimates, change orders, etc.
5. Site and building security.
6. Location and maintenance of temporary storage areas, field offices, vehicular parking and access, waste disposal, etc.
7. Safety and first-aid procedures.
8. Date and time for regular monthly coordination and progress meeting (to be coordinated with monthly application for payment).
9. MaineHousing agenda

1.2 CONSTRUCTION SCHEDULE

- A. Refer to General Conditions, Paragraph 3.10, for general provisions concerning construction progress schedule. Schedule shall show activities, itemized according to specification Section, and be organized in bar-chart or graph form so as to show both projected and actual progress of work.
- B. Arrange schedule to indicate required sequencing of units, and to show time allowances for submittals, inspections, and similar time margins.

- C. Show critical submittal dates related to each time bar, or prepare a separate coordinated listing of critical submittal dates.
- D. Show phases of work within each time bar for major elements which involve purchase lead-time, fabrication, seasonal treatment, mockups, testing, or similar phases as well as installation.
- E. Submit updated schedule monthly, together with application for payment.

1.3 SCHEDULE OF VALUES

- A. Refer to General Conditions, Paragraph 9.2 for general provisions concerning schedule of values.
- B. For these submittals, use AIA Document G702/703, Application and Certificate for Payment.
- C. Use specifications Sections as listed in Table of Contents as basis for format for listing costs.
- D. Itemize separately general cost items, such as bonds and allowances.
- E. Itemize change orders separately as they are approved.

1.4 MEETINGS AND REPORTING

- A. Contractor shall conduct general progress and coordination meetings at least twice each month, attended by a representative of each primary entity engaged for performance of work. Record discussions and decisions, and distribute copies to those attending and others affected, including Architect/Engineer.
- B. Date and time of at least one regular monthly progress and coordination meeting shall be determined at the pre-construction meeting. Timing of this monthly meeting shall be coordinated with payment requests.

1.5 APPLICATION FOR PAYMENT

- A. Refer to General Conditions, Paragraph 9.3, for general provisions concerning applications for payment.
- B. Use AIA Form G702/703, fully completed and executed.
- C. Submit the forms in triplicate including attachment of waivers and similar documentation with one copy.

1.6 SHOP DRAWINGS, PROJECT DATA, SAMPLES

- A. Refer to General Conditions, Product Data and Samples, paragraph 3.12, for general provisions covering this type of submittal.
- B. Coordinate the preparation and processing of work-related submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities that require sequential activity. Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the necessity of reviewing a related submittal.
- C. Architect/Engineer Review:
 - 1. Allow ten working days for the Architect/Engineer's initial processing of each submittal. Allow one week for reprocessing each submittal. No extension of time will be authorized because of failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.
 - 2. The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked and executed to indicate the status of the submittal.
- D. Mark each submittal with a permanent label for identification. Provide project name, date, name of Architect/Engineer, name of Contractor, number and title of appropriate specification section and similar definitive information. Provide a space on the label for Contractors and Architect/Engineer's review markings.
- E. Package each submittal appropriately for transmittal and handling. Send each submittal from the Contractor to the Architect/Engineer and other destinations using AIA Transmittal Form G810.
- F. Provide additional copies of submittals required by governing authorities that are in addition to copies specified for submittal to the Architect/Engineer.
- G. Where it is necessary to provide intermediate submittals between the initial and final submittals, provide and process intermediate submittals in the same manner as for initial submittals.
- H. Submit as follows:
 - 1. Shop drawings (original drawings prepared by Contractor or sub-contractor illustrating fabrication, layout, erection details, etc.): six prints, or one reproducible transparency and one opaque print, to Architect.

2. Manufacturers' specifications, installation instructions, charts, schedules, catalogs, brochures, etc.: number of copies required by Contractor for distribution, plus one copy for Architect's retention.
 3. Samples: one sample to Architect only, unless otherwise specified.
 4. In submitting shop drawings and product data to Architect, use separate transmittals for material in different specification Sections, with applicable specification Section clearly numbered.
- I. Architect will review submittals within ten working days, measured from date of receipt by Architect until date of mailing. Contractor shall promptly make corrections and resubmit when so directed. Where submittal is marked "Approved as Noted" or similar, assume that all items are approved other than those to which specific exception is taken. Do not delay fabrication, assembly and delivery pending receipt of entirely "Approved" submittal.
 - J. Distribute approved submittals to job site and record document files, and to suppliers and sub-contractors as required. Samples not designated by Contractor for incorporation into Work shall be kept on file until job completion. Any sample not reclaimed within 30 days after job completion will be considered unclaimed, and will be disposed of as directed by Architect.

1.7 PROJECT RECORD DOCUMENTS

- A. Keep on file at job site one complete set of up-to-date Contract Documents, including drawings and specifications, addenda, shop drawings and product data, testing data, change orders, field orders, and other modifications. Documents shall be neatly and securely stored in files or on racks, clearly indexed by trade activity or specification Section, and shall not be used for construction purposes.
- B. Legibly mark significant field changes such as following, using colored pencils or felt-tipped pens:
 1. Drawings: locations of concealed utilities, field changes of dimension and detail, changes resulting from change order or field order, and details not on original drawings.
 2. Specifications: manufacturer and model number of equipment actually installed.
 3. Shop drawings and manufacturers' literature: changes made after Architect's review.

- C. At completion of Work, deliver completed record documents to Architect. Final payment for Project will not be made until Architect reviews and approves these documents.

1.8 SUBSTANTIAL COMPLETION

- A. Refer to General Conditions, Article 9, Substantial Completion, for general provision concerning substantial Completion.
- B. Following issuance by Architect/Engineer of Certificate of Substantial Completion, Contractor may submit special payment request, provided the following have been completed:
 - 1. Obtain permits, certificates of inspection and other approval and releases by governing authorities, required for Owner's occupancy and use of project.
 - 2. Submit warranties and similar documentation.
 - 3. Submit maintenance manuals and provide instruction of Owner's operational/maintenance personnel.
 - 4. Complete final cleaning of the work.
 - 5. Submit record documents.
 - 6. Submit listing of work to be completed before final acceptance.
- C. Following completion of the following requirements, final payment request may be submitted:
 - 1. Complete work listed as incomplete at time of substantial completion, or otherwise assure Owner of subsequent completion of individual incomplete items.
 - 2. Settle liens and other claims, or assure Owner of subsequent settlement.
 - 3. Submit proof of payment on fees, taxes and similar obligations.
 - 4. Transfer operational, access, security and similar provisions to Owner; and remove temporary facilities, tools and similar items.
 - 5. Completion of requirements specified in "Project Closeout" section.
 - 6. Obtain consent of surety for final payment.

END OF SECTION

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Section Includes:
 - 1. Submittal procedures.
 - 2. Product Data, Shop Drawings, and Samples.
 - 3. Assurance/Control submittals.
 - a. Certificates.
 - b. Manufacturer's installation instructions.
 - 4. Architect's action.
- B. Related Documents: The Contract Documents, as defined in Section 01110 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 SUBMITTALS

- A. Submit two copies of proposed Schedule of Submittals to Contracting Officer Representative within 30 days after receipt of Notice to Proceed. List all items require submittal for review and approval by Contracting Officer.
- B. Submit two copies of final Schedule of Submittals to Contracting Officer Representative within 2 days after receipt of proposed Schedule of Submittals review from Contracting Officer.
- C. Submit schedule on Contracting Officer approved form provided to Contractor by Contracting Officer Representative.
- D. Schedule of Submittals: Include the following.
 - 1. Indicate type of submittal; product data, shop drawing, sample, certificate, or other submittal.
 - 2. Identify by Specification Section number, Specification paragraph number where item is specified, and description of item being submitted.
 - 3. Indicate scheduled date for initial submittal, date for approval, and date for possible resubmittal for each submittal.
- E. Coordinate Schedule of Submittals with Construction Schedule. Revise and update Schedule of Submittals when required by changes in the Construction Schedule. Provide Contracting Officer Representative with updated schedules within 2 days of date schedule is revised.

1.3 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Contracting Officer accepted form. Submit 3 copies of each transmittal.
- B. Sequentially number transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- C. Identify Project, Lessor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
- E. Schedule submittals to comply with scheduling requirements of Construction Schedule
- F. For each submittal for review, allow 10 days excluding delivery time to and from the Contractor.
- G. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- H. Provide space for Contractor and Architect of Record review stamps.
- I. Revise and resubmit, identify all changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.
- K. Submittals not requested will not be recognized or processed.

1.4 PRODUCT DATA

- A. Product data includes printed information such as catalog cuts, manufacturer's published instructions, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, performance curves and other similar items.
- A. Submit the number of copies which the Contractor requires, plus two copies which will be retained by Contracting Officer Representative and Architect of Record.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Indicate Product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

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1.5 SHOP DRAWINGS

- A. Submit in the form of one reproducible transparency and one opaque reproduction.
- B. Shop Drawings: Submit for review. After review, produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article above.
- C. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.5 SAMPLES

- B. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- C. Submit samples of finishes in colors selected, textures, and patterns for Contracting Officer selection.
- D. Include identification on each sample, with full Project information.
- E. Submit the number of samples specified in individual specification sections; one of which will be retained by the Contracting Officer.

1.6 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer to Contracting Officer, 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 Contracting Officer.

1.7 MANUFACTURER INSTALLATION INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, to Contracting Officer Representative in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.8 CONTRACTING OFFICER ACTION

- A. For submittals where action and return is required or requested, Contracting Officer Representative will review each submittal, mark to indicate action taken, and return promptly; generally within 10 calendar days from date of receipt.
 - 1. Compliance with specified characteristics is the Lessor's responsibility.
 - 2. Submittals for information, closeout documents, record documents and other submittals for similar purposes, no action will be taken.

- B. Action Stamp: Architect of Record will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken.
 - 1. "Accepted": Final Unrestricted Release. Where submittals are marked "Accepted", that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 - 2. "Accepted as Noted": Final-But-Restricted Release. When submittals are marked "Accepted as Noted", that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 - 3. "Rejected: Submit Specified Item" or "Revise and Resubmit": Returned for Resubmittal. When submittal is marked "Rejected: Submit Specified Item", "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Rejected: Submit Specified Item" or "Revise and Resubmit," to be used at the Project site, or elsewhere where Work is in progress.
 - 4. "Returned - Not Required": Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Returned - Not Required".

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01400

QUALITY CONTROL SERVICES

1. GENERAL

1.1 DESCRIPTION

- A. Quality control services include inspections and tests performed by independent agencies and governing authorities, as well as by the Contractor.
- B. Inspection and testing services are intended to determine compliance of the work with requirements specified.
- C. Specific quality control requirements are specified in individual specification sections.

1.2 RESPONSIBILITIES

- A. Except where indicated as being the Owner's responsibility, quality control services are the Contractor's responsibility, including those specified to be performed by an independent agency and not by the Contractor.
- B. The Contractor shall employ and pay an independent agency, testing laboratory or other qualified firm to perform quality control services specified.
- C. The Owner will engage and pay for services of an independent agency to perform the inspections and tests that are specified as Owner's responsibilities.
- D. Where results of inspections or tests do not indicate compliance with contract document, retests are the Contractor's responsibility.
- E. The Contractor shall cooperate with independent agencies performing inspections or tests. Provide auxiliary services as are reasonable. Auxiliary services include:
 - 1. Provide access to the work.
 - 2. Assist taking samples.
 - 3. Deliver samples to test laboratory.

1.3 COORDINATION

- A. The Contractor and independent test agencies shall coordinate the sequence of their activities. Avoid removing and replacing work to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections and tests.

1.4 QUALIFICATIONS FOR SERVICE AGENCIES

- A. Engage inspection and test service agencies which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories.
- B. Each agency shall be employed with the approval of the Architect/Engineer.

1.5 SUBMITTALS

- A. Notify the Architect/Engineer of the testing schedule.
- B. Submit a certified written report of each inspection test or similar service, in duplicate to the Architect/Engineer. Submit additional copies of each report to governing authority, when the authority so directs.

1.6 REPORT DATA

- A. Written inspection or test reports shall include:
 - 1. Name of testing agency or test laboratory.
 - 2. Dates and locations of samples, tests or inspections.
 - 3. Names of individuals present.
 - 4. Complete inspection or test data.
 - 5. Test results.
 - 6. Interpretations.
 - 7. Recommendations.
- B. Reports shall be provided to the Architect/Engineer in a timely manner.

1.7 REPAIR AND PROTECTION

- A. Upon completion of inspection or testing repair damaged work and restore substrates and finishes. Comply with requirements for "Cutting and Patching".

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

1. GENERAL

1.1 DESCRIPTION OF REQUIREMENTS: Provide temporary services and facilities ready for use when first needed to avoid delay in the work. Maintain, expand and modify as needed. Do not remove until no longer needed, or replaced by authorized use of permanent facilities.

1.2 USE CHARGES: Usage charges for temporary services or facilities are not chargeable to the Owner or Architect/Engineer.

1.3 REGULATIONS: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities.

1.4 STANDARDS: Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services".

1.5 INSPECTIONS: Inspect and test each service before placing temporary utilities in use. Arrange for inspections and tests by governing authorities, and obtain certifications and permits for use.

1.6 SUBMITTALS: Submit copies of reports and permits required or necessary for installation and operation, including reports of tests, inspections and meter readings performed on temporary utilities, and permits and easements necessary for installation, use and operation.

1.7 MATERIALS AND EQUIPMENT

A. Provide materials and equipment that are suitable for the intended use.

B. Provide new materials and equipment for temporary services and facilities; if acceptable to the Architect/Engineer, used materials and equipment that are undamaged may be used.

1.8 INSTALLATION

A. Use qualified tradesmen for installation.

B. Locate temporary services and facilities where they will serve the project adequately and result in minimum interference with the work.

1.9 TEMPORARY UTILITY INSTALLATION

- A. Engage, or make arrangements if necessary with, the local utility company to make connections to existing service.
- B. Arrange with the companies and existing users for an acceptable time when service can be interrupted to make connections.
- C. Establish a service implementation and termination schedule. As early as possible change to use of permanent service, to enable removal of the temporary utility and eliminate possible interference with completion of the work.
- D. Provide adequate capacity at each stage of construction. Prior to availability at the site, provide, trucked-in services for start up of construction operations.
- E. Obtain and pay for easements required to bring temporary utilities to the site, where the Owner's easement cannot be utilized for that purpose.

1.10 ELECTRIC POWER SERVICE

- A. Coordinate with Owner to use existing electrical service during construction.
- B. Comply with applicable requirements of NEMA, NECA and UL standards and governing regulations.
- C. Install temporary lighting of adequate illumination levels to perform the work specified.
- D. Comply with NEC pertaining to installation of temporary wiring service and grounding. Provide meters, transformers, and overcurrent protective devices at main distribution panel for power and light circuitry. Provide disconnects for equipment circuits.

1.11 POWER DISTRIBUTION SYSTEM

- A. Provide circuits of proper sizes, characteristics, and ratings for each use indicated.
- B. Install wiring overhead, and risers vertically where least exposed to damage.
- C. Provide rigid steel conduit to protect wiring on grade, floors, decks or other areas exposed to possible damage.
- D. Provide 20 amp, 4-gang receptacle outlets, equipped with ground-fault circuit interrupters, reset button and pilot light, spaced that a 100 foot extension cord can reach each area of work. Use only grounded extension cords; use "hard- service" cords where exposed to abrasion and traffic.

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- E. Provide warning signs at power outlets that are other than 110/120 volt. Provide outlets of proper NEMA configuration to prevent insertion of 110/120 volt plugs into higher voltage outlets.

1.12 TEMPORARY LIGHTING

- A. Provide general service incandescent lamps of wattage required for adequate illumination.
- B. Protect lamps with guard cages or tempered glass enclosures, where exposed to breakage.
- C. Provide exterior type fixtures where exposed to weather or moisture.
- D. Provide one 200-watt incandescent lamp per 1000 square feet of floor area for general construction lighting, one 100-watt incandescent lamp every 50 feet in corridors, and one lamp per story, located to illuminate each landing and flight in stairways.
- E. Install temporary lighting to fulfill security and protection requirements, without having to operate the entire temporary lighting system.

1.13 TEMPORARY TELEPHONES

- A. Install telephone for each temporary office and first aid station.
- B. At each telephone location post a list of operational and emergency telephone numbers.

1.14 TEMPORARY HEAT

- A. Provide temporary heat where needed for performance of work, for curing or drying of recently installed work or for protection of work in place from adverse effects of low temperatures or high humidity.
- B. Provide UL or FM tested and labeled heating units known to be safe and without adverse effect upon work in place or being installed. Coordinate with ventilation requirements to produce the ambient condition.
- C. Maintain a minimum temperature of 45 deg. F (7 deg. C) in permanently enclosed portions of the building and areas where finished work has been installed.
- D. Except where use of the permanent heating system is available and authorized, provide properly vented self-contained LP gas or fuel oil heaters with individual space thermostatic control for temporary heat. Do not use open burning or salamander type heating units.

1.15 FIELD OFFICES

- A. Provide standard prefabricated or mobile units, or the equivalent job-built field offices of sufficient size to accommodate required office personnel at the site.
- B. Provide insulated, weathertight units with lockable entrances.
- C. Provide vented space heater, capable of maintaining an indoor temperature of 68 deg. F (20 deg. C).

1.16 SANITARY FACILITIES

- A. Sanitary facilities include temporary toilets.
- B. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities.
- C. Supply toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility. Provide covered waste containers for used material.
- D. Install single occupant self-contained toilet units of the chemical, aerated recirculation or combustion type, properly vented and fully enclosed with glass fiber reinforced polyester shell. Use of pit-type privies will not be permitted.
- E. Provide separate toilet facilities for male and female construction personnel.
- F. Provide drinking water fountains where and when piped potable water, approved by local authorities, is reasonably accessible from permanent or temporary lines. Otherwise, provide containerized tap-dispenser bottled-water type drinking water units.

1.17 FIRST AID SUPPLIES: Comply with governing regulations and recognized recommendations within the construction industry.

1.18 DEWATERING FACILITIES AND DRAINS

- A. For temporary drainage and dewatering facilities and operations not directly associated with performance of work included under other sections, comply with dewatering requirements of applicable Division-2 sections. Where feasible, utilize the same facilities.
- B. Maintain the site, excavations and construction free of water.
- C. Dispose of rainwater in a lawful manner which will not result in flooding and project or adjoining property, nor endanger either permanent work or temporary facilities.

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1.19 TEMPORARY ENCLOSURE

- A. Provide temporary enclosure of materials, equipment, work in progress and completed portions of the Work to provide protection from exposure, foul weather, other construction operations, and similar activities.
- B. Provide enclosures where temporary heat is needed and the permanent building enclosure is not completed, and there is no other provision for containment of heat. Coordinate with ventilating and material drying or curing requirements to avoid dangerous conditions.
- C. Provide temporary enclosures by installing waterproof, fire- resistant, UL labeled tarpaulins with a flame-spread rating of 15 or less, using a minimum of wood framing. Use translucent nylon reinforced laminated polyethylene tarpaulins to admit the maximum amount of daylight. Individual openings of 25 square feet or less may be closed with plywood or similar materials.
- D. Close openings through the floor or roof decks and other horizontal surfaces with substantial load-bearing wood-framed or similar construction.

1.20 COLLECTION AND DISPOSAL OF WASTES

- A. Establish a system for daily collection and disposal of waste materials. Do not hold collected materials longer than 7 days.
- B. Handle waste materials that are hazardous, dangerous, or unsanitary separately from other waste by containerizing.
- C. Burying or burning of waste materials on the site or washing waste material down sewers will not be permitted.
- D. Waste management recycling per MaineHousing Green Standards.

1.21 MISCELLANEOUS SERVICES AND FACILITIES

- A. Contractor required to provide waste management recycling plan and provide reports.
- B. Design, construct, and maintain miscellaneous services and facilities as needed to accommodate performance of the work, including temporary stairs, ramps, ladders, staging, shoring, scaffolding, temporary partitions, waste chutes and similar items.

1.22 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Provide a neat and uniform appearance in security and protection facilities acceptable to the Architect/Engineer and the Owner.
- B. Maintain site in a safe, lawful and publicly acceptable manner.
- C. Take necessary measures to prevent erosion.
- D. Except for utilization of permanent fire protection facilities, as soon as available, do not change over to use of permanent facilities until substantial completion.

1.23 TEMPORARY FIRE PROTECTION

- A. Until fire protection needs may be fulfilled by permanent facilities, install and maintain temporary fire protection of the types needed to protect against losses.
- B. Comply with recommendations of NFPA Standard 10.
- C. Locate fire extinguishers where most effective; provide not less than one on each floor at or near each stairwell.
- D. Provide type "A" fire extinguishers for temporary offices and spaces where there is minimal danger of electrical or flammable liquid fires, and type "ABC" dry chemical extinguishers elsewhere.
- E. Store combustible materials in containers in fire-safe locations.
- F. Review fire prevention and protection needs with local fire department officials and establish procedures to be followed in the event of fire. Instruct personnel in procedures and post warnings and information.
- G. Maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways and other access routes.
- H. Prohibit smoking in hazardous areas.
- I. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of ignition.
- J. At temporary water outlets provide hoses of sufficient length to reach construction areas. Hang hoses with a warning sign, indicating that hoses are for fire protection purposes and are not to be removed.
- K. At the earliest feasible date complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel at the site on how to use facilities which may not be self-explanatory.

1.24 BARRICADES, WARNING SIGNS AND LIGHTS

- A. Comply with recognized standards and code requirements for erection of substantial, barricades where needed to prevent accidents.
- B. Paint with appropriate colors and warning signs to inform personnel at the site and the public, of the hazard being protected against.
- C. Provide lighting where needed, including flashing red lights where appropriate.

1.25 SECURITY ENCLOSURE AND LOCKUP: Where materials and equipment must be temporarily stored, and are of substantial value or attractive for possible theft, provide a secure lockup.

1.26 ENVIRONMENTAL PROTECTION

- A. Conduct construction activities, and by methods that comply with environmental regulations, minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result from the performance of work at the site.
- B. Avoid the use of tools and equipment which produce harmful noise.
- C. Restrict the use of noise making tools and equipment to hours of use that will minimize complaints.

1.27 OPERATION, TERMINATION AND REMOVAL

- A. Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse. Do not permit temporary installations to be abused or endangered.
- B. Operate and maintain temporary services and facilities in good operating condition and in a safe and efficient manner until removal is authorized. Do not overload services or facilities. Protect from damage by freezing temperatures and similar elements.
- C. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.
- D. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24- hour basis where required to achieve indicated results and avoid the possibility of damage to the Work or to temporary facilities.

- E. Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation.
- F. Remove each temporary service and facility promptly when need has ended, or when replaced by use of a permanent facility, but no later than substantial completion. Complete, or, if necessary, restore permanent work delayed because of interference with the temporary service or facility. Repair damaged work, clean exposed surfaces and replace work which cannot be repaired.
- G. At substantial completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during the construction period.

END OF SECTION

SECTION 01631

PRODUCTS AND SUBSTITUTIONS

1. GENERAL

1.1 PROCEDURAL REQUIREMENTS

A. Source Limitations:

1. To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work. Where it is not possible to do so, match separate procurements as closely as possible.
2. To the extent that the product selection process is under the Contractor's control, provide products that are compatible with previously selected products.
3. Where standard products are available that comply with specified requirements, provide those standard products that have been used successfully before in similar applications, and that are recommended by the manufacturers for the applications indicated.

1.2 PRODUCT SELECTION LIMITATIONS

A. Product Selections: Comply with the following requirements in the selection of products, materials and equipment:

1. Single Product Name: Where only a single product or manufacturer is named, provide the product, unless it is not available, is incompatible with existing work, or does not comply with specified requirements or governing regulations.
2. Two or More Products Named: Where two or more products or manufacturers are named, the selection is at the Contractor's option, provided the product selected complies with specified requirements.
3. "Or Approved Equal" Provisions: Where products or manufacturers are specified by name accompanied by the term "or approved equal", provide either the product named, or comply with the requirements for gaining approval of "substitutions" for the use of an unnamed product.
4. Compliance with Standards: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting any product that complies with specified requirements provided no product names are indicated.

5. Performance Requirements: Where the specifications require compliance with indicated performance requirements, the Contractor has the option of selecting any product that complies with the specific performance requirements, provided no product names are indicated.
 6. Visual Requirements: Where the specifications indicate that a product is to be selected from the manufacturer's standard options, without naming the manufacturer, the Architect/Engineer has the option of making the selection, after the Contractor has determined or selected the manufacturer.
- B. Nameplates: Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project.

1.3 SUBSTITUTIONS

- A. Conditions: The Contractor's requests for substitutions will be considered when they are reasonable, timely, fully documented, and when they qualify under one or more of the following circumstances.
1. The proposed substitution is related to an "or approved equal" or similar provision in the contract documents.
 2. The required product cannot be supplied in time for compliance with Contract Time requirements.
 3. The required product is acceptable to governing authorities.
 4. The required product cannot be properly coordinated with other materials in the work, or cannot be warranted or insured as specified.
 5. The proposed substitution will offer a substantial advantage to the Owner after deducting offsetting disadvantages including delays, additional compensation to the Architect/Engineer for redesign, evaluation and other necessary services, and similar considerations.
- B. Submittals: Include the following information, as appropriate, in each request for substitution:
1. Provide complete product documentation, including product data and samples, where appropriate.

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2. Provide detailed performance comparisons and evaluation, including testing laboratory reports where applicable.
3. Provide coordination information indicating the effect of the substitution on other work and the time schedule.
4. Provide cost information for the proposed change order.
5. Provide the Contractor's general certification of the recommended substitution.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Receive, store and handle products, materials and equipment in a manner which will prevent loss, deterioration and damage.
- B. Schedule deliveries so as to minimize long-term storage at the project site.

END OF SECTION



SECTION 01700

PROJECT CLOSEOUT

1. GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. Provisions of this section apply to the procedural requirements for the actual closeout of the Work, not to administrative matters such as final payment or the change over of insurance.
- B. Closeout requirements relate to both substantial and final completion of the Work; they also apply to individual portions of completed work as well as the total Work.
- C. Specific requirements contained in other sections have precedence over the general requirements contained in this section.

1.2 PROCEDURES AT SUBSTANTIAL COMPLETION

- A. Prerequisites: Comply with General Conditions and complete the following before requesting Architect's/Engineer's inspection of the Work, or a designated portion of the Work, for certification of substantial completion.
 - 1. Submit executed warranties, workmanship bonds, maintenance agreements, inspection certificates and similar required documentation for specific units of work, enabling owner's unrestricted occupancy and use.
 - 2. Submit record documentation, maintenance manuals, tools, spare parts, keys and similar operational items.
 - 3. Complete instruction of Owner's operating personnel, and start-up of systems.
 - 4. Complete final cleaning, and remove temporary facilities and tools.
- B. Inspection Procedures:
 - 1. Upon receipt of Contractor's request, Architect/Engineer will either proceed with inspection or advise Contractor of prerequisites not fulfilled.
 - 2. Following initial inspection, Architect/Engineer will either prepare certificate of substantial completion, or advise Contractor of work which must be performed prior to issuance of the certificate of substantial completion.

3. The Architect/Engineer will repeat the inspection when requested and assure that the Work has been substantially completed.
4. Results of the completed inspection will form the initial "punch-list" for final acceptance.

1.3 PROCEDURES AT FINAL ACCEPTANCE

A. Reinspection Procedure:

1. The Architect/Engineer will reinspect the Work upon receipt of the Contractor's notice that, except for those items whose completion has been delayed due to circumstances that are acceptable to the Architect/Engineer, the Work has been completed, including punch-list items from earlier inspections.
2. Upon completion of reinspection, the Architect/Engineer will either recommend final acceptance and final payment, or will advise the Contractor of work not completed or obligations not fulfilled as required for final acceptance. If necessary, this procedure will be repeated.

1.4 RECORD DOCUMENTATION

A. Record Drawings:

1. Maintain a complete set of either blue- or black-line prints of the contract drawings and shop drawing for record mark-up purposes throughout the Contract Time.
2. Mark-up these drawings during the course of the work to show both changes and the actual installation, in sufficient detail to form a complete record for the Owner's purposes. Give particular attention to work which will be concealed and difficult to measure and record at a later date, and work which may require servicing or replacement during the life of the project.
3. Require the entities marking prints to sign and date each mark-up.
4. Bind prints into manageable sets, with durable paper covers, appropriately labeled.

B. Maintenance Manuals:

1. Provide 3-ring vinyl-covered binders containing required maintenance manuals, properly identified and indexed.

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2. Include operating and maintenance instructions extended to cover emergencies, spare parts, warranties, inspection procedures, diagrams, safety, security, and similar appropriate data for each system or equipment item.

1.5 GENERAL CLOSEOUT REQUIREMENTS

- A. Operator Instructions: Require each Installer of systems requiring continued operation and maintenance by owner's operating personnel, to provide on-location instruction to Owner's personnel, sufficient to ensure safe, secure, efficient, non-failing utilization and operation of systems. Provide instructions for the following categories of work:
 1. Mechanical/electrical/electronic systems (not limited to work of Divisions 15 and 16).
 2. Live plant materials and lawns.
 3. Roofing, flashing, joint sealers.
 4. Floor finishes.
- B. Final Cleaning: At the time of project close out, clean or reclean the Work to the condition expected from a normal, commercial building cleaning and maintenance program. Complete the following cleaning operations before requesting the Architect/Engineer's inspection for certification of substantial completions.
 1. Remove non-permanent protection and labels.
 2. Polish glass.
 3. Clean exposed finishes.
 4. Touch-up minor finish damage.
 5. Clean or replace mechanical systems filters.
 6. Remove debris.
 7. Broom-clean unoccupied spaces.
 8. Sanitize plumbing and food service facilities.
 9. Clean light fixtures and replace burned-out lamps.
 10. Sweep and wash paved areas.
 11. Police yards and grounds

END OF SECTION



SECTION 01810

COMMISSIONING

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 Investment Engineering are utilized to achieve this.
 - 3. Verify that operation and maintenance manuals submitted to Maine Workforce Housing are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
 - 4. Verify that the Maine Workforce Housing's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.
- B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion
- C. Investment Engineering directs and coordinates all commissioning activities; this section describes some but not all of Investment Engineering's responsibilities.
- D. Investment Engineering is employed by Maine Workforce Housing.

1.02 SCOPE OF COMMISSIONING

- A. The following are to be commissioned:
- B. Plumbing Systems:
 - 1. Water heaters.
 - 2. Booster pumps.
- C. Building air tightness and sealing
 - 1. Blower Door testing
 - 2. Maximum building envelope leakage is not to exceed 0.25 cubic feet per minute per square foot at 50 pascals negative pressure (0.25 CFM/SF@50PA).
- D. HVAC System, including:
 - 1. Major and minor equipment items.
 - 2. Piping systems and equipment.
 - 3. Control system.
 - 4. Vibration control devices.
 - 5. Variable frequency drives.
- E. Electrical Systems:
 - 1. Emergency power systems if required.
 - 2. Lighting controls other than manual switches.
- F. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 RELATED SECTIONS

- A. Section 01815 - Investment Engineering Responsibilities.

1.04 REFERENCES

- A. PEI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests; Portland Energy Conservation, Inc.; located at <http://www.peci.org/library/mcpgs.htm>; current edition or approved alternate forms generated and provided by Investment Engineering.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures; except:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to Investment Engineering, unless they require review by Archetype, PA; in that case, submit to Archetype, PA first.
 - 2. Submit one copy to Investment Engineering, not to be returned.
 - 3. Make commissioning submittals on time schedule specified by Investment Engineering.
 - 4. Submittals indicated as "Draft" are intended for the use of Investment Engineering 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 Archetype, PA are approved, submit copy of approved submittal to Investment Engineering.
- 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 Archetype, PA 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 Maine Workforce Housing'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 Maine Workforce Housing.
- 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 Maine Workforce Housing; such equipment, tools, and instruments are to become the property of Maine Workforce Housing.

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- D. Blower door testing
- E. 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 Investment Engineering and will not become the property of Maine Workforce Housing.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

- A. Investment Engineering has prepared the Commissioning Plan.
 - 1. Attend meetings called by Investment Engineering 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 Investment Engineering 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 Investment Engineering for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 DOCUMENTATION IDENTIFICATION SYSTEM

- A. Give each submitted form or report a unique identification; use the following scheme.
- B. Type of Document: Use the following prefixes:
 - 1. Startup Plan: SP-
 - 2. Startup Report: SR-
 - 3. Prefunctional Checklist: PC-
 - 4. Functional Test Procedure: FTP-
 - 5. Functional Test Report: FTR-
- C. System Type: Use the first 4 digits from CSI/CSC MasterFormat, 2004 Edition, that are applicable to the system; for example:
 - 1. 2300: HVAC system as a whole.
 - 2. 2320: HVAC Piping and Pumps.
 - 3. 2330: HVAC Air Distribution.

- D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.
- E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.
- F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

3.03 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 Investment Engineering.

3.04 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 except for room control (IE thermostats and or zone controls) where as, a representative sampling will be commissioned.
 - 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. Commissioning agent is responsible for filling out Prefunctional Checklists, after completion of installation and before startup.
 - 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 correction provided the Contractor. 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 Investment Engineering within two days of completion.
- C. Investment Engineering is responsible for furnishing the Prefunctional Checklists.
 1. Provide all additional information to aid in preparation for functional testing. Such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
 2. Investment Engineering may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.
 3. When asked to review the proposed Checklists, do so in a timely manner.
- D. Investment Engineering 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 Maine Workforce Housing.
 1. If difficulty in correction would delay progress, report deficiency to Investment Engineering immediately.

3.05 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. Investment Engineering 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 Maine Workforce Housing; if a deficiency is not corrected and re-tested immediately, Investment Engineering 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 Investment Engineering; Investment Engineering 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 Maine Workforce Housing and Investment Engineering personnel time witnessing re-testing.
- 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 Investment Engineering 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 Investment Engineering 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.

3.06 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 Maine Workforce Housing 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.

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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. Flow Rate, Air: 10 percent of design.
 7. Flow Rate, Water: 4 percent of design.
 8. 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.

3.07 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, Investment Engineering 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 Investment Engineering's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
 2. Other points will be monitored by Investment Engineering using dataloggers.
 3. At the option of Investment Engineering, 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.

3.08 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01780 for additional requirements.
- B. Add design intent documentation furnished by Archetype, PA to manuals prior to submission to Maine Workforce Housing.
- C. Submit manuals related to items that were commissioned to Investment Engineering for review; make changes recommended by Investment Engineering.
- D. Investment Engineering will add commissioning records to manuals after submission to Maine Workforce Housing.

END OF SECTION

SECTION 01815

INVESTMENT ENGINEERING RESPONSIBILITIES

PART 1 GENERAL

1.01 SUMMARY

- A. Commissioning is intended to achieve the following specific objectives; this section covers Investment Engineering'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 are utilized to achieve this.
 - 2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests performed by Contractor and witnessed by Investment Engineering are utilized to achieve this.
 - 3. Verify that operation and maintenance manuals submitted to Maine Workforce Housing are complete: Detailed O&M data submittals are specified.
 - 4. Verify that the Maine Workforce Housing's operating personnel are adequately trained: Formal training conducted by Contractor is specified.
- B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.
- C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

1.02 SCOPE OF COMMISSIONING

- A. The following are to be commissioned:
- B. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 REFERENCES

- A. ASHRAE Guideline 1 - The HVAC Commissioning Process; 1996
- B. PECI (MCP) - Model Commissioning Plan; Portland Energy Conservation, Inc.; located at <http://www.peci.org/library/mcpgs.htm>; current edition.

1.04 SUBMITTALS

- A. Commissioning Plan:
 - 1. Submit preliminary draft for review by Maine Workforce Housing and Archetype, PA within 30 days after commencement of Investment Engineering contract.
 - 2. Submit revised draft to be included in the construction contract documents, not less than 4 weeks prior to bid date.
 - 3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.
- B. List of Prefunctional Checklists to be developed:
 - 1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
 - 2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
 - 3. Submit final list not more than 60 days after start of construction.

- C. Prefunctional Checklists:

1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
 2. Submit revised draft for review by Maine Workforce Housing and Archetype, PA not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
 3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.
- D. List of Functional Test procedures to be developed:
1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
 2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the Contract Documents; this is intended to be a list of titles, not full description of the tests.
 3. Submit final list not more than 60 days after start of construction.
- E. Functional Test Procedures:
1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
 2. Submit revised draft for review by Maine Workforce Housing and Archetype, PA not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
 3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.
- F. Training Plan.
- G. Commissioning Record: Submit to Contractor for inclusion with O&M manuals.
- H. Final Commissioning Report: Submit to Maine Workforce Housing.
- I. Recommissioning Manual: Submit within 60 days after receipt of Maine Workforce Housing's instructions to proceed with preparation.

PART 3 EXECUTION

2.01 COMMISSIONING PLAN

- A. Prepare and maintain the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.
1. Call and chair meetings of the Commissioning Team when appropriate.
 2. Give Contractor sufficient notice for scheduling commissioning activities.
 3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
 4. The PECE Model Commissioning Plan may be used as a guide for the Commissioning Plan.
 5. ASHRAE Guideline 1 may be used as a guide for the Commissioning Plan.
 6. Avoid replication of information included in the construction contract documents to the greatest extent possible.
- B. Review the construction contract documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of Investment Engineering in preparing the Commissioning Plan.
- C. Commissioning Schedule:
1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
 2. Contractor's scheduling responsibilities are specified in the construction contract documents.
 3. Revise and re-issue schedule monthly.
 4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.

2.02 CONSTRUCTION CONTRACT DOCUMENTS

- A. General Commissioning Specifications: Archetype, PA has prepared general commissioning specifications for inclusion in the construction contract documents; review and submit comments to Maine Workforce Housing.
 1. These specifications include:
 - a. Procedures applicable to all types of items to be commissioned.
 - b. Prepare specifications for any of the following that would be recommended, for incorporation into the construction contract documents by Archetype, PA:
 - a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.
 - b. Additional Maine Workforce Housing personnel training.
 - c. Additional operation or maintenance data that should be submitted.
 2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction contract documents by Archetype, PA:
 - a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.
 - b. Additional Maine Workforce Housing personnel training.
 - c. Additional operation or maintenance data that should be submitted.
- B. Prefunctional Checklists: Develop detailed Checklists for each item to be commissioned.
 1. List of Checklists to be Developed: Prepare and maintain a detailed list of titles, not full text.
 2. The Checklist forms are intended to be part of the Contractor's Contract Documents.
- C. Functional Testing: Develop detailed procedures for each item to be commissioned; submit for review by Maine Workforce Housing and Archetype, PA.
 1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.
 2. The forms Investment Engineering will use to report Functional Test results are not intended to be part of Contractor's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.
- D. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction contract documents.
- E. If any part of the documents described above have not been developed by the bid date, coordinate with Archetype, PA the issuance of modifications to the construction contract documents

2.03 PREFUNCTIONAL CHECKLISTS

- A. Prefunctional Checklists - Content: Prepare forms for Contractor's use, in sufficient detail to document that the work has been installed in accordance with the Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup.
 1. Prepare separate Checklists for each type of equipment, system, or other assembly, customized to the item.
 2. Identify each Checklist by using the contract documents identification number or name, if any; if none, create unique identifiers for each Checklist; do not rely on Contractor to number checklists.
 3. Multiple identical or near-identical items may appear on a single Checklist provided there is space to record all required data for each separately; label each set of data uniquely.
 4. Include space to record manufacturer name, model number, serial number, capacity and other relevant characteristics, and accessories and other features as applicable; include space to record "as specified", "as submitted", and "as installed" data.
 5. Include space to record whether or not the required submittals have been received; list each separate type of submittal.
 6. Include line items for each physical inspection to be performed.
 7. Include line items for each operational inspection to be performed, such as checking switch

- operation, fan rotation, valve and damper stroke, and measuring actual electrical loads.
 8. Include separate section for sensors and actuators, with space for documenting actual physical location and calibration measurements; provide a separate generic calibration checklist identified wherever referenced.
 9. Include spaces to record that related Checklists for related work upon which this work depends have been completed.
- B. Prefunctional Checklists - Format:
1. Provide a cover sheet showing name of equipment item or system, documentation identification number (see Documentation Identification Scheme), names of accessory components involved, and identification of related checklists.
 2. Include on cover sheet space for Contractor's use in attesting to completeness; provide spaces for the signatures of the general contractor and each subcontractor or other entity responsible, customized to the project and the type of item.
 3. Include on the cover sheet, above the signature block, the following statement: "The work referenced in this Checklist and other work integral to or dependent on this work is complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event." Include two checkboxes:
 - a. "This Checklist is submitted for approval with no exceptions."
 - b. "This Checklist is submitted for approval, subject to the attached list of outstanding items, none of which preclude the performance of safe and reliable functional tests. A statement of completion will be submitted upon completion of the outstanding items."
 4. Use a consistent, tabular format for all Checklists, with one line per checklist activity.
 5. For each line item, provide space for initials and date, and identification of the subcontractor or other entity responsible.

2.04 FUNCTIONAL TEST PROCEDURES

- A. Develop test procedures in sufficient detail to show that functional performance is in accordance with the Contract Documents and shows proper operation through all modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part-and full-load.
1. Obtain assistance and review by installing subcontractors.
 2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
 3. Include test setup instructions, description of tools and apparatus, special cautions, and.
 4. Avoid procedures that would void or otherwise limit warranties; review with Contractor prior to execution.
 5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.
 6. Obtain explicit approval of Contractor in regard to feasibility and safety prior to execution.
- B. Functional Test Report Forms: Prepare forms in advance of testing, using a consistent format; include all test procedure information given to Contractor and:
1. Report Identifier (see Documentation Identification Scheme).
 2. Test prerequisites.
 3. Formulas to be used in calculations.
 4. Yes/No check boxes for each step of test.
 5. Space to record results, document deficiencies, and make recommendations.
 6. Signature and date block for Investment Engineering.

- C. Functional Test Prerequisites: Include space to verify all of the following items on each Functional Test Report Form, unless truly inapplicable:
1. All related equipment has been started up and start-up reports and Prefunctional Checklists submitted and approved ready for Functional Testing.
 - a. For hydronic systems, check that:
 - 1) Piping system flushing is complete and required report approved.
 - 2) Water treatment system is complete and operational.
 - 3) Test and balance (TAB) is complete and approved.
 2. All control system functions for this and all interlocking systems are programmed and operable in accordance with the Contract Documents, including final set points and schedules with debugging, loop tuning and sensor calibrations completed, with space for signature of controls installer.
 3. Incomplete items identified by Archetype, PA during closeout inspections have been corrected or completed.
 4. Safeties and operating ranges have been reviewed.
 5. A copy of the specified sequence of operation is attached.
 6. A copy of applicable schedules and setpoints is attached.
 7. A copy of the specified Functional Test Procedures is attached.
 8. The Functional Test Procedures have been reviewed and approved by the applicable installer.
 9. Vibration control report approved (if required).
 10. False loading equipment, system and procedures ready.
 11. Sufficient clearance around equipment for servicing.
 12. Original values of pre-test setpoints that need to be changed to accommodate testing have been recorded, with a check box provided to verify return to original values (include control parameters, limits, delays, lockouts, schedules, etc.).
 13. Any other items on the Prefunctional Checklist or Start-up Reports that need to be re-verified.

2.05 CONSTRUCTION PHASE

- A. Coordinate the commissioning work with Contractor and Construction Manager, ensure that commissioning activities are being incorporated into the master schedule.
- B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.
- C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review commissioning activities and responsibilities with all parties involved. Require attendance by all members of the Commissioning Team.
- D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and Maine Workforce Housing personnel; hold meetings at least monthly.
- E. Submit periodic progress reports to Maine Workforce Housing and Contractor.
- F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that Maine Workforce Housing's responsibilities are clearly defined in warranties.
- G. Review and approve submittals directly related to commissioning.
- H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor.

- I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.
- J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.
- K. Coordinate, witness and approve Functional Tests performed by Contractor. Coordinate retesting until satisfactory performance is achieved.
- L. HVAC Commissioning:
 - 1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
 - 2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
 - 3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
 - 4. Review TAB Plan prepared by Contractor.
 - 5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.
 - 6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.
 - 7. Analyze trend logs and monitoring data to verify performance.
- M. Witness and document testing of systems and components over which Investment Engineering does not have direct control, such as smoke control systems, tests contracted directly by Maine Workforce Housing, and tests by manufacturer's personnel; include documentation in O&M manuals.
- N. Perform Functional Testing for systems and equipment so specified, without assistance of Contractor.
- O. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.
- P. O&M Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.
- Q. Notify Contractor and Maine Workforce Housing of deficiencies in procedures or results; suggest solutions.

2.06 TRAINING

- A. Training Plan: Prepare a comprehensive Training Plan, incorporating draft training plans submitted by Contractor.
 - 1. Include a ____ hour session by the HVAC design engineer covering the overall HVAC system and equipment design concepts, with one-line schematic drawings.
 - 2. Include a ____ hour session by Investment Engineering on the use of the blank Prefunctional Checklists and Functional Test report forms for re-commissioning purposes.
 - 3. Establish criteria for determining satisfactory completion of training.
- B. Verify that training was satisfactorily completed; provide formal approval if satisfactory.

2.07 CLOSEOUT

- A. Commissioning Record: Use the same format and organization as specified for the O&M manuals.
 - 1. Include the Final Commissioning Plan and Final Report.
 - 2. For each product or system and equipment item, include the following organized as

indicated, with separator tabs:

- a. Design intent documentation, furnished by Archetype, PA or others.
 - b. Detailed operational sequences.
 - c. Startup plan and approved startup reports.
 - d. Filled out Prefunctional Checklists.
 - e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.
 - f. Training plan and training records.
 - g. Recommissioning recommendations, including time schedule and procedures; include blank copies of all Prefunctional Checklists and Functional Test report forms.
- B. Final Commissioning Report: Include:
1. Executive summary.
 2. List of participants and roles.
 3. Brief facility description.
 4. Overview of commissioning scope and general description of testing and verification methods.
 5. For each item commissioned, an evaluation of adequacy of:
 - a. The product itself; i.e. compliance with the contract documents.
 - b. Installation.
 - c. Functional performance; include a brief description of the verification method used and observations and conclusions from the testing.
 - d. O&M documentation, including design intent.
 - e. Operator training.
 6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
 7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
 8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
 9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.
- C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

2.08 POST-OCCUPANCY PHASE

- A. Coordinate deferred and seasonal Functional Tests; verify correction of deficiencies.
- B. On-Site Review: 10 months after Substantial Completion conduct on-site review with Maine Workforce Housing's staff.
 1. Review the current facility operation and condition of outstanding issues related to the original and seasonal commissioning.
 2. Interview staff to identify problems or concerns they have operating the facility as originally intended.
 3. Make suggestions for improvements and for recording these changes in the O&M manuals.
 4. Identify areas of concern that are still under warranty or are the responsibility of the original construction contractor.
 5. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

END OF SECTION

SECTION 02230

SITE CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of surface debris.
- B. Clear site of plant life and grass.
- C. Removal of trees, shrubs, and other plants.
- D. Remove root system of trees, brush and shrubs.
- E. Removal of paving, curbs, and existing gravel.
- F. Removal of culverts, catch basins, manholes and other drainage features.
- G. Removal of fences, posts, bollards, poles, signs, gates and other minor structures.
- H. Removal and stockpiling of topsoil.

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering
- B. Section 02315 - Common Excavation, Embankment and Compaction
- C. Section 02320 - Slope Protection and Erosion Control.

1.03 DEFINITIONS

- A. Loam
 - 1. Friable clay loam surface soil found in depth of not less than 4 inches.
 - 2. Satisfactory topsoil is free of subsoil, clay lumps, stones, and other objects over 2 inch in diameter, and without weeds, roots and other objectionable material.

1.04 REGULATORY REQUIREMENTS

- A. Obtain required permits from authorities.
- B. Notify affected utility companies before starting work and comply with their requirements.

- C. Do not close or obstruct roadways without permits.
- D. Conform to applicable code for disposal of debris.
- E. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

1.05 PROJECT CONDITIONS

- A. Conform to applicable regulations relating to environmental requirements, disposal of debris, and use of herbicides.
- B. Coordinate clearing work with utility companies.
- C. Protect utilities to remain from damage.
- D. Provide traffic control as required, in accordance with the U.S. Department of Transportation "Manual of Uniform Traffic Control Devices" and Maine Department of Transportation (MDOT) requirements.
- E. Conduct site clearing operations to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Streets and roadways shall be thoroughly cleaned and/or swept on a daily basis or more frequently as required by the governing authority
- F. Promptly repair damage to adjacent facilities caused by the clearing and grubbing operations, at no cost to the Owner.
- G. Protect bench marks, survey control points, and existing structures from damage or displacement.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Herbicide: Use an approved chemical registered in the State of Maine for stump or basal bark treatment.
- B. Snow Fence: Beacon Plus Orange Construction Fence by Geotenax Corporation, 4800 Monument Street, Baltimore, Maryland, 21205 or approved equal. Snow or Construction Fence shall be supported with 1" steel posts spaced at a maximum of 8'-0" on center.

PART 3 EXECUTION

3.01 PREPARATION

- A. Locate and identify utilities to remain.

3.02 PROTECTION

- A. Protect utilities to remain from damage.
- B. Protect existing trees and other vegetation indicated or directed by the Owner to remain in place, against unnecessary cutting, breaking, or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within the drip line, excess foot or vehicular traffic, or parking of vehicles within dripline.
- C. Pollution Controls: Use water sprinkling to limit to the lowest practical level the amount of dust and dirt rising and scattering in the air. Do not use water when it may create hazardous conditions, ice, flooding or pollution.

3.03 CLEARING

- A. Clear areas required for access to site and execution of Work.

3.04 REMOVAL

- A. Remove paving, curbs, poles, posts, signs, fences, gates, culvert and minor structures to facilitate construction. Where required by these Drawings, or directed by Owner, preserve those curbs, poles, posts, signs, fences, gates, culverts, minor structures, and other features called for to be reset. Reset removed objects immediately upon completion of backfilling, unless otherwise directed by Owner.
- B. Remove portions of existing pavement; as indicated. Neatly saw cut edges at right angle to surface with a paving saw or compressed air cutter satisfactory to Owner.
- C. Excavate and remove underground storage tanks, retaining straps, associated plumbing piping, and foundation pad.
- D. Remove debris from site.

3.05 GRUBBING

- A. Remove all stumps, roots over 2 inches in diameter, and matted roots within limit of grubbing to depths of organics or maximum depths shown below:
 - 1. Walks - 18 inches.
 - 2. Roads - 24 inches.
 - 3. Parking Areas - 24 inches.
 - 4. Lawn Areas - 12 inches.

3.06 DISPOSAL

- A. Burning of Materials: Burning will not be permitted.
- B. Removal: Remove material, debris, rock and extracted plant life from site daily as it accumulates and legally dispose of.
- C. Dumping: Dispose of material in an approved off site legally operated disposal area.
- D. Chipping: Reduce to dimensions of less than 2 inches by use of an approved chipping machine and dispose of at an approved off site, legally operated disposal area.
- E. Trucks removing demolition debris from the site shall be covered or shall be of a closed body design to prevent the accidental throwing upon any way of tacks, nails, wire, scrap metal, glass, crockery, or other substances injurious to the feet of persons or animals or to tires or wheels of vehicles.

END OF SECTION

SECTION 02250

DEWATERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnish, operate and maintain dewatering equipment for control, collection, and disposal of ground and surface water entering trenches and excavations.

1.02 RELATED SECTIONS

- A. Section 02315- Common Excavation, Embankment and Compaction.
- B. Section 02317- Trenching.
- C. Section 02320 - Slope Protection and Erosion Control.

1.03 DESIGN REQUIREMENTS

- A. Design dewatering facilities including drains, piping and pumping.

1.04 SUBMITTALS

- A. Prior to start of excavation and trenching, submit dewatering design and methods to Owner for review.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. Provide pumps, drains, piping and other facilities necessary to keep excavations and trenches free of water including spare units available for immediate use in the event of equipment failure.

PART 3 EXECUTION

3.01 PROTECTION

- A. Protect watercourses, sewer systems and adjacent properties from siltation by use of sediment ponds or other measures acceptable to Owner.
- B. Keep excavations clear of groundwater, surface water, seepage, sewage and

stormwater.

3.02 INSTALLATION

- A. Install, construct and maintain equipment and facilities required for work of this section.
- B. Dispose of water removed from Work in a suitable manner which will not interfere with other work, cause erosion, damage pavements, other surfaces or property and is acceptable to Owner:
- C. Remove dewatering equipment and facilities when no longer required.
- D. Backfill excavations in accordance with 02315.
- E. Repair damage resulting from dewatering operations.

END OF SECTION

SECTION 02315

EXCAVATION, EMBANKMENT AND COMPACTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Common excavation, stockpile subsoil for later reuse. Remove excess from site.
- B. Construct embankments with excavated subsoil and borrow.
- C. Grade and rough contour site.
- D. Prepare subsoil and borrow to receive subbase and base gravels and topsoil materials.
- E. Place, grade and compact subbase and base gravels to receive pavement.
- F. Compaction requirements.
- G. Dust control.

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering: Dewatering of Excavations and water control.
- B. Section 02317 - Trenching
- C. Section 02320 - Slope Protection.
- D. Section 02741- Bituminous Concrete Paving.

1.03 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 1997.
- B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 1996a.
- C. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 1991.

- D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 1990 (Reapproved 1996).
- E. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 1991.
- F. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994.
- G. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System); 1998.
- H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 1996.
- I. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 1996.
- J. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 1998.

1.04 DEFINITIONS

- A. Common excavation: Excavated material meeting the description of MDOT Specification Section 203.01, except common excavation shall include the removal and disposal of boulders, solid mortared stone masonry, and concrete masonry when each is less than 2 cubic yards in volume.
- B. Rock Excavation
 - 1. Rock excavation includes removal and disposal of solid rock, boulders over 1 cu. yd., ledge rock, rock-hard cementitious deposits and other materials or obstructions which cannot be dislodged and excavated with modern, heavy-duty, track-mounted excavating equipment defined as follows:
 - a. For trenches less than 10' in width or pits in excess of 30' in either length or width: Caterpillar Model 215 or equivalent hydraulic excavator.
 - b. For open excavation (all excavations other than above): Caterpillar Model No. 973 or 977K or equivalent loader.
 - 2. If encountered, rock excavation will be paid for in accordance with contract conditions relative to changes in work. Rock payment lines are limited to the following:
 - a. Two feet outside of concrete work for which forms are required, except footings.
 - b. One foot outside perimeter of footings.
 - c. In pipe trenches, 6" below invert elevation of pipe and 2 ft. wider than inside diameter of pipe, but not less than 3 ft. minimum trench width.
 - d. Neat outside dimensions of concrete work where no forms are required.
 - e. Under slabs on grade, 6" below bottom of concrete slab.

- C. Unauthorized excavation (removal of materials beyond indicated subgrade elevations) may be filled with compacted structural fill.

1.05 SUBMITTALS

- A. Samples: 10 lb sample of each type of fill; submit in air-tight containers to testing laboratory.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.06 PROJECT CONDITIONS

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Protect abutter's plants, lawns, and other features that may be impacted by construction.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Protect above or below grade utilities which are to remain.
- E. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.
- F. Notify Owner of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.
- G. Protect excavations and soil adjacent to and beneath foundations from frost.
- H. Grade excavation top perimeter to prevent surface water runoff into excavations.
- I. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.
- J. Maintenance of existing flows:
 - 1. Keep existing sewers and drains in operation.
 - 2. If existing sewers and drains are disturbed, provide for maintenance of such flows until work is completed.

3. Do not allow raw sewage to flow on ground surface or stand in excavation.
- K. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- L. When fill materials need to be stored on site, locate stockpiles where indicated.
1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 2. Prevent contamination.
 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Subsoil: Reused, meeting the requirements of Common Borrow.
- B. Common Borrow: MDOT 703.18; Earth, suitable for embankment construction, free from frozen material, perishable rubbish, peat and other unsuitable material, with sufficient moisture content to provide the required compaction and stable embankment, moisture content shall not exceed 4 percent above optimum. Determine optimum moisture content in accordance with AASHTO T 180, Method C or D.
- C. Granular Borrow: MDOT 703.19; Sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that portion passing a 3 inch sieve shall meet the following requirements:
1. No. 40 sieve: 0 to 70 percent passing by weight.
 2. No. 200 sieve: 0 to 20 percent passing by weight.
- D. Granular borrow shall contain no particles or fragments with a maximum dimension in excess of one-half of the compacted thickness of the layer being placed.
- E. Gravel Borrow: MDOT 703.20; Uniformly graded granular material having no rocks with a maximum dimension of over 6 inches. The gradation of that portion passing a 3 inch sieve shall contain not more than 70 percent passing by weight a 1/4 inch mesh sieve and not more than 10 percent passing by weight a No. 200 mesh sieve.
- F. Aggregate Base: Crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the gradation requirements of MDOT Specification Section 703.06, Type A aggregate, with the following limits:
1. 1/2 inch sieve: 45 to 70 percent passing by weight
 2. 1/4 inch sieve: 30 to 55 percent passing by weight
 3. No. 40 sieve: 0 to 20 percent passing by weight

4. No. 200 sieve: 0 to 5 percent passing by weight
 5. Type A aggregate shall not contain particles of rock which will not pass the 2 inch square mesh sieve.
- G. Aggregate Subbase: Sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the gradation requirements of MDOT Specification Section 703.06, Type D aggregate, with the following limits:
1. 1/4 inch sieve: 25 to 70 percent passing by weight
 2. No. 40 sieve: 0 to 30 percent passing by weight
 3. No. 200 sieve: 0 to 7 percent passing by weight
 4. Type D aggregate shall not contain particles of rock which will not pass the 6 inch square mesh sieve.
- H. Select Fill: Screened or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 4 inch sieve shall meet the following requirements:
1. 4 inch sieve: 100 percent passing by weight
 2. 3 inch sieve: 90 to 100 percent passing by weight
 3. 1/4 inch sieve: 25 to 90 percent passing by weight
 4. No. 40 sieve: 0 to 30 percent passing by weight
 5. No. 200 sieve: 0 to 5 percent passing by weight
- I. Structural Fill: Granular soils with good drainage characteristics free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 4-inch sieve shall meet the following requirements:
1. 6 inch sieve: 100 percent passing by weight.
 2. No. 40 sieve: 0 to 70 percent passing by weight.
 3. No. 200 sieve: 0 to 20 percent passing by weight.

2.02 ACCESSORIES

- A. Water for sprinkling: Fresh and free from oil, acid, and injurious alkali or vegetable matter.
- B. Calcium chloride: ASTM D98 commercial grade except as waived by Owner.

2.03 SOURCE QUALITY CONTROL

- A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- B. If tests indicate materials do not meet specified requirements, change material and retest.

- C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Examine the areas and conditions under which excavating and filling is to be performed and notify Owner in writing of conditions detrimental to proper and timely completion of work
- C. Correct unsatisfactory conditions in a manner acceptable to Owner prior to proceeding with work
- D. Maintain in operating condition existing utilities, active utilities and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.
- E. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- F. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.02 INSPECTION

- A. Verify stockpiled fill to be reused is approved.
- B. Verify areas to be backfilled are free of debris, snow, ice or water, and surfaces are not frozen.

3.03 PREPARATION

- A. When necessary, compact subgrade surfaces to density requirements for embankment, aggregate base and aggregate subbase materials.
- B. Identify known underground utilities. Stake and flag locations.
- C. Identify and flag surface and aerial utilities.
- D. Notify utility companies of work to be done.
- E. Locate, identify, and protect utilities that remain and protect from damage.
- F. Scarify subgrade surface to a depth of 6 inches to identify soft spots.

- G. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular borrow or crushed stone.
- H. The building pad shall be constructed in such a manner as to provide positive drainage of surface water off the pad and to protect the pad surface and subgrade. Temporary ditches shall be constructed to carry any surface runoff away from the pad area, as directed by the Owner. At the start of building construction, the pad shall be prepared for foundations and temporary ditches properly backfilled.
- I. Surface preparation shall be performed in accordance with the soils report and the requirements of the Geotechnical Engineer.
- J. Soil fill placed adjacent to foundations (interior and exterior) within 8 inches of floor slabs and as backfill around exterior foundations (including features such as bollards and light pole bases) shall be select fill and shall be placed in lift thickness such that the desired density is achieved throughout the lift thickness 3 to 5 passes of the compaction equipment.
- K. Soil fill placed within the proposed building area, below select fill, shall be structural fill. Where structural fill is below footing grade, the zone of 95 percent compaction (maximum dry density as determined by ASTM D-1557) shall extend laterally beyond the foundation at least 1 foot for each foot of depth below foundation grade.

3.04 EXCAVATING

- A. Underpin adjacent structures which may be damaged by excavating work.
- B. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Excavate materials encountered when establishing required subgrade elevations in accordance with MDOT Specification Section 203.04 and 203.05.
- D. Remove lumped subsoil, boulders, solid mortared stone masonry, concrete masonry and rock up to 2 cubic yards, measured by volume.
- E. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.
- F. When excavation through roots is necessary, perform work by hand and cut roots with a sharp axe.
- G. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored. All excavations shall be consistent with OSHA regulations.

- H. Do not excavate wet subsoil.
- I. Remove all existing fill soils from beneath foundations.
- J. Do not interfere with 45 degree bearing splay of foundations.
- K. Correct areas that are over-excavated and load-bearing surfaces that are disturbed at no cost to Owner.
- L. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- M. Remove excavated material that is unsuitable for re-use from site.
- N. Surplus Material:
 - 1. Make arrangements to provide suitable disposal areas off-site
 - 2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.
 - 3. Obtain any necessary permits for disposal.
 - 4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.
 - 5. Keep crosswalks, streets, and pavements clean and free of debris.
 - 6. Clean up materials dropped from vehicles as often as directed by Owner.

3.05 FILLING AND SUBGRADE PREPARATION

- A. Subgrades shall be proof-rolled using a vibratory roller-compactor weighing at least 15 kips. Any areas that continue to yield after 3 to 5 passes of the compaction equipment shall be over-excavated and replaced with clean granular fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Place and compact fill materials in continuous layers not exceeding 12 inches loose depth upon compacted material.
- D. Fill to contours and elevations indicated using unfrozen materials.
- E. Fill up to subgrade elevations unless otherwise indicated.
- F. Employ a placement method that does not disturb or damage other work.
- G. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

- H. Maintain optimum moisture content of fill materials to attain required compaction density.
- I. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- J. Correct areas that are over-excavated.
 - 1. Load-bearing foundation surfaces: Use select fill, flush to required elevation, compacted to 95 percent of maximum dry density.
 - 2. Other areas: Use common borrow, flush to required subgrade elevation, compacted to minimum 95 percent of maximum dry density.
- K. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. At other locations: 90 percent of maximum dry density.
- L. Leave stockpile areas completely free of excess fill materials.
- M. Reshape and re-compact fills subjected to vehicular traffic.
- N. Frost:
 - 1. Do not excavate to full indicated depth when freezing temperatures may be expected unless fill material or structures can be constructed immediately after the excavation has been completed. Protect the excavation from frost if placing of fill or structure is delayed.
 - 2. Fill shall not be placed over frozen soil. Soil that is frozen shall be removed prior to placement of compacted fill. Remove all frozen uncompacted soil prior to placing additional fill for compaction.
- O. Native soils can undergo substantial strength loss when subjected to construction traffic and excavation activities, particularly during periods of precipitation and shallow groundwater levels. Care must be exercised to minimize disturbance of the bearing soils. Should the subgrade become yielding or difficult to work, disturbed areas shall be excavated and backfilled with select fill or crushed stone. Select fill shall be placed in lifts and compacted to at least 95 percent of its maximum dry density as determined by ASTM-1557.

3.06 CONSTRUCTION OF AGGREGATE BASE AND SUBBASE COURSE

- A. Place and compact aggregate base and subbase course materials in continuous layers not exceeding 8 inches loose depth upon compacted material.
- B. Employ a placement method so not to disturb or damage structures and utilities.

- C. Spread materials well mixed having no pockets of either fine or coarse material.
- D. Do not segregate large or fine particles.
- E. Compact by mechanical means to obtain 95 percent of maximum dry density as determined in accordance with ASTM Test Designation D1557. Base course material shall be compacted with a minimum of two coverages with self propelled vibratory compaction equipment.
- F. Maintain surface, compaction and stability until pavement course has been placed.
- G. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.

3.07 DUST CONTROL

- A. Upon request of Owner, implement the following dust control measures:
 - 1. Apply water and calcium chloride as directed by Owner.
 - 2. Spread calcium chloride uniformly over designated area.
 - 3. Apply water with equipment having a tank with pressure pump and nozzle equipped spray bar acceptable to Owner.

3.08 TOLERANCES

- A. Top surface of base and subbase course: Plus or minus 3/8 inch.

3.09 FIELD QUALITY CONTROL

- A. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D2922. Contractor shall be responsible for conducting and paying for all necessary compaction density testing.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests:
 - 1. Building subgrade areas, including 10'-0" outside exterior building lines: In cut areas, not less than one compaction test for every 2,500 square feet. In fill areas, same rate of testing for each lift.
 - 2. Areas of construction exclusive of building subgrade: In cut areas, not less than

one compaction test for every 10,000 square feet. In fill areas, same rate of testing for each lift.

3.10 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect newly graded areas from traffic and erosion and keep free of trash and debris.
- D. Repair and re-establish grades in settled, eroded and rutted areas within specified tolerances.

END OF SECTION

SECTION 02317

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating trenches for utilities.
- B. Excavating for manholes, catch basins and other structures.
- C. Compacted bedding and compacted backfilling over utilities to subgrade elevations.
- D. Compacted base and compacted backfilling for manholes, catch basins and other structures to subgrade elevations.
- E. Compaction requirements.
- F. Dust control.

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering.
- B. Section 02315 - Common Excavation, Embankment and Compaction.
- C. Section 02510 - Water Distribution.
- D. Section 02535 - Sanitary Sewer Piping.
- E. Section 02635 - Storm Drainage Piping.

1.03 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 1997.
- B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 1996a.
- C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2000a.

- D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.
- E. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2000.
- F. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994.
- G. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.
- H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 1996.
- I. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 1996.
- J. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2000.

1.04 INTENT

- A. It is the Owner's intent for the project to be constructed in a manner which will minimize either trench settlement or frost heaving due to differential soils. It is also the Owner's intent to use in-situ materials to accomplish these objectives when conditions permit. The Contractor shall recognize the varying compactive efforts required to compact in-situ materials and include the compaction in their bid for the effort since no additional payment will be made. The Owner will determine when off-site backfill materials shall be used.

1.05 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

1.06 SUBMITTALS

- A. Samples: 10 lb sample of each type of fill; submit in air-tight containers to testing laboratory.
- B. Materials Sources: Submit name of imported materials source.

- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.07 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.
- D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.
- H. Protect above or below grade utilities which are to remain.
- I. Repair damage.
- J. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.
- K. Protect excavations and soil adjacent to and beneath foundations from frost.
- L. Grade excavation top perimeter to prevent surface water runoff into excavations.
- M. Maintenance of existing flows:
 - 1. Keep existing sewers and drains in operation.
 - 2. If existing sewers and drains are disturbed, provide for maintenance of such flows until work is completed.
 - 3. Do not allow raw sewage to flow on ground surface or stand in excavation.

PART 2 PRODUCTS

2.01 PIPE BEDDING

- A. Bedding for ductile iron pipe or concrete pipe shall be a granular material meeting the requirements of AASHTO Specification M145 49 as revised, Classification A-3 or better.
- B. Bedding for pvc conduit or direct bury cable: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.
 - 1. Graded in accordance with the following limits:
 - a. 3/8 Inch sieve: 85 to 100 percent passing by weight
 - b. No. 200 sieve: 0 to 5 percent passing by weight.
- C. Bedding for all other pipe materials shall be 3/4 inch crushed stone. Aggregate for crushed stone shall be hard durable crushed stone free from friable materials, lumps or balls of clay, shale or other deleterious substances.
 - 1. Graded in accordance with the following limit
 - a. 1" sieve: 100 percent passing by weight
 - b. 3/4 Inch sieve: 90 to 100 percent passing by weight
 - c. 1/2 Inch sieve: 45 to 80 percent passing by weight
 - d. 3/8 Inch sieve: 20 to 55 percent passing by weight
 - e. 1/4 Inch sieve: 5 to 20 percent passing by weight
 - f. No. 4 sieve: 0 to 10 percent passing by weight
 - g. No. 8 sieve: 0 to 5 percent passing by weight
 - h. No. 200 sieve: 1.5 percent maximum passing by weight
- D. Heavy gravel: Bank run, uniformly graded, free of soil, subsoil, clay, shale, frozen material or foreign matter, stones larger than 8 inches, 20% maximum passing a #200 sieve. Gradation to provide a firm stable base upon compaction by normal vibratory or compressed air compaction equipment to satisfaction of Owner.

2.02 TRENCH BACKFILL

- A. Special backfill shall be a granular material meeting the requirements of AASHTO Specification M145 49 as revised, Classification A-3 or better.
- B. Select backfill shall be a granular material meeting the requirements of AASHTO Specification M145 49 as revised, Classification A-3 or better.
- C. Excavated material shall be granular in nature, free of gravel larger than 6 inch size, organic matter, roots, frozen material, debris and other objectionable material, and that can be compacted by vibratory means to obtain 92% of the optimum density.

2.03 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, non-woven, Mirafi 600x.
- B. Water for sprinkling: Fresh and free from oil, acid and injurious alkali or vegetable matter.
- C. Calcium Chloride: ASTM D98 commercial grade except as waived by the Owner.

2.04 SOURCE QUALITY CONTROL

- A. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Examine the areas and conditions under which excavating and filling is to be performed and notify Owner in writing of conditions detrimental to proper and timely completion of work.
- C. Correct unsatisfactory conditions in a manner acceptable to Owner prior to proceeding with work.
- D. Maintain in operating condition existing utilities, active utilities and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.
- E. Locate, identify, and protect utilities that remain and protect from damage.
- F. Notify utility company to remove and relocate utilities.

3.02 INSPECTION

- A. Verify stockpiled fill to be reused is approved.
- B. Verify areas to be backfilled are free of debris, snow, ice or water, and surfaces are not frozen.

3.03 PREPARATION

- A. When necessary, compact subgrade surfaces to density requirements for embankment, aggregate base and aggregate subbase materials.
- B. Identify known underground utilities. Stake and flag locations.
- C. Identify and flag surface and aerial utilities.
- D. Notify utility companies of work to be done.
- E. Cut out soft areas of subgrade not capable of compaction in place. Backfill with heavy gravel and compact to density equal to requirements for subsequent backfill material.
- F. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- G. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.04 GENERAL REQUIREMENTS

- A. Refer to Section 02315 Common Excavation, Embankment and Compaction.
- B. Provide trenching and backfilling for water service, sewerage pipes, conduits and structures. Water and sewerage lines separation shall be minimum 10 feet horizontally and 18 inches vertically. Lay all piping in open trench. Maintain access to fire hydrants by fire-fighting equipment.
- C. Excavate trenches of sufficient width for proper installation of the work. When the depth of backfill over sewer pipe exceeds 10 feet, keep the trench below the level of the top of the pipe as narrow as practical.
- D. Sheet and brace trenches and remove water as necessary to fully protect workmen and adjacent facilities, in keeping with local regulations or, in the absence thereof, with the provisions of the "Manual of Accident Prevention in Construction," of the Associated General Contractors of America, Inc. Under no circumstances lay pipe or install appurtenances in water. Keep the trench free from water until pipe joint material has hardened. Sheeting left in place shall be cut off not less than 2 feet below finished grade. Sheeting shall not be removed until the trench is substantially backfilled.
- E. It shall be noted that excavation under this contract shall be unclassified.
- F. Grade the bottom of the trenches evenly to insure uniform bearing for full length of all pipes. Excavate all rock, cemented gravel, old masonry, or other hard material to at

least 6 inches below the pipe at all points. Refill such space and all other cuts below grade with sand or fine gravel firmly compacted.

- G. Should soil conditions necessitate special supports for piping and/or appurtenances, including the removal of unsuitable material and refilling with gravel or other material, such work shall be performed as necessary.
- H. Backfill trenches only after piping has been inspected, tested and the locations of pipe and appurtenances have been recorded. Backfill by hand around pipe and for a depth of 1 foot above the pipe. Use earth without rock fragments or large stones and tamps, as specified, in layers not exceeding 6 inches in thickness, taking care not to disturb the pipe or injure the pipe coating. Compact the remainder of the backfill as specified with a rammer of suitable weight, or with an approved mechanical tamper, provided that under pavements, walks and other surfacing, the backfill shall be tamped as specified. Exclude all cinders, rubbish and scrap metal from trenches in which metal pipes are laid. Special care shall be used to properly tamp backfill under lower half of sewer pipe.

3.05 ELECTRICAL/TELEPHONE

- A. Refer to the Handbook of Standard Requirements for Electric Service and Meter Installation for installation requirements for primary electric service, secondary electric service, telephone service and cable services. Pull ropes shall be installed in all conduits.

3.06 TRENCHING

- A. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored. All excavations shall be consistent with OSHA requirements.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Excavate subsoil required for piping and appurtenances.
- E. Cut trenches wide enough to enable installation and allow inspection of installed utilities.
- F. Hand trim excavations. Remove loose matter.
- G. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.

- H. Remove excavated material that is unsuitable for re-use from site.
- I. Stockpile excavated material to be re-used in area designated on site. Do not store excavated materials adjacent to excavations where they would surcharge sideslopes.
- J. Correct unauthorized excavation with heavy gravel or as directed by Owner at no cost to Owner.
- K. Fill over-excavated areas under pipe bearing surfaces with heavy gravel or as directed by Owner.
- L. Do not store excavated material adjacent to excavations where they could surcharge sideslopes.
- M. Remove excess excavated material from site.
- N. Surplus Material:
 - 1. Make arrangements to provide suitable disposal areas off-site
 - 2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.
 - 3. Obtain any necessary permits for disposal.
 - 4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.
 - 5. Keep crosswalks, streets, and pavements clean and free of debris.
 - 6. Clean up materials dropped from vehicles as often as directed by Owner.

3.07 REPAIRS TO EXISTING PIPES, CONDUIT AND WATER LINES

- A. Remove damaged or broken portions of pipe or conduit and replace with a pipe or conduit of the same size and material, unless otherwise directed by Owner, designed to serve same function as existing pipe or conduit.
- B. Make connections for repair with flexible couplings to satisfaction of Owner.
- C. Maintain inventory of suitable repair materials on site.
- D. Make repairs immediately following discovery of damage.
- E. Do not backfill until repairs have been completed to satisfaction of Owner.
- F. Repairs to water mains and services will be by the water utility. Coordination and payment for repairs shall be the responsibility of the Contractor.

3.08 BACKFILLING

- A. Place and compact bedding material to grade of underside of pipe in trench bottom as soon as excavation reaches grade.
- B. Compact bedding material to provide firm laying base.
- C. After pipe is laid to grade, place bedding material uniformly on each side of pipe up to spring line while carefully compacting bedding material under haunches of pipe.
- D. Support pipe and conduit during placement and compaction of bedding fill.
- E. Place and compact base material to grade of underside of appurtenant structures in bottom of excavation as soon as excavation reaches grade.
- F. Compact base material for appurtenant structures to provide a firm laying base.
- G. Place and compact backfill materials in continuous layers not exceeding 8" in areas of paving, slabs-on-grade, and similar construction. Lift thickness not to exceed 16" in lawn or field areas.
- H. Backfill to contours and elevations indicated using unfrozen materials.
- I. Install geotextile fabric in accordance with manufacturer's recommendations and where shown on Drawings.
- J. Employ a placement method that does not disturb or damage other work or existing pipe.
- K. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- L. Maintain optimum moisture content of fill materials to attain required compaction density.
- M. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- N. Correct areas that are over-excavated.
 - 1. Thrust bearing surfaces: Fill with concrete.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- O. Leave stockpile areas completely free of excess fill materials.

- P. Upon completion of backfilling in paved areas, sweep undisturbed pavement.
- Q. Upon request of Owner implement the following dust control measures during the interim period between backfilling and capping of the trench:
 - 1. Apply water and calcium chloride as directed by Owner.
 - 2. Spread calcium chloride uniformly over designated areas.
 - 3. Apply water with equipment having a tank with pressure pump and nozzle equipped spray bar acceptable to Owner.
- R. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density based upon ASTM D-1557.
 - 2. At other locations: 90 percent of maximum dry density.
- S. Reshape and re-compact fills subjected to vehicular traffic.

3.09 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.10 FIELD QUALITY CONTROL

- A. Perform compaction density testing on compacted fill in accordance with ASTM D1556.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor").
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- D. Frequency of Tests: 1 test for each 200'-0" of trench for the first and every other lift of compacted trench backfill.

3.11 CLEAN-UP

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

TRENCHING

02317 - 10

SECTION 02320

SLOPE PROTECTION AND EROSION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary silt fence.
- B. Erosion control mesh.
- C. Hay bales, temporary erosion checks.
- D. Stone check dams.
- E. Plain riprap - machine placed stones on filter fabric.

1.02 RELATED SECTIONS

- A. Section 02230- Site Clearing and Grubbing.
- B. Section 02315 - Common Excavation, Embankment and Compaction.

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Conform to Maine Department of Environmental Protection publication "Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices".
- B. Maintain erosion control installations in a functional condition at all times. Inspect after each rainfall and at least daily during prolonged rainfall. Immediately correct deficiencies

PART 2 PRODUCTS

2.01 MATERIALS

- A. Silt Fence: MDOT Section 656.03.
- B. Erosion Control Mesh: MDOT Section 717.061.
- C. Hay Bales: Baled hay approximately 14" by 18" by 30" securely tied to form a firm

bale.

- D. Plain Riprap: MDOT Section 703.26.
- E. Filter Fabric: Mirafi 600x or Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts existing surface conditions.

3.02 INSTALLATION

- A. Install silt fences before beginning excavation.
- B. Install silt fences in accordance with MDOT 656.08.
- C. Install erosion control mesh in accordance with MDOT 613.
- D. Install hay bales in accordance with MDOT Section 656.
- E. Install plain riprap in accordance with MDOT 610 with the exception that plain riprap shall be installed on filter fabric installed per manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

- A. Inspect and repair temporary erosion control measures at least weekly and after any significant storm. A significant storm shall be defined as over 1 inch of precipitation in any consecutive 24 hour period.

3.04 MAINTENANCE

- A. Maintain erosion control installations in a functional condition at all times. Inspect after each rainfall and at least daily during prolonged rainfall. Immediately correct deficiencies
- B. Make a daily review of the location of erosion control measures in areas where construction activity causes drainage runoff to ensure that erosion control measures are properly located for effectiveness.
- C. Where deficiencies exist, install additional erosion control measures as approved or

directed by the Owner. No additional payment shall be made for additional erosion control measures which may be required.

3.05 TEMPORARY EROSION CONTROL REMOVAL

- A. Remove temporary silt fence and hay bales when no longer needed and dispose of in a proper manner.
- B. Remove stone check dams when no longer needed and dispose of in a proper manner. Stone shall be raked out to a maximum depth of one layer to allow future vegetation to grow through the stone.

END OF SECTION

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SECTION 02510

WATER DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and fittings for site water lines including domestic water lines and fire water lines.
- B. Valves and Fire hydrants.

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering: Dewatering and Water Control.
- B. Section 02317 - Trenching: Bedding and Backfill.
- C. Section 03300 - Cast-in-Place: Concrete for thrust restraints.

1.03 REFERENCES

- A. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; 1995 (ANSI/AWWA C104/A21.4).
- B. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2000 (ANSI/AWWA C111/A21.11).
- C. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 1996 (ANSI/AWWA C151/A21.51).
- D. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; 2001 (ANSI/AWWA C509).
- E. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; 1999 (ANSI/AWWA C600).
- F. UL 246 - Hydrants for Fire-Protection Service; Underwriters Laboratories Inc.; 1993.

1.04 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified

requirements.

- C. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Portland Water District requirements. The Contractor shall comply with the requirements contained within this section and those contained within the Department's requirements. In the event of conflicting requirements, the more stringent standard shall apply.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Unload materials so as to avoid shock or damage. Handle and store all pipe in such a manner as to avoid deterioration or other injury thereto. Place no pipe within pipe of larger size. Store pipe and fittings on sills above storm drainage level and delivery for laying after trenches are excavated. Valves and hydrants shall be drained and stored to protect them from damage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Ductile Iron Pipe: AWWA C151:
 - 1. Pipe shall meet requirements of AWWA Standard C-151 (latest revision) and be cement lined and seal coated to meet AWWA Standard C-104 (latest revision).
 - 2. Joints shall meet requirements of AWWA C-111 (latest revision).
 - 3. Interior seal coated, bituminous paint oil, cut emulsion not acceptable, thickness, minimum of 2 mils dry film thickness.
 - 4. Exterior bituminous coated with minimum of 2 mils dryfilm thickness
 - 5. Class 52 wall thickness, 4 inch diameter through 12 inch diameter inclusive.
 - 6. State nominal laying length and mark shorter lengths near bell.
 - 7. Mechanical joint pipe to be furnished with gland, gaskets, and Cor-ten bolts and nuts.
 - 8. Push on joint pipe to be supplied with gasket and gasket lubricants (approx. 5 lb. containers).

- B. Ductile Iron Fittings:
 - 1. Material shall be ASTM A536 latest, grade 70-50-05, in accordance with AWWA C153 (latest revision) for fittings 3" through 24".
 - 2. Fittings shall be cement lined AWWA C104 (latest revision).
 - 3. Interior seal coated AWWA C104 with minimum of 4 mils dry film thickness.

4. Exterior bituminous coated with minimum of 2 mils dry film thickness.
 5. Mechanical joint with accessories furnished: DI glands, gaskets, Cor-Ten T-bolts and nuts.
 6. Class 350 pressure rating in accordance with AWWA C110 - 3" - 24" sizes.
 7. The "compact design" fittings must provide adequate space for the MJ joint and accessories to be installed without special tools (i.e. Lowell wrench can be used).
- C. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters.
- D. Valve Boxes
1. Bottom section shall be slide-type with bell-type base.
 2. Top section shall be slide-type. It may have a top flange, but shall not have a "bead" or bottom flange.
 3. The cover shall be a 2" drop-type cover to fit the 7 1/4" opening of the top section.
 4. The intermediate (mid) section shall be slide-type with a minimum 3" belled bottom.
 5. Material shall be cast iron or ductile free from defects.
 6. Interior and exterior of all components shall be bituminous coated with a minimum of 4 mils dry film thickness.
- E. Service Rod Box and Rod
1. Service box shall be 1.0" Schedule 40 steel pipe with top having 1.0" NPT pipe threads for screw on cover or coupling.
 2. Service box shall be Erie style with 5'6" slide type riser.
 3. Service box cover shall be Quincy type (heavy-duty) cover that screws on E.1 above.
 4. Service box cover shall be tapped with a 1" rope thread with a solid brass plug with pentagon operating head.
 5. Service box foot piece shall be heavy-duty (Ford style or equal) cast iron design.
 6. The large heavy-duty foot piece shall have an arch that will fit over 2" inch ball valve curb stops.
 7. Service rod shall be 36" in length and have a self-aligning design.
 8. Service rod shall be of circular dimension and constructed of 5/8" dia. Min cold rolled steel with an epoxy coating (minimum 4 mil D.F.T.) or 1/2" dia. Min. #304 stainless steel.
 9. Service rod shall have a yoke design that is and integral part of the rod.
 10. The curb-stop attachment pin shall be a brass cotter pin.
 11. The rod "wrench flat" shall have a minimum thickness of 1/4" tapered to 1/16" and a width of 5/8" or 1/2".
- F. Gate Valves:
1. Shall be USP Metroseal, Waterous Series 500 (AFC), Mueller A-2360, American AVK or Clow F6100 Series.

2.02 THRUST BLOCKS

- A. Blocks shall be concrete of a mix not leaner than 1:2 -1/2:5 cement:sand:stone, and shall have a compressive strength of not less than 3,000 psi at 28 days. Concrete for thrust blocks shall be placed against undisturbed earth.
- B. Bedding: As specified in Section 02317.
- C. Cover: As specified in Section 02317.

2.03 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

PART 3 EXECUTION

3.01 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.02 TRENCHING

- A. See Sections 02315 and 02317 for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.03 INSTALLATION - PIPE

- A. Service line from existing main shall be furnished and installed to serve the project. The project contract work shall begin at indicated public water supply line and shall include all water lines, valves, fire hydrant and appurtenances as shown on the drawings, except as indicated otherwise.
- B. Pipe-Laying - General:
 - 1. The interior of all pipe shall be clean and joint surfaces wiped clean and dry before the pipe is lowered into trench. Lower each pipe, fitting and valve into the trench carefully and lay true to line and without objectionable breaks in grade. The depth of cover below finished grade shall be not less than 5'-0" and the standard cover

shall be 6'-0".

2. Provide uniform bearing for all pipe in trenches. Do not allow trench water or dirt to enter the pipe after laying. Insert a watertight plug in the open end of the piping while laying of pipe is not in progress.
 3. Do not lay pipe closer than 10 feet to a sewer. At cross-overs with sewers, no joint in the water line shall be closer than 6 feet from the cross- over point. A minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer shall be maintained when the water main is either above or below the sewer. Provide valves, plugs or caps, as required, where pipe ends are left for future connections.
- C. All pipe shall be laid with standard provisions for expansion and contraction and in accordance with manufacturer's recommendations. All pipe with slip type joints shall be restrained at elbows and tees by thrust blocks or rods and clamps.
- D. Install suitable fittings at all changes in direction, dead ends and branch connections, provided that double strap saddles, in lieu of tees, may be used for service taps.
- E. Before setting each valve, make sure that the interior is clean, and test opening and closing. Set valves and stops with stems plumb and at the exact location shown. Provide brick laid flat, or other similar foot-pieces, under each curb box. Valve and service boxes shall be plumb, with tops at finished grade.
- F. Maintain separation of water main from sewer piping in accordance with applicable code.
- G. Install ductile iron piping and fittings to AWWA C600.
- H. Route pipe in straight line.
- I. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- J. Slope water pipe and position drains at low points.

3.04 INSTALLATION - VALVES

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.

3.05 FIELD QUALITY CONTROL

- A. Pressure test water mains in accordance with the requirements of the Portland Water

District.

- B. Disinfect water mains in accordance with the requirements of the Portland Water District.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.06 ATTACHMENTS

- A. Portland Water District - Construction Handbook

END OF SECTION

SECTION 02535

SANITARY SEWER PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage drainage piping, fittings, and accessories.

1.02 RELATED SECTIONS

- A. Section 02315 -Common Excavation Embankment and Compaction.
- B. Section 02317 - Trenching.
- C. Section 02640 - Manholes and Covers.

1.03 REFERENCES

- A. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2000.
- B. ASTM D 2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 1996a.
- C. ASTM D 3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2000.

1.04 SUBMITTALS

- A. Product Data: Provide data indicating pipe, pipe accessories.

1.05 REGULATORY REQUIREMENTS

- A. Perform work in accordance with the Portland Public Works Department.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Plastic Pipe - gravity service: ASTM D 3034, Type PSM, Poly(Vinyl Chloride) (PVC) material rated SDR 35; inside nominal diameter of 8 inches, bell and spigot style

solvent sealed joint end.

- B. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM classification.
- C. Pipe joints shall be integrally molded bell ends in accordance with ASTM D-3034 Table 2, with factory supplied elastomeric gaskets and lubricant.
- D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 02317 for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Make all required connections to existing sewers. Carry out such work in accordance with local standards. Observe care to prevent debris from entering sewers. Check the invert elevations of existing sewers to which connections are to be made, and if appreciable difference from elevations noted on the drawings, or if they involve any difficulty in obtaining necessary drainage, notify the Engineer immediately so that appropriate corrective action may be taken.
- B. Commence at the lowest point in the system and lay the pipe with the bell-end upgrade. Test pipe for soundness and clean interior and joint surfaces before lowering the pipe into the trench. Lay pipe in straight lines and on uniform grades between points where changes in alignment or grade are shown. Bed the pipe barrel uniformly.
- C. Comply fully with manufacturer's instructions for sewer pipe jointing, using sealing or lubricating compound as supplied by the manufacturer, and apply proper pressure to seal the spigot in the bell.
- D. As soon as the joint material has set, pack fine earth carefully around the joints, and around and over the pipe. Carry this backfill operation to a depth of at least 12 inches above the top of the pipe. Care shall be used in tamping backfill under lower parts of the pipe to give proper support, especially in shallow trenches.

- E. Flush all sanitary sewers, including building connections, with water in sufficient volume to obtain free flow through each line. Remove any obstructions and correct any defects discovered.
- F. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- G. Install pipe, fittings, and accessories in accordance with ASTM D 2321 and manufacturer's instructions. Seal joints watertight.
- H. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with the requirements of the servicing utility.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.04 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION



SECTION 02635

STORM DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering.
- B. Section 02315 - Common Excavation, Embankment and Compaction
- C. Section 02317 - Trenching.
- D. Section 02640 - Manholes and Covers.

1.03 REFERENCES

- A. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2000.
- B. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets; 1998.
- C. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 1999.
- D. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2000.
- E. ASTM D 2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 1996a.
- F. ASTM D 3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2000.

1.04 SUBMITTALS

- A. Product Data: Provide data indicating pipe, pipe accessories.

B. Project Record Documents:

1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 PROJECT CONDITIONS

- A. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system.

PART 2 PRODUCTS

2.01 STORM DRAIN PIPE MATERIALS

- A. Reinforced Concrete Pipe: ANSI/ASTM C76, IV, with modified tongue-and-groove compression gasket joints complying with ANSI/ASTM C443.
- B. Reinforced Concrete Pipe Joint Device: ASTM C 443 (ASTM C 443M), rubber compression gasket joint.
- C. Corrugated Polyethylene Pipe (PE): Pipe complying with AASHTO M294 and MP7, and ASTM D3550. Interior of pipes shall be smooth, and shall have an "n" value of not less than 0.010. Pipes shall be joined with gasketed bell and spigot joints complying with ASSHTO M252 and M294. Gaskets shall comply with ASTM F477 and ASTM D1149. Provide minimum coverage per manufacturer's specifications.
1. Acceptable Manufacturers of Corrugated Polyethylene Pipe: Advanced Drainage Systems, N-12 pipe, or equivalent.
- D. Plastic Pipe: ASTM D 3034, Type PSM, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of specified inches, bell and spigot style solvent sealed joint end.

2.02 PIPE ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required. Fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 02317 for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight. Minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot (0.3 m) and for 60-inch (1500 mm) diameters shall be 2 ft (0.6 m) in single run applications.
- C. Install pipe, fittings, and accessories in accordance with ASTM D 2321 and manufacturer's instructions. Seal joints watertight.
- D. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance requirements of local authorities having jurisdiction.

3.04 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION



SECTION 02640

MANHOLES AND COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.
- B. Modular precast catch basins with frames and grates.
- C. Modular precast concrete electric handholds and telephone manholes, with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.
- D. Precast concrete grease trap

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering
- B. Section 02317 - Common Excavation, Embankment, and Compaction.
- C. Section 02535 - Sanitary Sewer Piping.
- D. Section 04810 - Unit Masonry Assemblies: Masonry units.
- E. Section 02635 - Storm Drainage Piping.

1.03 REFERENCES

- A. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 1997.
- B. ASTM C 478M - Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric); 1997.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.
- B. Product Data: Provide manhole covers, component construction, features,

configuration, and dimensions.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manhole and Catch Basin Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with gaskets in accordance with ASTM C 923 (ASTM C 923M).
 - 1. Use concrete that will attain a 28-day compressive strength of not less than 4,000 psi.
 - 2. Reinforcing: H-20 loading.
 - 3. Horizontal Joints:
 - a. Tongue and Groove formed of concrete to receive a flexible plastic gasket.
 - b. Joints to be watertight.
 - c. Cast to allow installation to be vertical and in true alignment.
 - 4. Provide two tapered lifting holes 180 degrees apart in each section for handling and placing.
 - 5. Base Section: Cast holes for pipes to provide invert elevations as required by Drawings.
 - 6. Pipe to Structure Joints:
 - a. Flexible sleeves, rubber quality, ASTM C-443 and C361 cast into base.
 - b. If pre-manufactured adaptor cannot be installed, use rubber concrete adaptor designed to provide a watertight seal between pipe and structure.
- B. Mortar and Grout: As specified in Section 04810, Type S.
- C. Concrete Masonry Units: ANSI/ASTM C139.
- D. Manhole Brick: ANSI/ASTM C32, Grade MS.
- E. Sewer Brick: ANSI/ASTM C32, Grade SS.
- F. Masonry Mortar: ANSI/ASTM C270, Type M.
- G. Manhole Frames and Covers: Grey cast iron, ANSI/ASTM A 48, Class 30 B.
 - 1. Comply with requirements of FS RR-F-621 for type and style indicated.
 - 2. Furnish covers with cast-in legend on roadway face as indicated.
- H. Manhole Steps: Grey cast iron, ANSI/ASTM A 48, Class 30B, integrally cast into

manhole sidewalls, unless otherwise indicated.

- I. Catch Basin Frames and Gratings: Grey cast iron, ANSI/ASTM A 48, Class 30 B.
 - 1. Comply with requirements of FS RR-F-621, for type and style required.
- J. Other Precast Structures:
 - 1. Use concrete that will attain a 28-day compressive strength of not less than 4,000 psi.
 - 2. Manufactured in accordance with ASTM C-478.
 - 3. Reinforcing: H-20 loading.
 - 4. Horizontal Joints:
 - a. Tongue and groove formed of concrete to receive a flexible plastic gasket.
 - b. Joints to be watertight.
 - c. Cast to allow installation to be vertical and in true alignment
 - 5. Pipe to Structure Joints:
 - a. Flexible sleeves, rubber quality, ASTM C-433 and C-361 cast into base.
 - b. If pre-manufactured adaptor cannot be installed, use rubber-concrete adaptor designed to provide a watertight seal between pipe and structure.

2.02 ELECTRIC HANDHOLDS AND TELEPHONE MANHOLES - DIVISION 16

- A. Electric handholds shall comply with the requirements of Central Maine Power.
- B. Telephone manholes shall comply with the requirements of Fairpoint Communications, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 PRECAST CONCRETE STRUCTURES

- A. Precast Concrete Structures: Place precast concrete sections as shown on drawings.

Where structures occur in pavement, set tops of frames and covers flush with finish surface. Elsewhere, set tops 3" above finish surface, unless otherwise indicated.

1. Use epoxy bonding compound where manhole steps are mortared into structure walls
2. Provide rubber joint gasket complying with ASTM C443.
3. Place base section level on 12 inch layer of crushed stone.
4. Fix inlet and outlet stubs into sleeves with stainless steel pipe clamp.
5. Place barrel sections, cones or tops of the appropriate combination of heights to meet grades required by Drawings or existing conditions.
6. Seal horizontal joints as recommended by manufacturer.
7. Apply lubricant to inside tongue and rubber gaskets immediately prior to joining sections.
8. Fill lifting holes with non-shrink mortar.
9. Place frame and grate on top or otherwise prevent accidental entry by unauthorized persons until ready for adjustment to grade.
10. Repair damaged coating of frames and covers with coat-tar-pitch varnish.

3.04 MASONRY WORK

A. Laying Brick:

1. Use clean bricks.
2. Lay brick by methods consistent with the trade acceptable to Owner
3. Lay in a full bed of mortar and joint without subsequent grouting, flushing, or filling, and thoroughly bond.
4. Bring casting rim to grade with brick and coat outside with mortar; minimum thickness 3/8 inch with troweled waterproof surface.

3.05 ELECTRIC HANDHOLDS AND TELEPHONE MANHOLES

- A. Electric handholds shall be installed in accordance with the requirements of Central Maine Power.
- B. Telephone manholes shall be installed in accordance with the requirements of Fairpoint Communications, Inc.

END OF SECTION

SECTION 02721

**ENGINEERED SURFACE DRAINAGE PRODUCTS
PVC CATCH BASINS**

PART 1 GENERAL

PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications. The ductileiron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.

1.01 SECTION INCLUDES

- A. Modular PVC catch basins with frames and grates and built in Snout traps.

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering
- B. Section 02317 - Common Excavation, Embankment, and Compaction.
- C. Section 02535 - Sanitary Sewer Piping.
- D. Section 02635 - Storm Drainage Piping.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.
- B. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

PART 2 PRODUCTS

2.01 MATERIALS

The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to

ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454. The grates and frames furnished for all surface drainage inlets shall be ductile iron for sizes 8", 10", 12", 15", 18", 24" and 30" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for drain basins shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas. 12" and 15" square grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 INSTALLATION

The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height. For H-20 load rated installations, a concrete ring will be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations such as migration of fines, ground water, and soft foundations refer to ASTM D2321 guidelines.

END OF SECTION

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**ENGINEERED SURFACE DRAINAGE PRODUCTS
PVC CATCH BASINS**

SECTION 02722

**ENGINEERED SURFACE DRAINAGE PRODUCTS
INLINE DRAINS**

PART 1 GENERAL

PVC surface drainage inlets shall be of the inline drain type as indicated on the contract drawing and referenced within the contract specifications. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer. The surfacedrainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.

1.01 SECTION INCLUDES

- A. Modular PVC surface drainage inlets

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering
- B. Section 02317 - Common Excavation, Embankment, and Compaction.
- C. Section 02535 - Sanitary Sewer Piping.
- D. Section 02635 - Storm Drainage Piping.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.
- B. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

PART 2 PRODUCTS

2.01 MATERIALS

The inline drain required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to

the inline drain body by use of a **swage mechanical joint**. The raw material used to manufacture the pipe stock that is used to manufacture the inline drain body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454. The grates furnished for all surface drainage inlets shall be ductile iron grates for sizes 8", 10", 12", 15", 18", 24" and 30" shall be made specifically for each fitting so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for inline drains shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas. 12" and 15" square grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 INSTALLATION

The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height. For H-20 load rated installations, a concrete ring will be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations such as migration of fines, ground water, and soft foundations refer to ASTM D2321 guidelines.

END OF SECTION

SECTION 02723

**ENGINEERED SURFACE DRAINAGE PRODUCTS
STORMWATER QUALITY UNIT**

PART 1 GENERAL

Storm Water Quality Unit to be as indicated on the contract drawing and referenced within the contract specifications. The ductile iron grates for each of these fittings are to be considered an integral part of the unit and shall be furnished by the same manufacturer. The Unit shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.

1.01 SECTION INCLUDES

- A. Modular storm water quality treatment unit

1.02 RELATED SECTIONS

- A. Section 02250 - Dewatering
- B. Section 02317 - Common Excavation, Embankment, and Compaction.
- C. Section 02535 - Sanitary Sewer Piping.
- D. Section 02635 - Storm Drainage Piping.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate unit location, elevations, piping sizes and elevations of penetrations. Unit detail drawings to be developed by ADS.
- B. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

PART 2 PRODUCT

2.01 MATERIALS

Virgin material for pipe & fittings used to produce Storm Water Quality Units shall be high density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch (100 to 250 mm) diameters, and 435400C for 12- through 60-inch (300 to 1500mm) diameters as defined and described in the latest version of ASTM D3350. The virgin pipe material shall be evaluated using the notched constant ligament- stress (NCLS) test as specified in Section 9.5 and 5.1 of AASHTO M294 and ASTM F2306, respectively. All smooth baffle and weir plates shall be high density polyethylene.

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2.02 REQUIREMENTS

Storm Water Quality Units shall have a smooth interior and annular exterior corrugations. The unit shall have at least three containment zones, each zone separated from the next by use of a weir or baffle plate. Weir and baffle plates shall be welded at all interfaces between the plate and water quality unit. First weir plate shall incorporate a saw tooth design and shall be reinforced with stiffeners positioned horizontally on the downstream side of the plate to be retained.

Storm Water Quality Units shall provide adequate clean-out and inspection access.

2.03 JOINT PERFORMANCE

Connections for the bypass line and the unit shall utilize the same joint quality as specified for the main storm sewer pipe. Couplers for the bypass line may be either split couplers, in-line bell couplers, snap couplers, bell-bell couplers, or welded bell couplers.

2.04 UNIT PERFORMANCE

Water Quality Units shall remove a minimum of 80% of the first flush total suspended solids (TSS) based on flow rates and corresponding sieve sizes shown in Table 1. Water Quality units shall be installed “offline” to prevent re-suspension of solids in high flow situations. Offline installation shall be constructed utilizing an ADS By-Pass structure. Flow through the unit shall be controlled by an orifice fabricated on the outlet end of the structure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for stormwater quality unit is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 INSTALLATION

Installation shall be in accordance with the ADS installation guidelines, utilizing a class I (ASTM D2321) structural backfill material or flowable fill (CLSM –Controlled Low Strength Material). Contact a local ADS representative for the latest installation instructions.

END OF SECTION

ENGINEERED SURFACE DRAINAGE PRODUCTS
STORMWATER QUALITY UNIT

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SECTION 02741

BITUMINOUS CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hot bituminous concrete paving.
- B. Granite Curb.
- C. Surface sealer.

1.02 RELATED SECTIONS

- A. Section 02315 - Common Excavation, Embankment and Compaction.
- B. Section 02317 - Trenching.

1.03 REFERENCES

- A. State of Maine Department of Transportation Standard Specifications Highways and Bridges, latest revision, hereafter designated as MDOT Specifications.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with MDOT Section 403.
- B. Mixing Plant: Conform to MDOT Section 401.
- C. Obtain materials from same source throughout.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for paving work on public property.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Weather and seasonal limitations as required by MDOT Section 401.07 shall apply to this Section.

1.07 TESTS

- A. Submit proposed mix design of each class of mix for review prior to commencement of work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: MDOT Section 702.
- B. Hot Bituminous Pavement: MDOT Section 401.02 through 401.06. Pavement course material DOT Standard Type B.
- C. Mineral Filler: MDOT Section 703. Base Course min 2" & wearing course Type D 1" thick, all roads, walks and parking.
- D. Emulsified Bituminous Sealing Compound: MDOT Section 702.12
- E. Granite Curb: MDOT Section 712.04. City of Portland
- F. Joint Mortar: MDOT Section 705.02
- G. Tack Coat: Emulsified asphalt for tack coat shall conform to MDOT Section 702.
- H. Bituminous Curb
- I. Pavement Stripping: MDOT Section 708.03, Type N glass beads conforming to AS HTO M 247 Type I.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Beginning of installation means acceptance of substrate.

3.02 PREPARATION AND PLACEMENT

- A. Place tack coat on swept surfaces as noted on Drawings.

- B. Prepare and place plant mix hot bituminous pavement in accordance with MDOT Sections 301 and 401.

3.03 CURBS

- A. Granite Curb: Conform to the requirements of MDOT Section 609.06.

3.04 SEAL COAT

- A. Apply seal coat to surface course in accordance with MDOT Section 609.06.

3.05 TOLERANCES

- A. Flatness: Conform to requirements of MDOT Section 401.20.
- B. Compacted Thickness: Conform to requirements of MDOT Section 401.17.
- C. Variation from True Elevation: Conform to requirements of MDOT Section 403.

3.06 FIELD QUALITY CONTROL

- A. Provide field inspection and testing. Take samples and perform tests in accordance with MDOT Specifications.

3.07 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for 5 days.

3.08 PAINTED PAVEMENT MARKINGS

- A. Cleaning: Sweep and clean surface to eliminate loose material and dust.
- B. Striping: Use acrylic-latex traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.
 - 1. Apply acrylic-latex paint with mechanical equipment to produce uniform straight edges. Apply as recommended by manufacturer to produce a dry film thickness of 7.5 to 9.0 mils.
 - 2. Color: white.
- C. Apply handicapped parking lines in accordance with the Americans with Disabilities Act (ADA) standards, and as directed by the Engineer. Submit shop drawings for roadway and parking lot line layouts to Engineer for approval before commencing with work. Use guide templates in good condition to achieve clean lines.

END OF SECTION

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SECTION 02950 - PLANTING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Include GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS as part of this Section.
- B. Examine all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 WORK INCLUDED

- A. Perform all work required to complete the work of the Section, as indicated. Such work includes, but is not limited to, the following:
 - 1. Installation of construction fencing for the protection of existing trees within property boundaries, as required.
 - 2. Planting of trees, shrubs, vines, groundcover and herbaceous materials.
 - 3. Application of fertilizer and soil amendments to support the health and growth of trees, shrubs, vines, groundcovers, perennials, and ornamental grasses.
 - 4. Installation, adjustment and removal of tree stakes and guying.
 - 5. Maintenance of plantings, including watering.
 - 6. One year Guarantee of plantings.

1.3 RELATED WORK

- A. Section 02970 – Structural Soil Mix

1.4 QUALITY ASSURANCE

- A. All plant materials shall be true to name according to "Standardized Plant Names", published by the American Joint Committee on Horticulture Nomenclature, latest edition. Each plant or bundle shall be tagged with the name and size of plants in accordance with the standards of the American Landscape and Nursery Association (ALNA). In all cases, botanical names shall take precedence over common names.
- B. Quality and size shall conform to the "American Standard for Nursery Stock", latest edition, for number one grade nursery stock as adopted by the ANLA.
- C. All plants and plant materials shall comply with all Federal, State, regional and local laws and regulations requiring inspection for plant disease and insect control.

1.5 PRODUCT HANDLING

- A. Delivery and Storage:
 - 1. Deliver all items to the job site in their original containers with all labels intact and legible at time of Landscape Architect's inspection.
 - 2. Immediately remove from the site all plants which are not true to name or damaged and all materials which do not comply with the specified requirements.

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3. Use all means necessary including wood construction fences to protect plant materials before, during, and after installation and to protect the work and materials of all other trades.
4. Replacements: in the event of damage, immediately make all repairs and replacements necessary to the approval of the Landscape Architect and at no additional cost to the Owner.
5. Nursery plant identification tags shall remain on plants until final acceptance of plant material.

1.6 JOB CONDITIONS

- A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as compacted soils, rubble fill, adverse drainage conditions, clay or obstructions, notify the Landscape Architect immediately for direction. Do not proceed with planting until direction has been given by the Landscape Architect.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Topsoil used in the Planting Soil Mix and plant beds shall meet the requirements of topsoil in Lawns and Topsoiling section.
- B. Manure - well rotted, unleached, cattle manure, reasonably free of wood shavings, sawdust or other litter and no chemicals or other ingredients harmful to plants. Dehydrated manure (Bovung or equal) is acceptable.
- C. Fertilizer – Fertilizer shall be a slow-release product. All plants shall be fertilized with a controlled release 16-8-16 analysis fertilizer contained in polyethylene perforated bags with micropore holes. The bag shall contain 4 ounces minimum of water soluble fertilizer to be effective for 8 years. Pills, spikes, tablets and injections are not considered controlled release packets.
 1. Fertilizer shall contain not less than the following percentages by weight of ingredients, unless the soil analysis indicates a different formulation:

<u>Plant Type</u>	<u>Composition</u> <u>(percentage nitrogen-phosphorous-potash)</u>
Deciduous and evergreen trees:	20-5-5
Deciduous shrubs and evergreen groundcovers:	5-10-5
Ericaceous plants, including rhododendrons and azaleas:	9-6-6
Needled evergreen shrubs:	3-4-3

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Perennials:	5-10-10
Ornamental grasses:	3-4-3
Bulbs:	0-12-0 (Bone Meal)

2. Deliver fertilizer to the site in the original unopened containers showing weight, analysis and manufacturer. Store fertilizer in a cool, dry, waterproof place. Submit manufacturers' Certificates of Compliance to the Owner.
 3. All fertilizers shall be approved by the EPA and all applicable state, regional and local agencies, and conform to their most recent standards.
- D. Peat - domestic or imported, of partially decomposed vegetable matter of natural occurrence, brown, clean, low in content of mineral and woody material; mildly acid, granulated or shredded, free from weedy grasses, sedges or rushes.
- E. Planting Soil Mix - 20 parts topsoil, 4 parts peat moss, and one part well rotted manure or other composted organic material of 7.0 to 6.5 Ph.
- F. Mulch - aged pine bark consisting of the outer bark of pine trees with minimum hardwood bark. Bark shall be thoroughly mixed and aged in stock piles a minimum of 6 months, partially decomposed, dark brown in color, and generally free of chunks of wood thicker than 1/4". Aged pine bark containing an excess of fine particles or stringy material over two inches will not be acceptable.
- G. Water – Provide hose and connections and/or water truck for watering all plant materials until completion of the project.
- H. Tree staking - Hardwood stake, 8' long (min.). Install as detailed on the Drawings.
- I. Tree protection – 4" by 4" wood posts, 2" by 6" wood rails, free of chemicals.
- J. Wire - pliable No. 12 to 14 gauge galvanized soft steel wire with rubber hose.
- K. Wrapping material - first quality, heavy, waterproof crepe paper manufactured for this purpose; not less than 4" wide. Use only when specified on Drawings.

2.2 PLANT MATERIALS

- A. Provide plants as per Drawings in quantities listed on plant materials list. If there is any discrepancy between quantities listed and plant material graphically shown, notify the Landscape Architect immediately for clarification prior to bidding. Be responsible for quantity of plant material graphically shown on Drawings and as per clarification by Landscape Architect.
- B. Plants shall be nursery grown unless otherwise authorized, and grown under climatic conditions similar to those of the project.
- C. Plants - in accordance with American Standard for Nursery Stock, latest edition, hardy under climatic conditions similar to location of Project, typical of species or variety, normal habit of growth, sound, healthy, vigorous, well-branched with well developed root systems, densely

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foliated when in leaf, and free of disease, insect pests, eggs, or larvae. All plants shall be freshly dug. No heeled-in plants or plants from cold storage shall be used. All parts of the plant and root ball shall be moist and the plant shall show active green cambium when cut, and shall be free of dead wood, bruises or other root or branch injuries. All plants shall conform to the highest grades and standards adopted by the American Nursery and Landscape Association. Perennials shall conform also to the standards as adopted by the Perennial Plant Association in the Perennial Plant Association Standards - latest edition.

- D. Upon signing contract immediately order and arrange to have the required plant material put on reserve for potential inspection by the Owner and use for the project. Provide proof of reservation to Landscape Architect. At this time if plants of specified kind or size are not available within states of NH, PA, MA, VT, NY, CT, RI or Long Island, issue a written statement to the Landscape Architect listing the unavailable plants. Substitutions may only be made if approved by Landscape Architect.
- E. Plant Dimensions - conform to the American Standard for Nursery Stock, latest edition, as specified. Exceptions as follows:
 - 1. Plants larger than specified may be used if approved by the Landscape Architect at no increase in contract price. Increase the root mass or root ball in proportion to increased size of plant.
 - 2. Undersize plants (10% max.) in any one variety or grade may be used if approved by the Landscape Architect. Provide sufficient plants above size to make average equal to or above specified grade. Undersize plants shall be larger than the average size of next smaller size group.
- F. Balled and burlapped (B & B) plants - dig with firm natural earth roots. Manufactured or man-made root balls are not acceptable.
- G. Container grown container plants - grown in container long enough for root system to have developed sufficiently to hold its soil together firm and whole. Plants loose in container will not be acceptable. Plants in grow bags shall not be accepted.
- H. Trees shall be a single trunk unless otherwise specified in project plant lists, and growing from a single intact and undamaged crown of roots. No part of the trunk shall be conspicuously crooked as compared with other specimen quality trees of the same variety. The trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. No pruning wounds shall be present having a diameter of more than 2" and such wounds must show vigorous bark on all edges.
- I. Protect B & B and container plants not planted immediately upon delivery with soil. Prevent voids among roots with careful filling. Do not bind plants with wire or rope so as to damage bark or break branches.
- J. The Landscape Architect reserves the right of inspection and rejection upon delivery at the Site or during progress of work. Remove and replace defective and rejected plants immediately from site.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

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- B. Prior to any planting operations, provide Owner and Landscape Architect with an inventory of topsoil and a sample survey of test sites for infiltration/percolation, conducted by a licensed Geotechnical Engineer.

3.2 PLANTING OPERATIONS

- A. Planting shall be performed by a licensed and bonded Contractor.
- B. Prior to construction, install a two railed wood fence at canopy drip line of existing trees to remain. Use 4"x4" posts and 2"x6" rails. Landscape Architect must be consulted to approve tree protection.
- C. Antidesiccant shall be applied to all plants before digging at the nursery and/or as directed by the Owner or Owner's Representative.
- D. Plants shall be installed only at the following times:
 - 1. Deciduous Trees, Shrubs, and Vines:
March 21 through May 1 and October 1 through December 1
 - 2. Evergreen Trees, Shrubs, and Groundcovers; Perennials and Ornamental Grasses:
April 15 through June 1 and August 15 through October 1
 - 3. Plants poorly adapted for fall planting shall only be planted during the spring planting season. Trees poorly adapted for fall planting include, but are not limited to, species of Quercus, Platanus, Magnolia, Cercidiphyllum japonica, Prunus, Populus, Liquidambar, Carpinus, Tilia, Salix, Zelkova, Pyrus calleryana, Pinus nigra, Nyssa sylvatica, Liriodendron tulipifera, Crataegus viridis 'Winter King, Cercis canadensis, Betula nigra, and Acer Rubrum 'Armstrong'.
 - 4. If a replacement is required for a tree known to be poorly adapted for fall planting, planting should take place only during the spring planting period. If such a schedule is unacceptable to the Owner, contact Landscape Architect for planting substitutions. Plant substitutions not authorized by Landscape Architect are unacceptable.
 - 5. Avoid planting in hot, dry weather and during rain events.
- E. Plant material delivery and planting schedules shall be arranged to minimize storage of plant material at the site. Plants shall be transported to the Site in closed or covered trucks. Tarps used to cover plants shall be made specifically to protect plants in transit, shall be new or in undamaged condition, and shall be secured sufficiently to protect plant material from harm.
- F. Keep plants and root balls sufficiently moist at all times. Store plants awaiting installation in a location with filtered sunlight and out of direct sun exposure. Contractor shall bear sole responsibility for health and security of plants stored at the Site.
- G. Landscape Contractor shall stake all proposed plant material locations for Landscape Architect review. Notify Landscape Architect a minimum of 72 hours prior to installation. Landscape Contractor shall be responsible for locations of installed plant materials.
- H. Trees should be planted when dormant, unless otherwise authorized by the Landscape Architect. Careful attention should be given to weather conditions, such as avoiding planting in hot, dry weather. All other planting may be done whenever weather and soil conditions are favorable and according to plant installation times in Specifications, or as otherwise authorized by the Landscape Architect. Contractor shall monitor moisture of root balls and keep plants sufficiently moist at all times. Store plants awaiting installation in a location with

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filtered sunlight and out of direct sun exposure. Contractor shall bear sole responsibility for health and security of plants stored on site.

- I. Set plants in center of pits, plumb and straight with the root collar level with finished grade or slightly higher (max 1-1/2") than finished grade as shown on the Drawings.
- J. When B & B plants are set, compact Planting Soil Mix around bases of balls to fill all voids. Cut off and remove burlap, ropes or wires from top 2/3 of balls, tuck and flatten the remaining 1/3 down on the sides before backfilling. Cover all roots with Planting Soil Mix (care should be taken not to crush the roots on bare root trees). No burlap shall emerge from the soil or be near the soil surface after the hole is backfilled.
- K. When container plants are set, remove plant from container, make sure root system is in good health and not root bound. Loosen the outside layer of the root system by scoring with a knife. Circling roots pose a serious health hazard to the plant and shall be divided by hand.
- L. Thoroughly compact Planting Soil Mix around roots and thoroughly and deeply water the root zone to the drip line immediately after plant pit is backfilled. Form a watering saucer 6" greater than the diameter of the root ball with a 4" ridge of loam to retain water. Maintain watering saucer throughout growing season. Rake saucer smooth to finish grade before first frost of the year. Cultivate soil in shrub beds, rake smooth and neatly edge after planting.
- M. Distribute controlled release fertilizer packets equidistant within the planting pit adjacent to the root ball but not in direct contact with the roots. Placement depth shall be 6 to 8 inches. Packets shall not be cut, ripped or damaged. Fertilization of stressed trees should include very low, if any nitrogen during the first year. Fertilizer should include humic acids and mycorrhizal spores. Soil tests should be conducted to verify acceptable pH levels.

1. Fertilizer application quantities as follows:

<u>Plant</u>	<u>Size</u>	<u>No. of Packets</u>
Deciduous Trees:	1-3" cal.	3
	4-6" cal.	4
Shrubs:	2-3 ft	2
	over 3 ft	3
Evergreen Trees:	5-10 ft	4
	over 10 ft	5
Vines:	1 gal.	1
Groundcover:		1 per four plants

- N. When specified on the Drawings, wrap all deciduous trees under 2" caliper immediately after planting. Wrap spirally from bottom to top and adequately secure. Overlap wrapping approximately 2" and entirely cover trunk from ground to height of second branch.
- O. Stake trees according to Drawings.
- P. Do not prune plants at the time of planting except to remove broken or crossed branches. Broken or crossed branches shall be pruned with a sharp tool in a manner to retain and encourage the plant's natural growth characteristics. The crown of a young tree should not be cut back to compensate for root loss. Wound paint or dressing shall not be used.
- Q. Cover all tree and shrub pits immediately after planting with 3" layer of specified mulch unless

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shown otherwise on the Drawings. Limit of mulch for trees shall be 6" beyond watering saucer; for shrubs in beds, entire area of shrub bed unless otherwise specified on Drawings.

- R. Keep mulch 3" away from the trunk.
- S. Furnish plans showing locations of underground utilities encountered, as required.

3.3 MAINTENANCE - PLANTING

A. Planting Maintenance

1. Maintenance shall begin immediately after each plant is installed and shall continue until final acceptance of all planting.
2. Maintenance shall consist of keeping plants in a healthy growing condition and shall include but is not limited to watering, weeding, cultivating, applying mulch as needed, tightening and repairing of guys, removal of dead material, resetting plants to proper grades or upright position, and maintaining the watering saucer. Maintenance shall include the following:
 - a. Plants shall be inspected for watering needs at least twice each week and watered as necessary to promote plant growth and vitality. During dry periods, the Contractor shall water plants deeply at least once weekly. **Irrigation is not provided on this project site.**
 - b. When staking is called for, stakes shall be kept plumb and neat in appearance. Guys, wires and anchoring cables shall be tightened and repaired weekly. The Contractor shall be responsible for removing staking and guying materials one year after planting.
 - c. Any plant of a species not shown in the planting plan and any plant growing outside of the area where it was originally planted shall be considered a weed and removed by the maintenance Contractor. Weeds include specific types of trees, shrubs, vines, perennials, biennials, bulbs, grasses, and annuals. Weeds shall be removed from all mulched areas, planted areas, shrub and tree plantings, lawns, paving, all hardscape areas, and all site improvements. Weed plants including all roots shall be removed using a long-handled fork-like spike. No weed roots shall remain in the soil, and a weed-wacker or string trimmer to control weeds shall not be used. Weeds shall be disposed of off site.
 - d. Mulch shall be replaced as required to maintain the specified layer of mulch. Beds and individual pits shall be neat in appearance and maintained to the designed layout.
 - e. Plants that die during the maintenance period shall be removed and replaced at once, unless designated otherwise by the Landscape Architect.
 - f. Spraying for both insect pests and diseases shall be included during the maintenance period as required and as directed.
3. During the maintenance period, any decline in the condition of plants shall require immediate action to identify potential problems and undertake corrective measures. If requested by the Landscape Architect, engage professional arborists and/or horticulturalists to inspect plant materials and to identify problems and recommend corrective procedures.

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3.4 ACCEPTANCE STANDARDS FOR PLANTING

- A. Following the completion of planting, request from the Landscape Architect in writing, a formal inspection of the completed work. If plant materials and workmanship for the Site are acceptable, written notice will be given to the Contractor stating that the work has been accepted and that the maintenance period is terminated. The one year guarantee period shall commence from the date of acceptance.
- B. If a number of plants are sickly or dead at the time of inspection, or if, in the Landscape Architect's opinion, workmanship is unacceptable, written notice will be given by the Landscape Architect to the Contractor in the form of a punch list, which itemizes necessary planting replacements and/or other deficiencies to be remedied. Maintenance of plants shall be extended until replacements are made or other deficiencies are corrected and are accepted by Landscape Architect. All dead and unsatisfactory plants shall be removed promptly from the project. Replacements shall conform in all respects to the Specifications for new plants and shall be planted accordingly.
- C. Deciduous plant material installed after September 21 cannot be reviewed for acceptance due to stage of leaf physiology. In this situation, review of plant material by the Landscape Architect will occur the following growing season. The guarantee period begins upon acceptance of plant material.

3.5 GUARANTEE FOR PLANT MATERIALS

- A. Plants shall be guaranteed for a period of one (1) year after written notification of acceptance and shall be alive and in satisfactory growth at the end of the guarantee period.
- B. At the end of the guarantee period, a final inspection will be held to determine whether any additional plant material replacements are required. Each plant shall show at least 80% healthy growth and shall have the natural character of its species as determined by the Landscape Architect. Plants found unacceptable shall be removed promptly from the site. These plants shall be replaced during the plant installation times given in the Specifications.
- C. Replacement plants shall have a one (1) year guarantee from time of plant approval.

END OF SECTION

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SECTION 02970- STRUCTURAL SOIL MIX

PART 1 - GENERAL

1.1 REFERENCES

- A. Include GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS as part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.
- C. Coordinate work with trades affecting, or affected by, work of this section. Cooperate with such trades to assure the steady progress of all work under the contract.

1.2 WORK INCLUDED

- A. Refer to the Drawings for the extent and details of this work.
- B. The work of this section consists of all Structural Soil work and related items as indicated on the drawings or as specified herein and includes, but is not limited to, the following:
 1. Preparation, placement, and compacting of structural soil mix on prepared subgrade, for the purposes of planting, necessitated by conditions encountered in the course of the work and as specified herein.
 2. Provide CU Soil™, a proprietary material patented by Cornell University (US Patent # 5,849,069). Only licensed producers are allowed to supply this material, meeting the specifications described in this text. The national distributor is AMEREQ, INC. at 1-800-832-8788.
New Hampshire producer: Outdoor World; 24 Lehoux Drive; Hookset, NH 03106 ph. 603-625-6620 contact Conor Cooper.
Maine producer: K. Lane Erosion Control Services; 199 Neck Rd. West Gardiner, ME 04345; ph 207-724-7369 contact Kevin Lane
 3. Power and/or hand excavation, stockpiling, re-handling and incidental work.
 4. One year Guarantee of Structural Soil as related to sidewalk paver performance.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. The following items of related work are specified and included in other Sections and Divisions of the Specifications:
 1. Section 02950 - Planting

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1.4 DEFINITIONS

- A. The following related items are included herein and shall mean:
1. Standard Specifications: State of New Hampshire, Highway Department, Standard Specifications for Highways and Bridges, latest edition.
 2. ASTM: American Society of Testing and Materials
 3. USDA: United States Department of Agriculture
 4. AASHTO: American Association of State Highway and Transportation Officials
 5. AOAC: Association of Official Agricultural Chemists

1.5 STANDARDS

- A. The following standards form a part of these Specifications:
1. ASTM D1556. Test for Density of Soil in Place by tile Sand-Cone Method.
 2. ASTM D1557. Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.5 kg) Rammer and 18-in. (457 mm) Drop.
 3. AASHTO T-59. The moisture-Density Relations of Soils Using a 5.5 lb. (2.5 kg) Rammer and a 12-in. (305 mm) Drop.

1.6 SUBMITTALS

- A. Submit: Manufacturer's product information, certificates and installation guidelines.
- B. Qualifications of Landscape or Pavement material Contractor: The work of this section shall be performed by a firm which has a minimum of five years experience successfully installing planting mix of a similar quality, schedule requirement and construction detailing to this project.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver or place materials in frozen condition.
- B. Deliver material at or near optimum compaction moisture content as determined by AASHTO T 99 D 698. Do not deliver or place materials in an excessively moist condition (beyond two (2) percent above optimum moisture content as determined by AASHTO T 99 D 698).
- C. Do not store material unprotected from large rainfall events. Protect soils and mixes from erosion and from absorbing excess water at all times. Do not allow excess water to enter the site prior to compaction (washing of tools, trucks, etc.) If water is introduced into the material after grading, allow material to drain to near optimum compaction moisture content.

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1.8 EXAMINATION OF CONDITIONS

- A. All areas to receive Structural Soil shall be inspected by the Contractor before starting work and all defects such as incorrect grading, compaction and inadequate drainage etc. shall be reported to the Landscape Architect prior to beginning this work.
- B. The Contractor shall be responsible for judging the full extent of work requirements involved, including but not limited to the potential need for temporary storage and staging of soils, including moving soil stock piles at the site to accommodate scheduling of other work and the need to protect installed soils from compaction, erosion and contamination.

1.9 QUALITY ASSURANCE

- A. Qualifications of Landscape or Pavement material Contractor: The work of this section shall be performed by a firm which has a minimum of five years experience successfully installing planting mix of a similar quality, schedule requirement and construction detailing to this project. Proof of this experience shall be submitted as per paragraph, SUBMITTALS, of this Section.

PART 2 – PRODUCTS

2.1 GENERAL

- A. CU Soil™. See 1.02 for product information and producer contact information.

PART 3 - EXECUTION

3.1 UNDERGROUND UTILITIES AND SUBSURFACE CONDITIONS

- A. Notify the Landscape Architect of any subsurface conditions which will effect the Contractor's ability to complete the work.
- B. Locate and confirm the location of all underground utilities prior to the start of any excavation.
- C. Repair any underground utilities or foundations damaged by the Contractor during the progress of this work. The cost of all repair shall be at the Contractor's expense.

3.2 SITE PREPARATION

- A. Do not proceed with the installation of the Structural Soil material until all walls, curb footings and utility work in the area have been installed. For site elements dependent on Structural Soil for foundation support, postpone installation until immediately after the installation of Structural Soil.
- B. Install subsurface drain lines as shown on the Civil Engineer's Drawings prior to installation of Structural Soil material.

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- C. Excavate and compact the proposed subgrade to depths, slopes and widths as shown on the Drawings. Maintain all required angles of repose of the adjacent materials as shown on the drawings. Do not over excavate compacted subgrades of adjacent pavement or structures.
- D. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and or toward the subsurface drain lines as shown on the Civil Engineer Drawings.
- E. Clear the excavation of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout silts or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required subgrade compaction.
- F. Do not proceed with the installation of Structural Soil until all utility work in the area has been installed. All subsurface drainage systems shall be operational prior to installation of Structural Soils.
- G. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use ½" plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.
- H. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.
- I. Any damage to the paving or architectural work caused by the soils installation Contractor shall be repaired by the general contractor at the soils installation contractor's expense.
- J. Maintain all silt and sediment control devices required by applicable regulations. Provide adequate methods to assure that trucks and other equipment do no track soil from the site onto adjacent property and the public right of way.

3.3 INSTALLATION OF STRUCTURAL SOIL MATERIAL

- A. Install Structural Soil in 6 inch lifts and compact each lift.
- B. Compact all materials to peak dry density from a standard AASHTO compaction curve (AASHTO T 99). No compaction shall occur when moisture content exceeds maximum as listed herein. Delay compaction 24 hours if moisture content exceeds maximum allowable and protect Structural Soil during delays in compaction with plastic or plywood as directed by the Landscape Architect.
- C. Bring Structural Soils to finished grades as shown on the Drawings. Immediately protect the Structural Soil material from contamination by toxic materials, trash, debris, water containing cement, clay, silt or materials that will alter the particle size distribution of the mix with plastic or plywood as directed by the Landscape Architect.

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- D. The Landscape Architect may periodically check the material being delivered and installed at the site for color and texture consistency with the approved sample provided by the Contractor as part of the submittal for Structural Soil. In the event that the installed material varies significantly from the approved sample, the Landscape Architect may request that the Contractor test the installed Structural Soil. Any soil which varies significantly from the approved testing results, as determined by the Landscape Architect, shall be removed and new Structural Soil installed that meets these specifications.

3.4 FINE GRADING

- A. After the initial placement and rough grading of the Structural Soil but prior to the start of fine grading, the Contractor shall request review of the rough grading by the Landscape Architect. The Contractor shall set sufficient grade stakes for checking the finished grades.
- B. Adjust the finish grades to meet field conditions as directed.
 - 1. Provide smooth transitions between slopes of different gradients and direction.
 - 2. Fill all dips with CU-Soil™ and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in Structural Soil areas shall be a 3" deviation from the plane in 10'.
 - 3. All fine grading shall be inspected and approved by the Landscape Architect prior to the installation of other items to be placed on the Structural Soil.
- C. The Landscape Architect will inspect the fine grading work upon the request of the Contractor. Request for inspection shall be received by the Landscape Architect at least 3 days before the anticipated date of inspection.

3.5 PLACEMENT OF PLANTING MEDIA IN TREE PITS

- A. After subgrade levels have been reached in tree pits, a minimum of four inches of Sand Based Structural Planting Medium to be placed and compacted to 84 to 88 percent Modified Proctor Maximum Dry Density as a base for the root ball.
- B. After setting root balls, back fill tree pits with Loam Based Planting Medium in six inch lifts and tamped to 84 to 88 percent Modified Proctor Maximum Dry Density. The surface area of each lift to be scarified by raking prior to placing the next lift.

3.6 ACCEPTANCE STANDARDS

- A. The Landscape Architect will inspect the work upon the request of the Contractor. Request for inspection shall be received by the Landscape Architect at least 3 days before the anticipated date of inspection.

3.7 CLEAN-UP

- A. Upon completion of the Structural Soil installation operations, clean areas within the contract limits. Remove all excess fills, soils and mix stockpiles and legally dispose of all waste materials, trash and debris. Remove all tools and equipment and provide a clean, clear site. Sweep, do not wash, all paving and other exposed surfaces of dirt and mud until the paving has been installed over the Structural Soil material. Do not wash until finished materials covering Structural Soil material are in place.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
 - 2. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Each mix design will also indicate where concrete will be used.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Setting Drawings shall be complete in showing and identifying by mark or otherwise all the bars to be incorporated into the work. Reinforcement of concrete walls shall be shown on wall elevations and reinforcement of beams shall be shown on beam elevations with sections as required. Elevations of walls and beams shall be at least 1/4 inch scale.

- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- E. Minutes of preinstallation conference.
- F. Anchor Bolt Survey: Stamped Survey Plan of Anchor Bolt As-Built.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Supplier Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the 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-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
 - 1. Before submitting design mixes, review concrete mix design 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 and project manager.
 - b. Independent testing agency responsible for concrete design mixes.
 - c. Ready-mix concrete producer.
 - d. Concrete subcontractor.
 - e. Structural engineer of record.
 - f. Owner's representative.
 - g. Owner's testing agency.

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h. Architect

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- D. 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.
- E. Form Ties: 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 (25 mm) to the plane of the exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Wire: ASTM A82
- C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's

"Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete 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 or CRSI Class 2 stainless-steel bar supports.
 2. For chairs supporting reinforcement above soil, provide sand plates to properly support bars.
- B. Slab On Grade Construction Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM 150, Type I/II.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
1. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).
- C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
- B. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

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2.7 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, Class C or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick:
 - 1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils (0.25 mm) thick.
- B. Vapor Retarder: 110-mil- (2.8-mm-) thick, semiflexible, seven-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weathercoating, and removable plastic release liner. Furnish manufacturer's accessories including bonding asphalt, pointing mastics, and self-adhering joint tape.
 - 1. Water-Vapor Permeance: 0.00 grains/h x sq. ft. x inches Hg (0.00 ng/Pa x s x sq. m); ASTM E 154.
 - 2. Tensile Strength: 140 lbf/in. (24.5 kN/m); ASTM E 154.
 - 3. Puncture Resistance: 90 lbf (400 N); ASTM E 154.
 - 4. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Premoulded Membrane Vapor Seal" by W. R. Meadows, Inc.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 (4.75-mm) sieve and 10 to 30 percent passing a No. 100 (0.15-mm) sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.
- D. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.8 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- B. Water: Potable.
- C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.10 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
 - 2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

- B. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): Refer to plans.
 - 2. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.

- C. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): Refer to plans.
 - 2. Maximum Slump: 4 inches (100 mm) before adding additives.

- D. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.

- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Combined Fly Ash and Pozzolan: 25 percent.

- F. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.

- G. Air Content: Where required, add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
 - 1. Air Content: 6 percent for 3/4-inch- (19-mm-) nominal maximum aggregate size.

- H. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 2 percent.

- I. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture 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.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

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2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRST's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information. Provide amount of water withheld from Design Mix on batch ticket.
 - 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

3.1 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 B, 1/4 inch (6 mm).
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Chamfer edges of permanently exposed concrete, as indicated on the drawings.
- F. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 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 bolts, accurately located, to elevations required. All anchor bolts shall be dryset (set prior to placement – wetsetting is unacceptable).

3.3 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 provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- 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.

3.4 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.
- B. Fine-Graded Granular Material: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).
- C. Granular Fill: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).
 - 1. Cover vapor barrier with 8" of granular fill.
 - 2. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.
 - 3. Do not allow granular fill to wet by rain or construction activities.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRST's "Manual of Standard Practice" for placing reinforcement.

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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.
- 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.
- 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. Use sand chair supports at slabs on grade.

3.6 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. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38mm) into concrete.
 3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 4. Use neat cement slurry at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Slab On Grade Construction Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated. Refer to drawings for details.
 1. Construction joints shall be saw cut and filled with joint filler.

3.7 WATERSTOPS

- A. Flexible 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 Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.8 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. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- C. Deposit concrete continuously or in 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 specified. Deposit concrete to avoid segregation.
- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators 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 mix 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.

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5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater 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 air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 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 mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to 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. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified. Use at areas not exposed to 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 and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 2. Do not apply rubbed finish to smooth-formed finish.
- C. Rubbed Finish: Apply the following to smooth-formed finished concrete, as indicated on plans:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

- D. 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.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first trowel finish 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 surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15 for slabs-on-grade.
 - b. Specified overall values of flatness, F(F) 25; for elevated slabs on steel beams and metal deck (equivalent to ¼" gap under 10-foot straightedge). Elevated slab elevations shall be set by lasers taking in consideration that beams and deck shall deflect due to dead load..
- D. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- E. 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.

3.11 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 Work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 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. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, 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 or adhesive applied floor finishes.

- c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
- 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.
- 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.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 1.5 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 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 (1.2-mm) 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 pro-

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- ceeding 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 by removal and replacement.
 5. Repair defective areas and low 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 mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Correct low areas scheduled to remain exposed by removal and replacement.
- 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.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: 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 one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

- a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. 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 mix. Perform additional tests when concrete consistency appears to change.
4. 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 mix.
5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
7. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. Test two field-cured specimens at 7 days and two at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix 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 (3.4 MPa).
- E. Test results shall be reported in writing to Architect, the SER, concrete manufacturer, 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 mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. 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.
- G. 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

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to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

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SECTION 03450

ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes precast concrete units.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide precast concrete units and connections capable of withstanding design loads within limits and under all existing code criteria.

1.03 SUBMITALS

- A. Product Data: For each product indicated.
- B. Design Mixes: For each concrete mix.
- C. Shop Drawings: Detail Fabrication and installation of precast concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish and types of reinforcement, including special reinforcement.
 - 1. Comprehensive engineering analysis stamped and signed by the qualified professional engineer responsible for its preparation. Analysis shall indicate design loads, member spans, member reinforcement, and connection design and detail for attachment to supporting structure.
- D. Samples: For each type of finish, in sets of 3, 12 by 12 by 2 inches.
- E. Welding certificates.
- F. Material certificates.

1.04 QUALITY ASSURANCE:

- A. Fabricator Qualifications: A qualified fabricator who assumes responsibility for engineering precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

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1. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group A, Category A1 – Architectural Cladding and Load Bearing Units.
 - B. Design Standards: Comply with ACI 318 and the design recommendations in PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete."
 - C. Quality-Control Standard: Comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
 - D. Welding: Qualified procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel", and AWS D1.4, "Structural Welding Code-Reinforcing Steel."
 - E. Sample Panels: Produce a minimum of 3 sets of full-scale sample panels, approximately 48 inches long by 48 inches high, to demonstrate range of finish, color, and texture variations of approved samples.
- 1.05 DELIVERY, STORAGE, AND HANDLING
- A. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.
 - B. Lift and support units only at designated lifting and supporting pints shown on Shop Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Steel Reinforcing:
 1. Reinforcing Bars: ASTM A 615/A 615M, Grade 69, deformed.
 2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
 3. Plain-Steel Wire: ASTM A 496.
 4. Deformed-Steel Wire: ASTM A496.

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5. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
6. Deformed-Steel Welded Wire Fabric: ASTM A 497 flat sheet.
7. Supports: Manufacture's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to PCI MNL 117.
8. Prestressing Strand: ASTM A 416/A 416M, Grade 250 or 270, uncoated, 7-wire, low-relaxation strand.

B. Concrete:

1. Portland Cement: ASTM C 150, Type I or Type III, of same type, brand, and source. Color samples to be submitted to Design /Builder for approval. Color to be MCTC.
2. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S.
3. Light-Weight Aggregates: ASTM C 330.
4. Coloring Admixture: ASTM C 979 synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
5. Air-Entraining Admixture: ASTM C 260.
6. Fly Ash Admixture: ASTM C 618, Class C or F.
7. Metakaloin Admixture: ASTM C 618, Class N.
8. Silica Fume Admixture: ASTM C 1240.

C. Steel Connections:

1. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

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2. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.
 3. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
 4. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
 5. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
 6. Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coated by hot-dip process according to ASTM A 123/A 123M, after fabrication and ASTM A 153/A 153M as applicable.
 - a. Galvanizing Repair Paint: DOD-P-21035A or SSPC-Paint 20.
 7. Shop-Primed Finish: Prepare surfaces of non-galvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead and chromate-free, rust-inhibitive primer, complying with performance requirements in FS TT-P-664, SSPC-Paint 25, according to SSPC-PA 1.
- D. Sand-Cement Grout: Portland cement, ASTM C 150, Type 1, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2 ½ parts sand, by volume, with minimum water required for placement and hydration.
- E. Pre-Cast units: To include pre-cast beams at lobby and west stair, pre-cast column covers, and pre-cast sill elements as shown.

2.02 CONCRETE MIXES:

- A. Light-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or filed test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28 Days): 5000 psi.
 2. Maximum Water-Cementitious Materials Ratio: 0.40.

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- B. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

2.03 FABRICATION:

- A. Anchorage Hardware: Fabricate with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during pre-casting operations.
- B. Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing pre-cast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast concrete units to receive windows, cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.
- D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.
- E. Reinforce precast concrete units to resist handling, transportation, and erection stresses.
- F. Prestress tendons for precast concrete units by either pre-tensioning or post-tensioning methods. Comply with PCI MNL 117.
- G. Mix concrete according to PCI MNL 117 and requirements in the Section. After concrete batching, no additional water may be added.
- H. Place face mix to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover.

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- I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting and placing concrete.
 - 1. Place backup concrete to ensure bond with face mix concrete.
 - J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.
 - K. Comply with ACI 306.1 procedures for cold-weather concrete placement.
 - L. Comply with ACI 305 R recommendations for hot-weather concrete placement.
 - M. Identify pickup pints of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure.
 - N. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
 - O. Discard precast concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Design/Builder.
 - P. Fabricate precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finish panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in-items.
- 2.04 FINISHES:
- A. Finish exposed-face surfaces of precast concrete units to match approved design reference sample and as follows:
 - 1. Finish to Simulate Granite Per TT13, Northern Design Precast, Inc. (603-783-8985).
Note: Window sills color to be equal to Smokey.5.

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2. PCI and APA's "Architectural Precast Concrete – Color and Texture Selection Guide, :” of plate numbers indicated.
 3. Smooth-Surface Finish: Free of pockets, sand streaks, and honeycombs, with uniform color and texture.
 4. Textured-Surface Finish: Impart by form liners or inserts to produce surfaces free of pockets, streaks, and honeycombs, with uniform color and texture.
 5. Bushhammer Finish: Use power or hand tools to remove matrix and fracture coarse aggregates.
 6. Retarded Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
 7. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 8. Horned Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 9. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
- B. Finish exposed top and bottom surfaces of precast concrete units to match face-surface finish.

2.05 SOURCE QUALITY CONTROL

- A. Design/Builder will employ an independent testing agency to evaluate precast concrete fabricator's quality-control and testing methods.
- B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

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- A. Install precast concrete. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
 - 1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
- B. Anchor precast concrete units in position by bolting, welding, grouting, or as otherwise indicated.
- C. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
 - 1. Repair damaged steel surfaces by cleaning and applying a coat of galvanized repair paint to galvanized and re-priming damaged painted surfaces.
- D. Install pre-cast concrete units level, plumb, square, true, and in alignment without exceeding the non-cumulative erection tolerances of PCI MNL 117, Appendix 1.
- E. Repair exposed exterior surfaces of precast concrete units to match color, texture, and uniformity of surrounding precast concrete if permitted by Design/Builder.
- F. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt and stains.

END OF SECTION

SECTION 04200

UNIT MASONRY

1. GENERAL

1.1 DESCRIPTION OF WORK

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. Extent of Unit Masonry is shown on the drawings.
- C. In addition to work shown on the drawings and specified elsewhere in this Section, build in steel lintels, anchors, inserts and sleeves.

1.2 QUALITY ASSURANCE

- A. Standards: Comply with recommendations of Brick Institute of America (BIA), and National Concrete Masonry Assoc. (NCMA).

1.3 SUBMITTALS

- A. Issue submittals in accordance with Section 01300, Submittals.
- B. Submit product data and installation recommendations for masonry units, cementitious products for mortar and grout, coloring pigments, throughwall flashing, and masonry accessories.
- C. Submit samples of exposed masonry units and mortar, illustrating full range of colors and textures.
- D. Build 4 x 4 sample wall on site for Architect's inspection. Sample wall to include back up wall finishes, weeps, 15# felt, brick ties.

PRODUCTS

2.1 FACE BRICK

- A. Face brick shall be Old Port Narrow Flashed Range.
- B. Face brick shall comply with ASTM C 216, Grade SW, Type FBS. Units shall be standard size, modular for 3/8 in. mortar joints, nominal dimensions 3-5/8 in. thick, 2-1/4 in. high, 7-5/8 in. long, and 8" x 8" x 3-5/8".

2.2 CONCRETE MASONRY UNITS

- A. Except as shown on Drawings or specified otherwise, all concrete masonry units shall be as follows:
1. Hollow-type complying with ASTM C 90, Type 1 (moisture-controlled), Grade N.
 2. Compressive strength: 2500 psi net, 1250 psi gross (average of three units). Prism strength $f_m=2500$ psi in Pier A, $f_m=2000$ elsewhere.
 3. Normal-weight, with sand and gravel aggregate complying with ASTM C 33, approximate oven-dry unit weight of 135 lbs. per cu. ft.
 4. Nominal 8" x 16" face dimensions (modular for 3/8 in. mortar joints), thickness per drawings, smooth face, standard gray color, laid up in running bond. 3" "Shouldice" designer stone.
 5. Shouldice Designer Stone, see drawings for size type and style. SHOULDICE DESIGNER STONE PHONE: (519) 935-2771 or (800) 265-3174

2.3 MORTAR AND GROUT

- A. Mortar shall comply with ASTM C 270, BIA Technical Notes 8 and 8A, and local Building Code.
- B. Materials shall conform to applicable ASTM specifications including the following:
1. Portland Cement: ASTM 150, Types I, II, or III (do not use Types IA, IIA, or IIIA).
 2. Masonry Cement: ASTM C 91.
 3. Hydrated Lime: ASTM C 207, Type S only (do not use Type N).
 4. Natural or manufactured sand aggregate: ASTM C 144, gradation conforming to Table 1 in BIA Technical Note 8.
 5. Masonry cement shall not contain ground limestone.
 6. Water: clean, potable, and free of deleterious amounts of acids, alkalies or organic materials.
- C. Mortar Type
1. General:

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- a. Mortar for exterior brick shall be colored, submit samples to Architect for approval. Color to be SGS 22A Tan.
- b. Use 1800 psi minimum Type S mortar for reinforced masonry and where indicated.
- c. Use 750 psi minimum Type N mortar for exterior, above-grade loadbearing and non-loadbearing walls, and for other applications where another type is not indicated.

D. Grout

1. Grout shall conform to ASTM C 476 and to match existing.
2. Fine and coarse aggregate for grout mixes shall be defined in ASTM C 404.
 - a. Fine grout shall consist of one part portland cement, 0 to 1/10 part lime, 2-1/4 to 3 parts fine sand.
 - b. Coarse grout shall consist of the fine grout mix described in "a" above plus 1 to 2 parts coarse aggregate.
 - c. Use coarse grout (pea gravel aggregate) except where minimum horizontal core dimension is under 4 in., in which case use fine grout (sand aggregate). Ordinary concrete (maximum 1 in. aggregate) may be used where minimum core dimension exceeds 6 inches.

- E. During cold-weather construction at exterior walls, use Type III (high-early strength) cement and Type S hydrated lime. A non-calcium-chloride-based accelerator such as Dur-o-Wal, Dur-o-Guard, or Euco Accelguard 80 may be used, in quantities recommended by manufacturer for expected ambient temperature. Calcium chloride may not be used. Refer to EXECUTION portion of this Section for general provisions governing cold weather construction.

2.4 METAL REINFORCING, TIES, ANCHORS

- A. Acceptable manufacturers: Heckmann Building Products, or approved equal.
- B. Brick ties at masonry veneer construction:
 1. 14 Ga # 315-D anchor with 3/16 x 4" #316 triangle ties. Min. 2" into bed joints. Ties to be stainless steel.
 2. Secure anchors to sheathing with s/s wood screws as recommended by anchorage manufacturer.

3. Maximum spacing: 24 in. o.c. vertically, 16 in. o.c. horizontally or closer spacing as required at expansion joints, corners, floors, etc., or to secure directly to studs.
4. Material: stainless steel.

2.5 THROUGHWALL FLASHING

- A. Through-wall flashing: Thru wall flashing at base and all window and door heads to be equal to "EPRA"- max EPDM. Flashing to be extended sufficiently beyond jambs and form end dams. Thru wall flashing with H & B # DP stainless steel drip plate as manufactured by Hohmann & Barnard Inc. "Henry Thru Wall", blue skin is also an acceptable product.
- B. Through-wall flashing sealant: Shall be Sandell Trowel Mastic, as manufactured by Sandell Manufacturing Co., Inc.

2.6 ROOFING FELT

- A. No. 15, asphalt-saturated, unperforated organic roofing felt, complying with ASTM D 226, Type I, 36 inches wide.

2.7 MASONRY ACCESSORIES

- A. Weepholes: medium-density polyethylene, 3/8 in. diameter, full depth of outer wythe.
- B. Chemical cleaning agents for newly-installed masonry: ProSoco Sure-Klean liquid masonry cleaners or equal by Diedrich, as recommended by manufacturer for particular condition. Recommended cleaners include Sure-Klean No. 600 Detergent, No. 101 Lime Solvent, and Vana Trol.
- C. Apply water proofing – Karnac 920 A.F. or Henry 785 Asphalt Emulsion trowel grade, on all block face bearing brick veneer.

3. EXECUTION

3.1 MASONRY WORK IN GENERAL

- A. Erect all masonry work in compliance with the line and level tolerances specified herein. Correct, or replace, as directed by the Architect, non-conforming masonry work at no additional cost to the Contract.

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- B. Lay no face brick or concrete masonry unit having chipped edges or face defects where such unit or piece would be exposed to view. Remove any such unit or piece, if installed, replace with new matching material, and bear all costs therefore.
- C. Examine all Drawings as to requirements for the accommodation of work of other trades. Provide all required recesses, chases, slots, cutouts, and set loose lintels. Place anchors, bolts, sleeves and other items occurring in the masonry work. Take every precaution to minimize future cutting and patching. Closely coordinate the location and placement of such items.
- D. Protect all masonry from rain prior to, and during the installation thereof. If the temperature is in excess of 80 degrees F. at time of installation, lightly moisten contact surfaces or masonry units by brushing with water.
- E. Lay all masonry in full mortar beds, and completely butter all concealed from view vertical edges with mortar. Completely fill cells of masonry units with mortar where vertical reinforcement is to be installed therein and in other locations specified or indicated on the Drawings.
- F. Provide complete protection against breakage and weather damage to all masonry work, including substantial wood boxing around door jambs, over the tops of walls and wherever necessary to protect work at all stages of completion. Protect masonry when not roofed over, at all times when masons are not working on the walls. Apply non-staining tarpaulins or waterproof paper, properly weighted, or nailed, to assure their remaining in place to protect masonry from all possible hazards.
- G. Fit masonry into bucks and frames so as not to distort alignment of such items, and fill backs of such items with mortar, except where joints are indicated to receive caulking and sealant and have no compressible filler therein, in which case rake joints to a uniform depth of $\frac{3}{4}$ inch for proper installation of caulking and sealant material.
- H. Use only power saw, equipped with carborundum blade, for cutting exposed masonry, as needed to assure straight, evenly-cut edges.
- I. Lay out coursing before setting to minimize cutting closures or jumping bond. Do not spread any more mortar than can be covered before surface of mortar has begun to dry. Do not endanger bond or mortar by moving masonry when once laid. If necessary to re-adjust any items, remove entirely, clean-off mortar, and reset with fresh mortar.
- J. Except for cleaning down and pointing, finish all new masonry as the walls and partitions are carried up.
- K. Point and fill all holes and cracks in mortar joints with additional fresh mortar; do not merely spread adjacent mortar over defect or use dead mortar droppings. Do all

pointing while mortar is still soft and plastic. If hardened, chisel defect out and refill solidly with fresh additional mortar, and tool as specified.

3.2 JOB CONDITIONS

- A. Store cement, lime and other cementitious materials under cover in a dry place.
- B. Keep steel reinforcing, ties and anchors free from oil, dirt, rust, and other materials which would destroy bond.
- C. Store masonry above ground on level platforms which allow air circulation under stacked units. Masonry units shall be dry and free from soil and ice before being laid in wall.
- D. Keep installed walls dry and clean at all times. Immediately remove grout or mortar from face of masonry to be left exposed or painted. Protect previously installed elements such as louvers, doors, frames, and windows from mortar droppings and construction damage, using masking elements, dropcloths, etc.
- E. Cover exposed walls at end of working day with well-secured canvas tarpaulins. Protect base of exterior walls from splashing mud and mortar by spreading sand, straw, and sawdust or plastic sheeting 3 to 4 ft. horizontally and up face of wall. Turn scaffold boards near wall on edge at end of day to prevent splashing mortar or dirt.
- F. Securely brace partially completed walls against wind damage. Walls shall have been before completed 24 hours minimum before application of distributed loads, 72 hours concentrated loads.
- G. Comply with cold-weather construction specifications in NCMA-TEK 16 and BIA Technical Note 1A:
 - 1. Maintain masonry above 32 degrees F. for 24 hours minimum using insulated blankets or heated enclosures. Construct windbreaks at wind velocities over 15 mph. Maintain mortar on board at 40 degrees F. minimum, heating mixing water and sand as required.
 - 2. Sprinkle units with high rates of absorption with heated water. Refer to mortar paragraph under PRODUCTS in this Section for provisions governing cold-weather additives to mortar. If standard instead of Type III high-early strength cement must be used, maintain installed masonry above freezing for 48 instead of 24 hours.
 - 3. Do no masonry work at temperatures below 38 degrees F and falling or 35 degrees F and rising, until General Contractor has contacted Architect.

3.3 INSTALLATION

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- A. Verify that substrate is dry and free from frost, dirt, laitance, loose sand and other material which would prevent satisfactory bond. Lay first course in full mortar bed including face shells and webs of concrete masonry units. Keep cells to be grouted free from mortar.
- B. Dampen masonry units as required to prevent excess suction of mortar. Lay concrete masonry units to form continuous unobstructed vertical spaces within wall. Provide full mortar coverage on horizontal and vertical face shells. Also bed webs adjacent to reinforced cores to prevent grout leakage, except omit web bedding at fully grouted walls to permit grout to flow laterally. Lay face brick with full vertical and bed joints, except as specified below to provide weepholes. Cut exposed masonry units, where necessary, with a power saw. Avoid the use (by proper layout) of less-than-half-size units.
- C. Install masonry units in the bond pattern indicated, or if none is indicated, in running bond.
- D. Step back unfinished work -- tothing is not permitted. Do not adjust installed units -- where necessary, completely remove and reinstall using fresh mortar.
- E. Maximum variation of installed walls from plumb, level, or plan grid shall not exceed 1/4 in. in 10 ft. Wall thickness shall not vary more than 1/4 in. plus or minus from dimension shown on drawings.
- F. Mortar:
 - 1. Measure materials in calibrated containers, or by similar easily-controlled and maintained method. Do not use shovel measurement.
 - 2. Mix materials in a mechanical mixer at least three minutes with minimum amount of water necessary to produce a workable consistency. Retemper stiffened as required to restore evaporated water, but do not place mortar any later than 2-1/2 hours after mixing.
 - 3. Exposed-to-view joints shall be approximately 3/8 in. wide, to meet coursing shown, tooled when thumbprint hard with a round bar to produce a dense, slightly concave surface well-bonded to masonry edges.
 - 4. After tooling, cut off mortar tailings with a trowel and brush off excess. Concealed joints, including those on cavity side of masonry veneer, and joints in masonry to be plastered or stuccoed shall be struck off flush, with no protrusions.

5. Mortar not tight at time of tooling shall be raked out, pointed with fresh mortar, and retooled. Where sealant is shown, rake out joint 3/4 in., ready for backer rod and sealant specified in Division 7 sealants Section.

G. Through-wall flashing:

1. Install flashing to the profiles shown on the drawings.
2. Masonry and concrete surfaces receiving through wall flashings shall be thoroughly dry, free from loose material, and reasonably smooth. There shall be no slopes that will form pockets or prevent free drainage of water to exterior surfaces of wall.
3. Set flashing in sealant. Hold sealant back 1/4 inch from face of lintel. Hold flashing 1/2 inch back from face of lintel.
4. At wall openings, extend flashing 6 in. beyond each side of opening and turn up to form pan. Fold all corners, do not cut.
5. Lap joints between lengths of flashing 6 in. minimum and seal with mastic. Seal penetrations through flashing with mastic or overlapping piece of flashing.

H. Provide weepholes at 24 inches on center maximum spacing through outer face of masonry at all through-wall flashing.

I. At masonry veneer construction over gypsum sheathing, provide rubber washers or bituminous dampproofing compound at all penetrations made in sheathing board or paper as part of work under this Section, including screw heads and veneer-tie anchorage.

J. Provide openings and chases as required for structural members, ductwork, large pipes, etc. Cut exposed masonry with carborundum saw to ensure straight even edges. Neatly block around and patch penetrations. Provide compressible filler around edges of openings to accommodate vibration and structural deflection. Ensure that joint reinforcement remains uncut or is well-lapped.

K. Provide control and expansion joints at locations shown, and keep clean of mortar droppings. Install Joint Sealers in accordance with Section 07900.

L. Build other work into the masonry work as shown, fitting masonry units around other work, and grouting to secure anchorage.

3.4 ALLOWABLE TOLERANCES FOR MASONRY WORK

A. Maximum variation from true surface level for exposed to view walls and partitions:

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1. Unit-to-unit tolerance: 1/8 inch.
2. Surface, overall tolerance: ¼ inch in 10 feet in any direction when tested with ten foot long straightedge. Where both faces or wall or partition will be exposed to view, request and obtain decision from the Architect as to which face will be required to conform to the specified surface level tolerance.

B. Maximum variation from true vertical plumb lines:

1. In lines of walls and arises:
 - a. ¼ inch in 10 feet.
 - b. 3/8 inch in any story, or up to 20 feet maximum.
 - c. ½ inch in 40 feet maximum.
2. For external corner lines, control joints, and other conspicuous lines:
 - a. ¼ inch in any story, or up to 20 feet maximum.

C. Maximum variation from horizontal level or grades for exposed sills, lintel blocks, and other conspicuous lines:

1. ¼ inch in any bay, or up to 20 feet maximum.
2. ½ inch in 40 feet maximum.

D. Maximum variation of linear building line from an established position in plan and related portions of walls and partitions:

1. ½ inch in any bay or up to 20 feet.
2. ¾ inch in 40 feet maximum.

3.5 WALL AND PARTITION CONSTRUCTION

A. General:

1. Build the masonry walls and partitions in the various combinations and thickness as indicated on the Drawings and as herein specified.
2. Build in anchorage items and loose lintels as the work progresses.
3. Lay first course of masonry on a smooth bed or mortar, after supporting concrete has been cleaned. Fill cells of first course concrete masonry units with mortar in all

cases. Completely fill cells of concrete masonry units wherever vertical reinforcing rods are installed therein.

4. For exterior masonry cavity walls, install cavity insulation, through wall membrane flashings, weep wicks, and peastone, as specified herein.
5. Fill pressed metal frames occurring in masonry with mortar, as the masonry is erected.

3.6 GROUT

- A. Lay masonry units with core cells vertically aligned and cavities clear of mortar and unobstructed.
- B. Permit mortar to cure three (3) days before placing grout.
- C. ACI Building Code requirements for Masonry Structures and ACI Specifications for Masonry Structures are made part of this specification as are all pertinent sections of the ACI Building Code.

3.6 CLEANING MASONRY

- A. Masonry cleaning procedures shall follow recommendations of NCMA-TEK 45 and BIA Technical Note 20 (revised).
- B. Dry brush masonry work at end of each day's work.
- C. After new mortar has cured 14 days minimum, remove large mortar particles with non-metallic scrapers, chisels, or wooden paddles. Wash off dirt and other foreign materials with clean water and light concentration of soap or detergent.
- D. For mortar smears, construction dirt, stains, efflorescence, etc., not removable by above methods, use proprietary cleaners specified under PRODUCTS. Muriatic acid may not be used. Adhere strictly to manufacturer's recommendations.
- E. Apply and scrub cleaning solutions with non-metallic fibrous brushes. Thoroughly rinse cleaned area before cleaning solution can dry, using water hosed under moderate pressure.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART I - GENERAL

1.01 GENERAL REQUIREMENTS

- A. RELATED DOCUMENTS: The drawings and the general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

- A. Work covered by this Section includes the furnishing of all labor, material, equipment and accessories, and the performing of all operations in connection with the wood framing, other carpentry as indicated on the Drawings and/or specified within this Section.
- B. The work covered by this Section includes, but is not necessarily limited to, the following:
 - 1. Furnishing and installing all rough carpentry, including miscellaneous grounds, blocking, sills, plates, shoes, shims, and furring, framing, framing anchors, and fasteners.
 - 2. Furnishing and installing plywood wall back up panels and backer boards for telephone and electrical equipment.
 - 3. Drilling concrete and masonry and drilling and tapping of metal work as required for installation of rough carpentry.
 - 4. Any other items of carpentry necessary to complete work properly.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Finish Carpentry - Section 06200.
- B. Insulation - Section 07210.
- C. Caulking and Sealants - Section 07900.
- E. Finish Hardware - Section 08710.

1.04 QUALITY ASSURANCE

A. Codes and Standards:

1. IBC - 2003
2. AITC Timber Construction Manual - 1994
3. NFPA National Design Specification For Wood Construction - 1991

PART 2 - PRODUCTS

2.01 LUMBER

- A. Lumber shall conform to American Softwood Lumber Standard Voluntary Product Standard PS20-70. Lumber shall bear the grade and trademark of the Association under whose rules it is produced and a mark of mill identification. Use framing lumber harvested from sustainably managed forest or local/regional materials or durable materials. See Section 8 R-1 of MaineHousing Green Building Standards.
- B. Protect all lumber and keep dry, both in transit and at the job site.
- C. All lumber shall be well seasoned and contain not more than 15% moisture content (marked "S-Dry"), or durable materials.
- D. All two inch nominal framing lumber shall have the following minimum base values, unless otherwise noted:
1. Extreme Fiber Stress in Bending, $F_b = 875$ psi.
 2. Horizontal Shear, $F_v = 135$ psi.
 3. Compression Perpendicular to Grain, $F_{cA} = 425$ psi.
 4. Compression Parallel to Grain, $F_c = 1100$ psi.
 5. Tension Parallel to Grain, $F_t = 450$ psi.
 6. Modulus of Elasticity, $E = 1,400,000$ psi.
- E. Engineered Wood Products: Provide engineered wood products manufactured by TrusJoist/MacMillan or approved alternate.

2.02 PLYWOOD

A. General:

1. Each panel shall be identified with appropriate American Plywood Association grade-trademark, showing panel type, span rating, thickness, veneer grade, species group member, edge detail (where applicable), and exposure grade.
 2. Each panel shall meet requirements of U.S. Product Standard PS 1 for Construction and Industrial Plywood, or APA Performance Standards where applicable.
 3. Panels shall be square-edged except as noted below for flooring panels.
- B. Exposure Classification: All panels shall be APA "Exposure 1" panels, unless noted otherwise on the Drawing Set, or qualified below:
1. In areas of high humidity, or in locations permanently exposed to weather, panels shall be APA "Exterior".
 2. "Exposure 2" panels may be used if only moderate construction delays are anticipated.
 3. "Interior" grade panels may be used only if the panels will be fully protected from weather, both during and after construction.
- C. Finish:
1. Plywood with one face exposed-to-view shall be APA A-D Veneer Grade or better.
 2. Plywood that is not exposed to view shall be APA C-D Plugged Grade or better.

Panel Size and Grade

1. Floor shall be 23/32, 24" o.c. "Advantech Floor Span" T&G by J.M. Huber or equal. Refer to Structural Drawings.
2. Underlayment over deck flooring, except in carpet pad areas, shall be 1/4" APA "Underlayment" with sanded face and T&G joints.
3. Wall sheathing shall be 7/16 O.S.B. Refer to Structural Drawings.

2.03 PRESERVATIVE TREATED LUMBER

- A. The following wood members shall be Southern Yellow Pine or Douglass Fir supplied by Osmose Inc. with "Natural Wood Preservative", or equal. Wood shall be air dried or kiln-dried to reduce maximum moisture content to 15 percent. Each piece shall bear the AWPA stamp, indicating the plant number, preservative symbol, symbol of standard, date of treatment and moisture content after treatment:
1. Wood sills plates, rough bucks and frames in exterior masonry wall openings.
 2. Wall plates and furring in contact with exterior masonry or concrete.

3. Nailers that are set into, or are in contact with, concrete or masonry.
 4. Blocking and nailers for roof deck, sub-fascia members, roof cants and saddles.
 5. Lumber in contact with the ground, embedded in or in contact with concrete or masonry and all exterior trim.
- B. Cut Surfaces: Cut surfaces of preservative-treated materials shall be brush coated with at least two coats of the same preservative used in the pressure treatment.
- C. Odors and Compatibility: Treated wood exposed in the final structure shall be free from objectionable odors and shall not be harmful or corrosive to adjacent materials or anchorages.
- D. Plywood Backer Panels:
1. Plywood telephone and electrical backer panels, and any other wood designated as fire-retardant treated on drawings, shall be pressure-treated with fire-retardant 2 chemicals to achieve a UL FR-S rating, designating a surface-burning characteristics rating of 25 or less for flame-spread, fuel contributed, and smoke developed, per ASTM E 84, in compliance with AWWA C 20 (lumber) and AWWA C 27 (plywood). Each piece shall be dried to a 15-to-19 percent moisture content after treatment.
 2. Acceptable products include: Koppers Dricon, Osmose Flame-Proof, and Hoover Pro-Tex.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Wood Framing:
1. General Requirements:
 - a. Wood construction practices shall conform to recommendations of the NFPA "National Design Specification" and the AITC "Timber Construction Manual".
 - b. All members are to be installed as shown on the drawings.
 - c. When individual members have built-in camber, the members shall be placed with camber up.
 - d. No cutting of holes or notches in trusses for pipe, conduit or other reasons will be allowed.
 - e. All bearing surfaces shall be horizontal and even over the entire width of support.

- f. Accurately and properly fit and brace all work. Secure in proper position and orientation. Framing, studding and blocking shall be as indicated on the Design Drawings, or as required by the work.
 - g. Cooperate with all other trades as required.
 - h. Use acoustical sealant along shoe and header of all party walls.
2. Cutting and Patching: Do all cutting, patching, heading and blocking required for work of all trades. Notify Telephone Company to place jacks at rough-in stages.
3. Blocking and Supports:
- a. Install 2" nominal blocking in stud partitions for anchoring all cabinets, mirrors, towel bars, grab bars, handrail brackets and other items applied to or in the walls.
 - b. Set all blocking required to erect all exterior and interior woodwork, cabinets, plumbing, electrical and mechanical equipment, rough bucks and blocking for roofing work.
 - c. Backing Boards: Install 3/4" plywood backer boards for electrical and mechanical trades as required.
 - d. Provide pressure-treated blocking at exterior window openings in steel stud walls.
- B. Plywood Installation:
- 1. Plywood sheathing shall be installed with face-grain perpendicular to supports and be continuous over a minimum of two spans.
 - 2. End joints of sheets shall be staggered so that joints are not continuous along a support.
 - 3. When framing members (including walls and roofs) are 24" or more on center, support edges of plywood sheathing perpendicular to and at midpoints between framing with metal "H" clips or solid blocking.
- C. Fastening:
- 1. Fastening shall be as indicated on the Design Drawings, or in accordance with Table 2304.9.1 of IBC 2003.
 - 2. Framing supported by concrete or masonry shall be anchored with built-in threaded bolts or lags, as indicated on the design drawings. Powder actuated fasteners shall not be substituted, except in the attachment of wall furring strips.
 - 3. Fasteners shall be non-corrosive on exposed and exterior locations.

- D. Firestops: Firestops of 2" nominal stock, shall be provided in all concealed spaces not otherwise cut off from passage of air from one space to another.

3.02 CLEAN-UP

- A. Keep the premises and working surfaces in a neat, safe, and orderly condition at all times during execution of this portion of the work.
 - 1. At the end of each day, or more often if necessary, remove accumulation of sawdust, cut-ends, and other debris to proper storage areas for disposal.
- B. Upon completion of this portion of the work, thoroughly clean up the area.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

1. GENERAL

1.1 GENERAL PROVISIONS: Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.

1.2 DESCRIPTION OF WORK:

A. The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:

1. All finished carpentry work and millwork as required by Drawings and as specified under this section.
2. Installation of metal and other items furnished by other trades, if specifically noted in these Specifications.

2. PRODUCTS:

2.1 BOARD LUMBER shall comply with the American Lumber Standards Simplified Practice Recommendation No. 16. Grade of board lumber shall be suitable for its intended use. Finish lumber is to be painted and shall be dressed free of tool marks and other objectionable defects. All exposed lumber to be architectural quality grade: Custom.

2.2 INTERIOR TRIM: Door trim casing LWM412, Window Apron - Brosco style 8645, Back Relieved. Window stool – See Drawings. All interior trim unless noted otherwise on Drawings or in Specifications to be equal to No. 1 Pine or Poplar. Finger joints shall be allowed. See drawings for bay window detail. Note: Windows to receive one finish coat over factory prime.

2.3 PUBLIC & UNITS CORIDORS: Brosco B688 baseboard, units to be Brosco B688.

2.4 STAIR RISERS AND TREADS: 3/4" APA plywood.

2.5 STAIR RAILINGS: Similar to Brosco, #75 Oak (1-1/2" x 1-3/4" round).

2.6 STAIR HANDRAIL BRACKETS: Stanley SP7081, Satin brass finish. Secure with #8 or #10 Brass screws of adequate length for wall condition, minimum 1-1/4" into blocking. At CMU wall condition, anchor with 5/8" or 3/4" diameter HILTI HIT HY20 Adhesive Anchor (or similar).

2.7 NAILS: 6d for 1/2" finish stock and 4d finish for thinner wood. Use 8d generally for nailing 3/4" wood trim to framing.

2.8 SCREWS, BOLTS & OTHER FASTENERS: as shown on Drawings with penetration into framing or blocking adequate to support loads shown. Where not shown, consult Architect.

2.9 COUNTERTOPS: Rounded-edge preformed plastic laminate countertops, color choice of Architect. See Section 11450-Residential Equipment & Kitchens.

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2.10 PLASTIC LAMINATE: See Section 11450

2.11 CLOSET SHELVING: Premanufactured plastic coated wire shelving with integral clothes hanger. Closet Maid or equal.

3. EXECUTION:

3.1 ALL ITEMS OF MILLWORK shall be carefully erected, leveled and plumbed with tight-fitting joints and square corners, carefully cut and secured. Exposed nails shall be set adequately for putty. Moulds and faces shall be free from hammer or other tool marks, clean-cut and true pattern. All work shall be thoroughly cleaned and sanded to receive the finish. Sharp corners of small members of finished woodwork shall be slightly rounded. All trim baseboards, etc. fastened to walls shall be secured to wall framing members and nails set. Care shall be taken to avoid splitting ends of trim boards.

3.2 INTERIOR TRIM: Install trim with finishing nails and glue where required to assure permanent, tight joints, according to Drawing details.

3.3 STAIRS: Handrails installed as shown on Drawings (handrails supported every 4'-0" o.c. minimum) secured into solid blocking (1-1/4" minimum screw depth for handrails). Risers and treads to be glued and screwed together.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

1.1 SUMMARY

A. Applications:

1. Cavity-wall insulation.
2. Concealed building insulation.
3. Exposed building insulation.
4. Loose-fill building insulation.
5. Self-supported, spray-applied cellulosic insulation.
6. Sound attenuation insulation.

1.2 PERFORMANCE REQUIREMENTS

- A. Product meets ASTM E 84 for surface burning characteristics.
- B. Product is tested for ASTM E 90 for STC ratings.
- C. Product is tested to ASTM C 739 standards.
- D. Product is tested to ASTM E 119 standards.

1.3 MATERIALS

A. Insulation:

1. 1. Cellulose Spray-on Insulation: Installed Density 3.2 lb/cu. ft. (51 kg/cu. m)
2. 2. Cellulose Attic Insulation: Installed Density 1.60 lb/cu. ft. (26 kg/cu.)

Product Specification

1. PRODUCT NAME

NU-WOOL Premium Cellulose and WALLSEAL are registered trademarks for NU-WOOL Co. Inc.

2. MANUFACTURER

NU-WOOL Premium Cellulose is made from recycled paper (85%) and is packaged in 26 pound bags. Installation is done by factory trained installers. NU-WOOL WALLSEAL Cellulose Insulation is a spray-in-place cellulose insulation made from recycled paper, primarily newspaper. It is installed in both attics and walls of residential and commercial buildings because of its superior thermal and air infiltration properties. WALLSEAL is an energy-saving material that has an R-Value of 3.8 per inch, and will last for the life of the structure. NU-WOOL uses borate chemicals as a fire retardant, making

NU-WOOL WALLSEAL Cellulose Insulation one of the most environmentally friendly materials used in home construction.

3. PRODUCT DESCRIPTION

NU-WOOL Insulation is an energy-saving insulation made from recycled newspapers. NUWOOL Insulation, with its superior thermal and air infiltration properties, is installed in both attics and walls of residential and commercial buildings. This environmentally friendly, "green" insulation provides up to 40% savings on energy bills when compared to conventional insulation materials. NU-WOOL Insulation also contains an E.P.A. registered fungicide making it resistant to the growth of mold.

WALLSEAL is applied by a spray-on method that insures the correct density to prevent settling while making the wall resistant to air movement and achieving maximum thermal performance.

4. TECHNICAL DATA

4.1 All cellulose insulation must conform to the CPSC standard 16 CFR Part 1209 and 1404. NU-WOOL also meets ASTM C-739. Also refer to UL R-8078 and R-13173.

4.2 Density is measured using ASTM C-739 standards and is 1.6 lb/ft³.

4.3 Thermal resistance was measured by test method ASTM C-518 (4 in. thick) and is 3.8 (R-value/in.)

4.4 Surface Burning Characteristics: Surface burning characteristics are determined using two methods. Critical radiant flux using test method ASTM E 970 and ASTM E 84.

ASTM E 970 Greater than 0.12 watts/cm²

ASTM E 84 Less than 25, Class 1

4.5 Moisture Vapor Sorption: NU-WOOL meets the requirements of ASTM C 739 of less than 15% maximum weight gain under test conditions. Variations in relative humidity will not affect the thermal properties of the insulation.

4.6 Corrosiveness: NU-WOOL is tested for contact against copper, steel and aluminum under the test conditions of ASTM C 739 and is not corrosive to these metals.

4.7 Building Codes: NU-WOOL meets all the current building codes.

4.8 Sound Transmission Loss (STC) Ratings: NU-WOOL has been tested for numerous wall assemblies at Riverbank Laboratories using ASTM E 90. Specific wall assemblies are listed in this book.

4.9 Other Test Properties: Under ASTM C 739, there are tests for fungi resistance, odor and smolder resistance.

www.nuwool.com 1-8 00-74 8-01 28

END OF SECTION 072100

DRYVIT SYSTEMS, INC.
MANUFACTURER'S SPECIFICATION
SECTION 07240

OUTSULATION EXTERIOR INSULATION AND FINISH SYSTEM CLASS PB

PART I – GENERAL**1.01 SUMMARY**

A. This document is to be used in preparing specifications for projects utilizing the Dryvit Outsulation System. For complete product description and usage refer to:

1. Dryvit Outsulation System Data Sheet, DS447.
2. Dryvit Outsulation System Application Instructions, DS204.
3. Dryvit Outsulation System Installation Details, DS107.

B. Related Sections

1. Unit Masonry – Section 04200
2. Concrete – Sections 03300 and 03400
3. Light Gauge Cold Formed Steel Framing – Section 05400
4. Wood Framing – Section 06100
5. Sealant – Section 07900
6. Flashing – Section 07600

1.02. REFERENCES

A. Section Includes

1. ASTM B 117 (Federal Test Standard 141A Method 6061) Standard Practice for Operating Salt Spray (Fog) Apparatus
2. ASTM C 150 Standard Specification for Portland Cement
3. ASTM C 297 Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
4. ASTM C 1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
5. ASTM C 1396 (formerly C 79) Standard Specification for Gypsum Board
6. ASTM D 968 (Federal Test Standard 141A Method 6191) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
7. ASTM D 2247 (Federal Test Standard 141A Method 6201) Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
8. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
9. ASTM D 4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
10. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
11. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
12. ASTM E 119 Standard Method for Fire Tests of Building Construction and Materials
13. ASTM E 330 Test Method for Structural Performance of Exterior Windows, Doors and Curtain Walls by Uniform Static Air Pressure Difference
14. ASTM E 331 Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference.
15. ASTM E 2098 Test Method for Determining the Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to Sodium Hydroxide Solution
16. ASTM E 2134 Test Method for Evaluating the Tensile-Adhesion Performance of Exterior Insulation and Finish Systems (EIFS)
17. ASTM E 2430 Standard Specification for Expanded Polystyrene (EPS) Thermal Insulation Boards for use in Exterior Insulation and Finish System (EIFS)
18. ASTM E 2485 (formerly EIMA Std. 101.01) Standard Test Method for Freeze-Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water-Resistive Barrier Coatings
19. ASTM E 2486 (formerly EIMA Std. 101.86) Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
20. ASTM G 155 (Federal Test Standard 141A Method 6151) Standard Practice for Operating-Xenon Arc Light Apparatus, for Exposure of Nonmetallic Materials
21. DS107, Dryvit Outsulation System Installation Details
22. DS131, Dryvit Expanded Polystyrene Insulation Board Specification
23. DS135, Specification for Outsulation System with Mechanical Fasteners
24. DS151, Custom Brick™ Polymer System Specifications for Use on Vertical Walls
25. DS152, Dryvit Cleaning and Recoating
26. DS153, Dryvit Expansion Joints and Sealants
27. DS159, Dryvit Water Vapor Transmission
28. DS204, Dryvit Outsulation System Application Instructions
29. DS456, Rapidry DM™ 35-50 or DS457, Rapidry DM™ 50-75 Data Sheets

30. DS494, Dryvit AquaFlash™ System
31. Mil Std E5272 Environmental Testing
32. Mil Std 810B Environmental Test Methods
33. UBC Std 26-4 (Formerly UBC 17-6) Multi-Story Fire Evaluation of Exterior Non Load-Bearing Foam Plastic Insulated Wall Systems
34. NFPA 268 Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
35. NFPA 285 Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus
36. ULC S101 Standard Methods of Fire Endurance Tests of Building Construction Materials
37. ANSI FM 4880 Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies; Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems

1.03 DEFINITIONS

- A. Base Coat: Material used to encapsulate one or more layers of reinforcing mesh fully embedded that is applied to the outside surface of the EPS.
- B. Building Expansion Joint: A joint through the entire building structure designed to accommodate structural movement.
- C. Contractor: The contractor that installs the Outsulation System to the substrate.
- D. Dryvit: Dryvit Systems, Inc., the manufacturer of the Outsulation System, a Rhode Island corporation.
- E. Expansion Joint: A structural discontinuity in the Outsulation System.
- F. Finish: An acrylic-based coating, available in a variety of textures and colors that is applied over the base coat.
- G. Insulation Board: Expanded polystyrene (EPS) insulation board, which is affixed to the substrate.
- H. Panel Erector: The contractor who installs the panelized Outsulation System.
- I. Panel Fabricator: The contractor who fabricates the panelized Outsulation System.
- J. Reinforcing Mesh: Glass fiber mesh(es) used to reinforce the base coat and to provide impact resistance.
- K. Sheathing: A substrate in sheet form.
- L. Substrate: The material to which the Outsulation System is affixed.
- M. Substrate System: The total wall assembly including the attached substrate to which the Outsulation System is affixed.

1.04 SYSTEM DESCRIPTION

- A. General: The Dryvit Outsulation System is an Exterior Insulation and Finish System, Class PB, consisting of an adhesive, expanded polystyrene insulation board, base coat, reinforcing mesh(es) and finish. Mechanically attached systems shall conform to Dryvit specification DS135.
- B. Methods of Installation
 1. Field Applied: The Outsulation System is applied to the substrate system in place.
 2. Panelized: The Outsulation System is shop-applied to the prefabricated wall panels.
- C. Design Requirements
 1. Acceptable substrates for the Outsulation System shall be:
 - a. Exterior grade gypsum sheathing meeting ASTM C 1396 (formerly C 79) requirements for water-resistant core or Type X core at the time of application of the Outsulation System.
 - b. Exterior sheathing having a water-resistant core with fiberglass mat facers meeting ASTM C 1177.
 - c. Exterior fiber reinforced cement or calcium silicate boards.
 - d. APA Exterior or Exposure 1 Rated Plywood, Grade C-D or better, nominal 12.7 mm (1/2 in), minimum 4-ply.
 - e. Unglazed brick, cement plaster, concrete, or masonry.
 - f. APA Exposure 1 rated Oriented Strand Board (OSB), nominal 12.7 mm (1/2 in).
 - g. Galvanized expanded metal lath 1.4 or 1.8 kg/m² (2.5 or 3.4 lbs/yd²) installed over a solid substrate.
 2. Deflection of substrate systems shall not exceed 1/240 times the span.
 3. The substrate shall be flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
 4. The slope of inclined surfaces shall not be less than 6:12, and the length shall not exceed 305 mm (12 in).
 5. All areas requiring an impact resistance classification higher than "standard", as defined by ASTM E 2486 (formerly EIMA Std. 101.86), shall be as detailed in the drawings and described in the contract documents. Refer to Section 1.04.D.1.c of this specification.
 6. Expansion Joints
 - a. Design and location of expansion joints in the Outsulation System is the responsibility of the project designer and shall be noted on the project drawings. As a minimum, expansion joints shall be placed at the following locations:
 - 1) Where expansion joints occur in the substrate system.
 - 2) Where building expansion joints occur.
 - 3) At floor lines in wood frame construction.
 - 4) At floor lines of non-wood framed buildings where significant movement is expected.

- 5) Where the Outsulation System abuts dissimilar materials.
- 6) Where the substrate type changes
- 7) Where prefabricated panels abut one another
- 8) In continuous elevations at intervals not exceeding 23 m (75 ft).
- 9) Where significant structural movement occurs such as changes in roofline, building shape or structural system.

7. Terminations

- a. Prior to applying the Dryvit Outsulation System, wall openings shall be treated with Dryvit AquaFlash System or Flashing Tape. Refer to Dryvit Outsulation System Installation Details, DS107.
- b. The Outsulation System shall be held back from adjoining materials around openings and penetrations such as windows, doors and mechanical equipment a minimum of 19 mm (3/4 in) for sealant application. See Dryvit's Outsulation System Installation Details, DS107.
- c. The system shall be terminated a minimum of 203 mm (8 in) above finished grade.
- d. Sealants
 - 1) Shall be manufactured and supplied by others.
 - 2) Shall be compatible with Outsulation System materials. Refer to current Dryvit Publication DS153 for listing of sealants tested by sealant manufacturer for compatibility.
 - 3) The sealant backer rod shall be of closed cell.

8. Vapor Retarders – The use and location of vapor retarders within a wall assembly is the responsibility of the project designer and shall comply with local building code requirements. The type and location shall be noted on the project drawings and specifications. Vapor retarders may be inappropriate in certain climates and can result in condensation within the wall assembly. Refer to Dryvit Publication DS159 for additional information.

9. Dark Colors - The use of dark colors must be considered in relation to wall surface temperature as a function of local climatic conditions. Use of dark colors in high temperature climates can affect the performance of the system.

10. Flashing: Shall be provided at all roof-wall intersections, windows, doors, chimneys, decks, balconies and other areas as necessary to prevent water from entering behind the Outsulation System.

D. Performance Requirements

- 1. The Outsulation System shall have been tested as follows:
 - a. Durability

TEST	TEST METHOD	CRITERIA	RESULTS
Abrasion Resistance	ASTM D 968	No deleterious effects after 500 liters (528 quarts)	No deleterious effects after 1000 liters (1056 quarts)
Accelerated Weathering	ASTM G 155 Cycle 1	No deleterious effects after 2000 hours	No deleterious effects after 5000 hours
	ASTM G 154 Cycle 1 (QUV)		No deleterious effects after 5000 hours
Freeze-Thaw	ASTM E 2485 (formerly EIMA 101.01)	No deleterious effects after 60 cycles	Passed - No deleterious effects after 90 cycles
	ASTM C 67 modified	No deleterious effects after 60 cycles	Passed - No deleterious effects after 60 cycles
Mildew Resistance	ASTM E 2485/ICC-ES Proc.; ICC ES (AC219)***	No deleterious effects after 10 cycles	Passed - No deleterious effects after 10 cycles
	ASTM D 3273	No growth during 28 day exposure period	No growth during 60 day exposure period
Water Resistance	ASTM D 2247	No deleterious effects after 14 days exposure	No deleterious effects after 42 days exposure
Taber Abrasion	ASTM D 4060	N/A	Passed 1000 cycles
Salt Spray Resistance	ASTM B 117	No deleterious effects after 300 hours exposure	No deleterious effects after 1000 hours exposure
Water Penetration	ASTM E 331 ICC ES (AC 219)***	No water penetration beyond the inner-most plane of the wall after 2 hours at 299 Pa (6.24 psf)	Passed 2 hours at 299 Pa (6.24 psf)
Water Vapor Transmission	ASTM E 96 Procedure B	Vapor permeable	EPS 5 perm-inch Base Coat* 40 Perms Finish** 40 Perms

* Base Coat perm value based on Dryvit Genesis®
 ** Finish perm value based on Dryvit Quarzputz
 *** AC 219 – Acceptance Criteria for EIFS

b. Structural

TEST	TEST METHOD	CRITERIA	RESULTS
Tensile Bond	ASTM C 297/E 2134	Minimum 104 kPa (15 psi) -- substrate or insulation failure	Minimum 132 kPa (19.1 psi)
Transverse Wind Load	ASTM E 330	Withstand positive and negative wind loads as specified by the building code	Minimum 4.3 kPa (90 psf)* 16 inch o.c. framing, ½ in sheathing screw attached at 203 mm (8 inch) o.c.

* All Dryvit components remain intact -- for higher wind loads contact Dryvit Systems, Inc.

c. Impact Resistance: In accordance with ASTM E 2486 (formerly EIMA Standard 101.86).

Reinforcing Mesh/Weight g/m ² (oz/yd ²)	Minimum Tensile Strengths	EIMA Impact Classification	EIMA Impact Range		Impact Test Results	
			Joules	(in-lbs)	Joules	(in-lbs)
Standard - 146 (4.3)	27 g/cm (150 lbs/in)	Standard	3-6	(25-49)	4	(36)
Standard Plus™ - 203 (6)	36 g/cm (200 lbs/in)	Medium	6-10	(50-89)	6	(56)
Intermediate® - 407 (12)	54 g/cm (300 lbs/in)	High	10-17	(90-150)	12	(108)
Panzer® 15 * - 509 (15)	71 g/cm (400 lbs/in)	Ultra High	>17	(>150)	18	(162)
Panzer 20 * - 695 (20.5)	98 g/cm (550 lbs/in)	Ultra High	>17	(>150)	40	(352)
Detail® Short Rolls - 146 (4.3)	27 g/cm (150 lbs/in)	n/a	n/a	n/a	n/a	n/a
Corner Mesh™ - 244 (7.2)	49 g/cm (274 lbs/in)	n/a	n/a	n/a	n/a	n/a

*Shall be used in conjunction with Standard Mesh (recommended for areas exposed to high traffic)

d. Fire performance

TEST	TEST METHOD	CRITERIA	RESULTS
Fire Resistance	ASTM E 119	No effect on the fire resistance of a rated wall assembly	Passed 1 hour Passed 2 hour
Ignitability	NFPA 268	No ignition at 12.5 kw/m ² at 20 minutes	Passed
Full Scale Multi-Story Fire Test	UBC Std. 26-4 (formerly 17-6)	1. Resist vertical spread of flame within the core of the panel from one story to the next 2. Resist flame propagation over the exterior surface 3. Resist spread of vertical flame over the interior surface from one story to the next 4. Resist significant lateral spread of flame from the compartment of fire origin to adjacent spaces	Passed
Intermediate Multi-Story Fire Test	NFPA 285 (UBC 26-9)	1. Resist flame propagation over the exterior surface 2. Resist vertical spread of flame within combustible core/component of panel from one story to the next 3. Resist vertical spread of flame over the interior surface from one story to the next 4. Resist lateral spread of flame from the compartment of fire origin to adjacent spaces	Passed
Full Scale Multi-Story* (corner test)	ANSI FM 4880	Resist flame propagation over the exterior surface.	Passed; No height restrictions*

* Dryvit FM products must be specified

2. The Outsulation components shall be tested for:
 a. Fire

TEST	TEST METHOD	CRITERIA	RESULTS
Surface Burning Characteristics	ASTM E 84	All components shall have a: Flame Spread \leq 25 Smoke Developed $<$ 450	Passed

- b. Durability

TEST	TEST METHOD	CRITERIA	RESULTS
Reinforcing Mesh Alkali Resistance of Reinforcing Mesh	ASTM E 2098 (formerly EIMA 105.01)	$>$ 21dN/cm (120 pli) retained tensile strength after exposure	Passed
EPS (Physical Properties) Density	ASTM C 303, D 1622	15.2-20.0 kg/m ³ (0.95-1.25 lb/ft ³)	Pass
Thermal Resistance	ASTM C 177, C 518	4.0 @ 4.4 °C (40 °F) 3.6 @ 23.9 °C (75 °F)	Pass Pass
Water Absorption	ASTM C 272	2.5 % max. by volume	Pass
Oxygen Index	ASTM D 2863	24% min. by volume	Pass
Compressive Strength	ASTM D 1621 Proc. A	69 kPa (10 psi) min.	Pass
Flexural Strength	ASTM C 203	172 kPa (25 psi) min.	Pass
Flame Spread	ASTM E 84	25 max.	Pass
Smoke Developed		450 max.	Pass

1.05 SUBMITTALS

- A. Product Data – The contractor shall submit to the owner/architect the manufacturer’s product data sheets describing products, which will be used on this project.
- B. Shop Drawing for Panelized Construction: The panel fabricator shall prepare and submit to the owner/architect complete drawings, showing: wall layout, connections, details, expansion joints and installation sequence.
- C. Samples: The contractor shall submit to the owner/architect two (2) samples of the Outsulation System for each finish, texture and color to be used on the project. The same tools and techniques proposed for the actual installation shall be used. Samples shall be of sufficient size to accurately represent each color and texture being utilized on the project.
- D. Test Reports – When requested, the contractor shall submit to the owner/architect copies of selected test reports verifying the performance of the Outsulation System.

1.06 QUALITY ASSURANCE

A. Qualifications

- 1. System Manufacturer: Shall be Dryvit Systems, Inc. All materials shall be manufactured or sold by Dryvit and shall be purchased from Dryvit or its authorized distributors.
 - a. Materials shall be manufactured at a facility covered by a current ISO 9001:2000 certification. Certification of the facility shall be done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).
- 2. Contractor: Shall be knowledgeable in the proper installation of the Dryvit Outsulation System and shall be experienced and competent in the installation of Exterior Insulation and Finish Systems. Additionally, the contractor shall possess a current Outsulation System Trained Contractor Certificate* issued by Dryvit Systems, Inc.
- 3. Insulation Board Manufacturer: Shall be listed by Dryvit Systems, Inc., shall be capable of producing the Expanded Polystyrene (EPS) in accordance with current Dryvit Specification for Insulation Board, DS131, and shall subscribe to the Dryvit Third Party Certification and Quality Assurance Program.
- 4. Panel Fabricator: Shall be a contractor experienced and competent in the fabrication of architectural wall panels and shall possess a current Outsulation System Contractor Certificate* issued by Dryvit Systems, Inc.
- 5. Panel Erector: Shall be experienced and competent in the installation of architectural wall panel systems and shall be:
 - a. The panel fabricator, or
 - b. An erector approved by the panel fabricator or
 - c. An erector under the direct supervision of the panel fabricator

B. Regulatory Requirements

- 1. The EPS shall be separated from the interior of the building by a minimum 15-minute thermal barrier.
- 2. The use and maximum thickness of EPS shall be in accordance with the applicable building codes.

C. Certification

1. The Outsulation System shall be recognized for the intended use by the applicable building code(s).

D. Mock-Up

1. The contractor shall, before the project commences, provide the owner/architect with a mock-up for approval.
2. The mock-up shall be of suitable size as required to accurately represent the products being installed, as well as each color and texture to be utilized on the project.
3. The mock-up shall be prepared with the same products, tools, equipment and techniques required for the actual application. The finish used shall be from the same batch that is being used on the project.
4. The approved mock-up shall be available and maintained at the job site.
5. For panelized construction, the mock-up shall be available and maintained at the panel fabrication location.

1.07 DELIVERY, STORAGE AND HANDLING

A. All Dryvit materials shall be delivered to the job site in the original, unopened packages with labels intact.

B. Upon arrival, materials shall be inspected for physical damage, freezing, or overheating. Questionable materials shall not be used.

1. Materials shall be stored at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Minimum storage temperature shall be as follows:
 - a. Demandit®, Revyvit®: 7 °C (45 °F)
 - b. Ameristone™, TerraNeo® and Limestone™: 10 °C (50 °F)
 - c. DPR, PMR™ and E™ Finishes, Color Prime™, Primus®, Genesis and NCB™: 4 °C (40 °F)
 - d. Custom Brick™ finish: Refer to Custom Brick Polymer Specification, DS151.
 - e. For other products, refer to specific product data sheets.

2. Maximum storage temperature shall not exceed 38° C (100 °F).

NOTE: Minimize exposure of materials to temperatures over 32 °C (90 °F). Finishes exposed to temperatures over 43 °C (110 °F) for even short periods may exhibit skinning, increased viscosity and should be inspected prior to use.

C. Protect all products from inclement weather and direct sunlight.

1.08 PROJECT CONDITIONS

A. Environmental Requirements

1. Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.
2. At the time of application, the minimum air and wall surface temperatures shall be as follows:
 - a. Demandit, Revyvit: 7 °C (45 °F)
 - b. Ameristone, TerraNeo and Limestone: 10 °C (50 °F)
 - c. DPR, PMR and E Finishes, Color Prime, Primus, Genesis and NCB: 4 °C (40 °F)
 - d. Custom Brick Finish: refer to Custom Brick Polymer Specification, DS151.
 - e. For other products, refer to specific product data sheets.

3. These temperatures shall be maintained with adequate air ventilation and circulation for a minimum of 24 hours (48 hours for Ameristone, TerraNeo and Limestone) thereafter, or until the products are completely dry. Refer to published product data sheets for more specific information.

B. Existing Conditions - The contractor shall have access to electric power, clean water, and a clean work area at the location where the Dryvit materials are to be applied.

1.09 SEQUENCING AND SCHEDULING

A. Installation of the Outsulation System shall be coordinated with other construction trades.

B. Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.10 LIMITED MATERIALS WARRANTY

A. Dryvit Systems, Inc. shall provide a limited warranty against defective material upon written request. Dryvit shall make no other warranties, expressed or implied. Dryvit does not warrant workmanship. Full details are available from Dryvit Systems, Inc.

B. The applicator shall warrant workmanship separately. Dryvit shall not be responsible for workmanship associated with installation of the Outsulation System.

1.11 DESIGN RESPONSIBILITY

A. It is the responsibility of both the specifier and the purchaser to determine if a product is suitable for its intended use. The designer selected by the purchaser shall be responsible for all decisions pertaining to design, detail, structural capability, attachment details, shop drawings and the like. Dryvit has prepared guidelines in the form of specifications, installation details and product sheets to facilitate the design process only. Dryvit is not liable for any errors or omissions in design, detail, structural capability, attachment details, shop drawings, or the like, whether based upon the information prepared by Dryvit or otherwise, or for any changes which purchasers, specifiers, designers, or their appointed representatives may make to Dryvit's published comments.

1.12 MAINTENANCE

- A. Maintenance and repair shall follow the procedures noted in Dryvit Outsulation Application Instructions, DS204.
- B. All Dryvit products are designed to minimize maintenance. However, as with all building products, depending on location, some cleaning may be required. See Dryvit publication DS152 on Cleaning & Recoating.
- C. Sealants and Flashings should be inspected on a regular basis and repairs made as necessary.

PART II – PRODUCTS**2.01 MANUFACTURER**

- A. All components of the Outsulation System shall be supplied or obtained from Dryvit or its authorized distributors. Substitutions or additions of materials other than specified will void the warranty.

2.02 MATERIALS

- A. Portland Cement: Shall be Type I or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.
- B. Water: Shall be clean and free of foreign matter.
- C. Mechanical Fasteners (required when installing in accordance with DS135): Shall be Wind-lock's Wind Devil™ plates, or equivalent, used in conjunction with corrosion resistant fasteners appropriate for the substrate system.

2.03 COMPONENTS

- A. Flashing Materials: Used to protect substrate edges at terminations.
 - 1. Liquid Applied: An extremely flexible water-based polymer material, ready for use.
 - a. Shall be AquaFlash and AquaFlash Mesh
 - 2. Sheet Type:
 - a. Shall be Flashing Tape and Surface Conditioner
 - 1) Dryvit Flashing Tape™: A high density polyethylene film backed with a rubberized asphalt adhesive available in rolls 102 mm (4 in), 152 mm (6 in) and 229 mm (9 in) wide by 23 m (75 ft) long.
 - 2) Dryvit Flashing Tape Surface Conditioner™: A water-based surface conditioner and adhesion promoter for the Dryvit Flashing Tape.
- B. Adhesives: Used to adhere the EPS to the substrate, shall be compatible with the substrate and the EPS.
 - 1. Cementitious: A liquid polymer-based material, which is field mixed with Portland cement for use over non wood-based substrates.
 - a. Shall be Primus®, Genesis® or Genesis FM
 - 2. Ready mixed: A dry blend cementitious, copolymer-based product, field mixed with water for use over non wood-based substrates.
 - a. Shall be Primus® DM, Genesis® DM, Genesis® DMS, Rapidry DM 35-50 or Rapidry DM 50-75.
 - 3. Noncementitious: A factory-mixed, fully formulated water-based adhesive for use over wood-based substrates.
 - a. Shall be ADEPS®.
- C. Insulation Board: Expanded polystyrene meeting Dryvit Specification for Insulation Board, DS131.
 - 1. Thickness of insulation board shall be minimum 19 mm (3/4 in) and shall be maintained at all locations. **Note: Dryvit recommends that a minimum of 25 mm (1 in) thick insulation board be installed to maintain the minimum thickness after rasping, reveals are installed, etc.**
 - 2. The insulation board shall be manufactured by a board supplier listed by Dryvit Systems, Inc.
- D. Base Coat: Shall be compatible with the EPS insulation board and reinforcing mesh(es).
 - 1. Cementitious: A liquid polymer-based material, which is field mixed with Portland cement.
 - a. Shall be Primus, Genesis or Genesis FM.
 - 2. Noncementitious: A factory-mixed, fully formulated, water-based product.
 - a. Shall be NCB™.
 - 3. Ready mixed: A dry blend cementitious, copolymer-based product, field mixed with water.
 - a. Shall be Primus DM, Genesis DM, Genesis DMS, Rapidry DM 35-50 or Rapidry DM 50-75.
- E. Reinforcing Mesh: A balanced open weave, glass fiber fabric treated for compatibility with other system materials. **Note: Reinforcing meshes are classified by impact resistance and specified by weight and tensile strength as Section 1.04.D.1.c.**
 - 1. Shall be Standard, Standard Plus, Intermediate, Panzer 15, Panzer 20, Detail and Corner Mesh.
- F. Finish: Shall be the type, color and texture as selected by the architect/owner and shall be one or more of the following:
 - 1. Standard DPR (Dirt Pickup Resistance): Water-based, acrylic coating with integral color and texture and formulated with DPR chemistry:
 - a. Quarzputz® DPR: Open-texture.
 - b. Sandblast® DPR: Medium texture.
 - c. Freestyle® DPR: Fine texture.
 - d. Sandpebble® DPR: Pebble texture.
 - e. Sandpebble® Fine DPR: Fine pebble texture.

2. **E:** Water-based, lightweight acrylic coating with integral color and texture and formulated with DPR chemistry:
 - a. Quarzputz® **E**
 - b. Sandpebble® **E**
 - c. Sandpebble® Fine **E**
3. **FM:** Water-based, acrylic coating with integral color and texture, formulated with PMR chemistry:
 - a. Quarzputz® FM
 - b. Sandblast® FM
 - c. Sandpebble® FM
 - d. Sandpebble® Fine FM
4. **Specialty:** Factory mixed, water-based acrylic:
 - a. Ameristone: Multi-colored quartz aggregate with a flamed granite appearance.
 - b. Stone Mist®: Ceramically colored quartz aggregate.
 - c. Custom Brick: Acrylic polymer-based finish used in conjunction with a proprietary template system to create the look of stone, brick, slate or tile.
 - d. TerraNeo: 100% acrylic-based finish with large mica chips and multi-colored quartz aggregates.
 - e. Limestone: A premixed, 100% acrylic-based finish designed to replicate the appearance of limestone blocks.
5. **Elastomeric DPR (Dirt Pickup Resistance):** Water-based elastomeric acrylic coating with integral color and texture and formulated with DPR chemistry:
 - a. Weatherlastic® Quarzputz
 - b. Weatherlastic® Sandpebble
 - c. Weatherlastic® Sandpebble Fine
 - d. Weatherlastic® Adobe
6. **Medallion Series PMR™ (Proven Mildew Resistance):** Water-based acrylic coating with integral color and texture and formulated with PMR chemistry:
 - a. Quarzputz® PMR
 - b. Sandblast® PMR
 - c. Freestyle® PMR
 - d. Sandpebble® PMR
 - e. Sandpebble® Fine PMR
7. **Coatings, Primers and Sealers:**
 - a. Demandit
 - b. Weatherlastic® Smooth
 - c. Tuscan Glaze™
 - d. Revyvit
 - e. Color Prime
 - f. Prymit®
 - g. SealClear™

PART III – EXECUTION

3.01 EXAMINATION

- A. Prior to installation of the Outsulation System, the contractor shall verify that the substrate:
 1. Is of a type listed in Section 1.04.C.1.
 2. Is flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
 3. Is sound, dry, connections are tight, has no surface voids, projections or other conditions that may interfere with the Outsulation System installation or performance.
- B. Prior to the installation of the Outsulation System, the architect or general contractor shall insure that all needed flashings and other waterproofing details have been completed, if such completion is required prior to the Outsulation application. Additionally, the Contractor shall ensure that:
 1. Metal roof flashing has been installed in accordance with Asphalt Roofing Manufacturers Association (ARMA) Standards.
 2. Openings are flashed in accordance with the Outsulation System Installation Details, DS107, or as otherwise necessary to prevent water penetration.
 3. Chimneys, Balconies, and Decks have been properly flashed.
 4. Windows, Doors, etc. are installed and flashed per manufacturer's requirements and the Outsulation System Installation Details, DS107.
- C. Prior to the installation of the Outsulation System, the contractor shall notify the general contractor, and/or architect, and/or owner of all discrepancies.

3.02 PREPARATION

- A. The Outsulation materials shall be protected by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.
- B. Protect adjoining work and property during Outsulation installation.

C. The substrate shall be prepared as to be free of foreign materials, such as, oil, dust, dirt, form release agents, efflorescence, paint, wax, water repellants, moisture, frost and any other condition that inhibit adhesion.

3.03 INSTALLATION

- A. The system shall be installed in accordance with the current Dryvit Outsulation System Application Instructions, DS204.
- B. The overall minimum base coat thickness shall be sufficient to fully embed the mesh. The recommended method is to apply the base coat in two (2) passes.
- C. Sealant shall not be applied directly to textured finishes or base coat surfaces. Dryvit Outsulation System base coat surfaces in contact with sealant shall be coated with Demandit or Color Prime.
- D. When installing the Outsulation System, the notched trowel method of adhesive application shall be used over gypsum sheathing substrates.
- E. High impact meshes shall be installed as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage.

3.04 FIELD QUALITY CONTROL

- A. The contractor shall be responsible for the proper application of the Outsulation materials.
- B. Dryvit assumes no responsibility for on-site inspections or application of its products.
- C. If required, the contractor shall certify in writing the quality of work performed relative to the substrate system, details, installation procedures, workmanship and as to the specific products used.
- D. If required, the EPS supplier shall certify in writing that the EPS meets Dryvit's specifications.
- E. If required, the sealant contractor shall certify in writing that the sealant application is in accordance with the sealant manufacturer's and Dryvit's recommendations.

3.05 CLEANING

- A. All excess Outsulation System materials shall be removed from the job site by the contractor in accordance with contract provisions and as required by applicable law.
- B. All surrounding areas, where the Outsulation System has been installed, shall be left free of debris and foreign substances resulting from the contractor's work.

3.06 PROTECTION

- A. The Outsulation System shall be protected from inclement weather and other sources of damage until dry and permanent protection in the form of flashings, sealants, etc. are installed.

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SECTION 07460

SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiber cement siding panels, fascia, moulding and accessories.

1.2 RELATED SECTIONS

- A. Section 05400 – Light Gage Metal Framing: Wall framing and bracing.
- B. Section 06100 – Rough Carpentry: Wood framing and bracing.
- C. Section 06100 – Rough Carpentry: Sheathing.
- D. Section 07210 – Insulation: Exterior wall insulation.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.
- B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

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1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

- A. Product Warranty: Limited product warranty against manufacturing defects.
 - 1. Hardieplank lap and Hardipanel vertical siding for 50 years.
 - 2. HardieTrim for 10 years.
- B. Finish Warranty: Limited product warranty against manufacturing finish defects.
 - 1. When used for its intended purpose, properly installed and maintained according to Hardie's published installation instructions, James Hardie's ColorPlus finish with ColorPlus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip.
- C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: James Hardie Building Products, Inc; 26300 La Alameda, Suite 250, Mission Viejo, CA 92691. ASD. Toll Free Residential: (888) J-HARDIE. Toll Free Commercial: (866) 274-3464. Tel: (949) 348-1800. Fax: (949) 367-0185. Email: info@JamesHardie.com. Web - Residential: <http://www.jameshardie.com>. Web - Commercial: <http://www.jameshardiecommercial.com>.
- B. Substitutions: Not permitted.
- C. Requests for approval of equal substitutions will be considered in accordance with provisions of Section 01600.

2.2 SIDING

- A. Code Compliance Requirement for Materials:
 - 1. National Evaluation Report No. NER 405 (BOCA, ICBO, SBCCI)
 - 2. City of Los Angeles, Research Report No. 24862
 - 3. Metro Dade County, Florida Acceptance No. 07-0148, 04
 - 4. US Department of Housing and Urban Development Materials Release 1263d
 - 5. California DSA PA-019.

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6. City of New York M EA 223-93-M.
 7. Non-asbestos fiber-cement siding where required to be non-combustible shall be tested in accordance with ASTM E136.
- B. Lap Siding: Hardieplank as manufactured by James Hardie Building Products, Inc.
1. Type: Smooth 6-1/4 inches (159 mm) with 5 inches (127 mm) exposure.
- C. Vertical Siding: Hardiepanel as manufactured by James Hardie Building Products, Inc.
1. Type: Smooth Vertical siding panel 4 feet by 8 feet (1219 mm by 2438 mm).
- D. Trim: Hardietrim Fascia and Moulding as manufactured by James Hardie Building Products, Inc.

2.3 FASTENERS

- A. Wood Framing Fasteners:
1. Wood framing: 6d common corrosion resistant nails.
- B. Metal Framing:
1. Metal framing: 1-5/8 inches (41 mm) No. 8-18 by 0.323 inch (8.2 mm) head self-drilling, corrosion resistant S-12 ribbed buglehead screws.

2.4 FINISHES

- A. Factory Primer: Provide factory applied universal primer.
1. Primer: PrimePlus by James Hardie.
 2. Topcoat: Field finish two (2) coats.
- B. Factory Finish: Refer to Exterior Finish Schedule.
1. Product: ColorPlus by James Hardie.
- C. Factory Finish Color for Trim, Soffit and Siding Colors: - By Architect

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Nominal 2 inch by 6 inch (51 mm by 102 mm) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
1. Install water-resistive barriers and claddings to dry surfaces.
 2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
 3. Protect siding from other trades.
- D. Minimum 20 gauge 6 inch (92 mm) C-Stud 16 inches maximum on center metal framing complying with local building codes, including the use of water-resistive barriers and/or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.

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1. Install water-resistive barriers and claddings to dry surfaces.
2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
3. Protect siding from other trades.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION - HARDIEPLANK SIDING

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.
- C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- D. Align vertical joints of the planks over framing members.
- E. Maintain clearance between siding and adjacent finished grade.
- F. Locate splices at least one stud cavity away from window and door openings.
- G. Use off-stud metal joiner in strict accordance with manufacturer's installation instructions.
- H. Wind Resistance: Where a specified level of wind resistance is required Hardieplank lap siding is installed to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405.
- C. Face nail to sheathing.
- D. Locate splices at least 12 inches (305 mm) away from window and door openings.
- E. Wind Resistance: Where a specified level of wind resistance is required Hardieplank lap siding is installed to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405.

3.4 INSTALLATION - HARDIEPANEL SIDING

- A. Install materials in strict accordance with manufacturer's installation instructions. (See instructions at end of section) Use "Extruded Aluminum Details" from James Hardie with Aluminum Piers by Fry Reglet Inc.
- B. Block framing between studs where Hardiepanel siding horizontal joints occur.
- C. Place fasteners no closer than 3/8 inch (9.5 mm) from panel edges and 2 inches (51 mm) from panel corners.

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- D. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- E. Maintain clearance between siding and adjacent finished grade.
- F. Specific framing and fastener requirements refer to Tables 2 and 3 in National Evaluation Service Report No. NER-405.

3.5 INSTALLATION – HARDIE SHINGLESIDE CLADDING

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Substrate: Install a minimum 7/16 inch (11 mm) thick OSB wall sheathing or equivalent braced walls complying with applicable building codes.
- C. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall.
- D. Maintain clearance between siding and adjacent finished grade.
- E. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- F. Wind Resistance: Where a specified level of wind resistance is required Hardie Shingleside cladding is installed to substrate and secured with a minimum two fasteners described in Table No. 6, 7 and 8 in National Evaluation Service Report No. NER-405.

3.6 INSTALLATION - HARDIETRIM FASCIA AND MOULDING

- A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.
- B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
- C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.
- D. Maintain clearance between trim and adjacent finished grade.
- E. Trim inside corner with single board.
- F. Outside Corner Board: For 3/4 inch (19 mm) trim only. Install single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Hardietrim board to Hardietrim board.
- G. Outside Corner Board: For 1 inch (25 mm) and 1-1/2 inches (38 mm) trim only. Pre Build corners by fastening trim together with 16 ga. corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.
- H. Allow 1/8 inch gap between trim and siding.

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- I. Seal gap with high quality, paint-able caulk.
- J. Shim frieze board as required to align with corner trim.
- K. Install Hardietrim fascia over structural subfascia.
- L. Overlay siding with Hardietrim molding at windows, doors and inside corners.
- M. Fasten through overlapping boards. Do not nail between lap joints.
- N. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Hardietrim boards to Hardietrim boards.
- O. Shim frieze board as required to align with corner trim.
- P. Install Hardietrim fascia over structural subfascia.

3.7 FINISHING

- A. Finish unprimed siding with a minimum one coat high quality, alkali resistant primer and one coat of either, 100 percent acrylic or latex or oil based, exterior grade topcoats or two coats high quality alkali resistant 100 percent acrylic or latex, exterior grade topcoat within 90 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.
- B. Finish factory primed siding with a minimum of one coat of high quality 100 percent acrylic or latex or oil based exterior grade paint within 180 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.

3.8 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

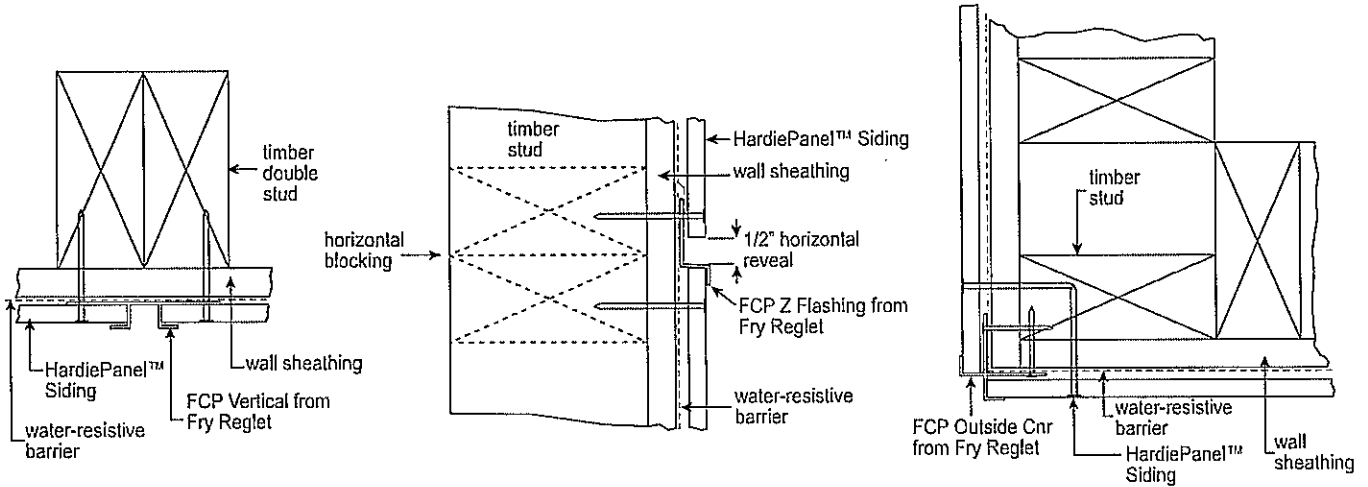
END OF SECTION

IMPORTANT: FAILURE TO INSTALL AND FINISH THIS PRODUCT IN ACCORDANCE WITH APPLICABLE BUILDING CODES AND JAMES HARDIE WRITTEN APPLICATION INSTRUCTIONS MAY LEAD TO PERSONAL INJURY, AFFECT SYSTEM PERFORMANCE, VIOLATE LOCAL BUILDING CODES, AND VOID THE PRODUCT ONLY WARRANTY.

This supplement must be read in conjunction with the current HardiePanel™ siding installation instructions. The details below provide an alternative joint treatment option using extruded aluminum to achieve an expressed joint treatment for HardiePanel™ siding. HardiePanel siding will need to be trimmed/cut back to accommodate the width of the reveal and maintain layout.

EXTRUDED ALUMINUM DETAILS

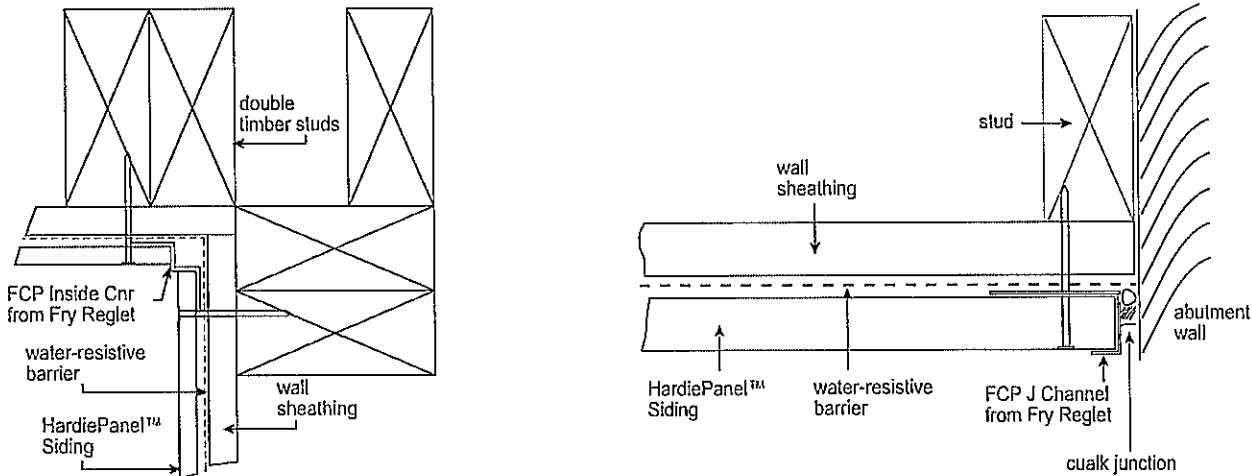
Aluminum components designed specifically for use with HardiePanel™ siding is available from Fry Reglet, Inc. When field painting the aluminum reveals ensure that the product ordered has a chem-film treatment for improved paint adhesion performance.



Vertical Joint Detail

Horizontal Joint Detail

External Corner Detail



Internal Corner Detail

Wall Abutment Detail

ADDITIONAL INFORMATION

Additional information including wind load documentation, fastener requirements, CAD details, test reports are available at www.jameshardiecommercial.com.

WARNING: AVOID BREATHING SILICA DUST

James Hardie® products contain respirable crystalline silica, which is known to the State of California to cause cancer and is considered by IARC and NIOSH to be a cause of cancer from some occupational sources. Breathing excessive amounts of respirable silica dust can also cause a disabling and potentially fatal lung disease called silicosis, and has been linked with other diseases. Some studies suggest smoking may increase these risks. During installation or handling: (1) work in outdoor areas with ample ventilation; (2) use fiber cement shears for cutting or, where not feasible, use a Hardieblade™ saw blade and dust-reducing circular saw attached to a HEPA vacuum; (3) warn others in the immediate area; (4) wear a properly-fitted, NIOSH-approved dust mask or respirator (e.g. N-95) in accordance with applicable government regulations and manufacturer instructions to further limit respirable silica exposures. During clean-up, use HEPA vacuums or wet cleanup methods - never dry sweep. For further information, refer to our installation instructions and Material Safety Data Sheet available at www.jameshardie.com or by calling 1-800-9HARDIE (1-800-942-7343). FAILURE TO ADHERE TO OUR WARNINGS, MSDS, AND INSTALLATION INSTRUCTIONS MAY LEAD TO SERIOUS PERSONAL INJURY OR DEATH.

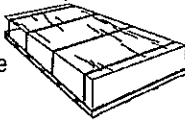


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STORAGE & HANDLING:

Store flat and keep dry and covered prior to installation. Installing siding wet or saturated may result in shrinkage at butt joints. Carry panels on edge. Protect edges and corners from breakage. James Hardie is not responsible for damage caused by improper storage and handling of the product



CUTTING INSTRUCTIONS

OUTDOORS

- Position cutting station so that wind will blow dust away from user and others in working area.
- Use one of the following methods:
 - Best:
 - Score and snap
 - Shears (manual, electric or pneumatic)
 - Better:
 - Dust reducing circular saw equipped with a Hardieblade™ saw blade and HEPA vacuum extraction
 - Dust reducing circular saw with a Hardieblade saw blade (only use for low to moderate cutting)
 - Good:

INDOORS

- Cut only using score and snap, or shears (manual, electric or pneumatic).
- Position cutting station in well-ventilated area

- NEVER use a power saw indoors
- NEVER use a circular saw blade that does not carry the Hardieblade saw blade trademark
- NEVER dry sweep - Use wet suppression or HEPA Vacuum

Important Note: For maximum protection (lowest respirable dust production), James Hardie recommends always using "Best"-level cutting methods where feasible.

NIOSH-approved respirators can be used in conjunction with above cutting practices to further reduce dust exposures. Additional exposure information is available at www.jameshardie.com to help you determine the most appropriate cutting method for your job requirements. If concern still exists about exposure levels or you do not comply with the above practices, you should always consult a qualified industrial hygienist or contact James Hardie for further information.

SD523105

GENERAL REQUIREMENTS:

- Hardiepanel™ vertical siding can be installed over braced wood or steel studs spaced a maximum of 24" o.c. Irregularities in framing and sheathing can mirror through the finished application.
- Hardiepanel vertical siding can also be installed over foam insulation/sheathing up to 1" thick. When using foam insulation/sheathing, avoid over-driving nails (fasteners), which can result in dimpling of the siding due to the compressible nature of the foam insulation/sheathing. Extra caution is necessary if power-driven nails (fasteners) are used for attaching siding over foam insulation/sheathing.
- A water-resistive barrier is required in accordance with local building code requirements. The water-resistive barrier must be appropriately installed with penetration and junction flashings in accordance with local building code requirements. James Hardie will assume no responsibility for water infiltration.
- Install James Hardie® products with a minimum 6" clearance to the finished grade on the exterior of the building or in accordance with local building codes if greater than 6" is required (fig. 5).
- Maintain a minimum 2" clearance between James Hardie products and roofs, decks, paths, steps and driveways (figs. 6, 7 & 8).
- Maintain a 1/4" clearance between James Hardie products and horizontal flashing (figs. 3 & 9).
- Ensure gutters have end caps. Maintain a minimum 1" gap between end caps and siding & trim (fig.10).
- Install kickout flashing at roof-wall junctions (fig. 11).
- Adjacent finished grade must slope away from the building in accordance with local building codes - typically a minimum of 6" in the first 10'.
- Do not install James Hardie products, such that they may remain in contact with standing water.
- Hardiepanel lap siding may be installed on vertical wall applications only.
- DO NOT use stain on James Hardie® products.

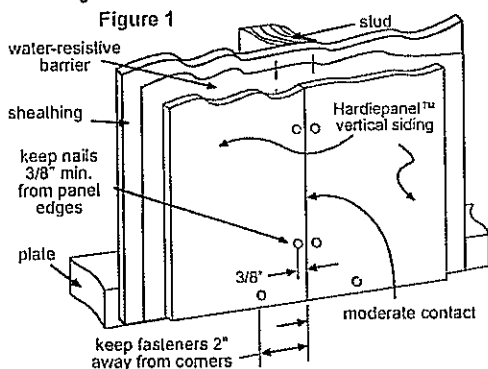
INSTALLATION:

Fastener Requirements

Position fasteners 3/8" from panel edges and no closer than 2" away from corners. Do not nail into corners.

Hardiepanel Vertical Siding Installation

- Framing must be provided at horizontal and vertical edges for nailing.
- Hardiepanel vertical siding must be joined on stud.
- Double stud may be required to maintain minimum edge nailing distances.



Joint Treatment

- Vertical Joints - Install panels in moderate contact (fig. 1), alternatively joints may also be covered with battens, PVC or metal jointers or caulked (fig. 2).
- Horizontal Joints - Provide Z-flashing at all horizontal joints (fig. 3)

Figure 2

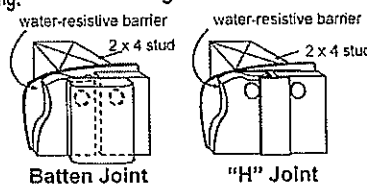


Figure 3

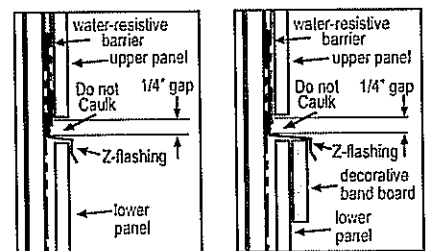
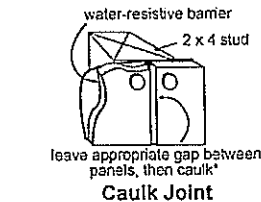
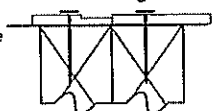


Figure 4

Recommendation: When installing Sierra 8, provide a double stud at panel joints to avoid nailing through grooves.



*Apply caulk in accordance with caulk manufacturers written application instructions.

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SD523105

CLEARANCES

Install siding and trim products in compliance with local building code requirements for clearance between the bottom edge of the siding and the adjacent finished grade.

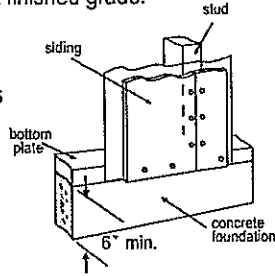


Figure 5

Maintain a minimum 2" clearance between James Hardie® products and paths, steps and driveways.

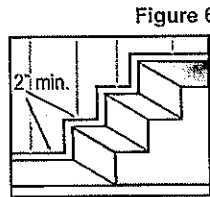


Figure 6

Maintain a minimum 2" clearance between James Hardie products and decking material.

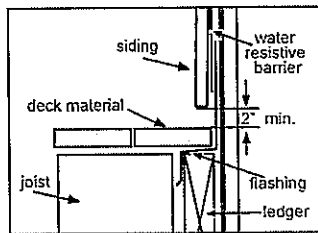


Figure 7

At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be installed per the roofing manufacturer's instructions. Provide a minimum 2" clearance between the roofing and the bottom edge of the siding and trim.

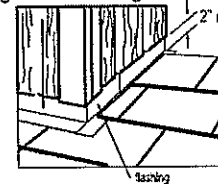


Figure 8

Maintain a 1/4" clearance between the bottom of James Hardie products and horizontal flashing. Do not caulk gap.

Maintain a minimum 1" gap between gutter end caps and siding & trim.

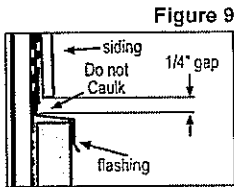


Figure 9

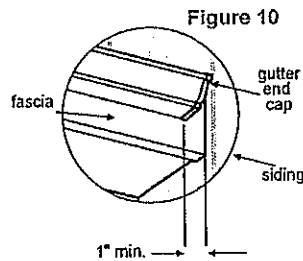


Figure 10

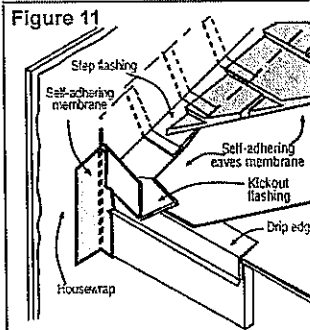


Figure 11

KICKOUT FLASHING

Because of the volume of water that can pour down a sloped roof, one of the most critical flashing details occurs where a roof intersects a sidewall. The roof must be flashed with step flashing. Where the roof terminates, install a kickout to deflect water away from the siding.

It is best to install a self-adhering membrane on the wall before the subsfascia and trim boards are nailed in place, and then come back to install the kickout.

Figure 11, Kickout Flashing To prevent water from dumping behind the siding and the end of the roof intersection, install a "kickout" of sufficient length and angle to direct the water running down the roof away from the siding.

GENERAL FASTENING REQUIREMENTS

Fasteners must be corrosion resistant, galvanized, or stainless steel. Electro-galvanized are acceptable but may exhibit premature corrosion. James Hardie recommends the use of quality, hot-dipped galvanized nails. James Hardie is not responsible for the corrosion resistance of fasteners. Stainless steel fasteners are recommended when installing James Hardie® products near the ocean, large bodies of water, or in very humid climates.

PNEUMATIC FASTENING

James Hardie products can be hand nailed or fastened with a pneumatic tool. Pneumatic fastening is highly recommended. Set air pressure so that the fastener is driven snug with the surface of the siding. A flush mount attachment on the pneumatic tool is recommended. This will help control the depth the nail is driven. If setting the nail depth proves difficult, choose a setting that under drives the nail. (Drive under driven nails snug with a smooth faced hammer - Does not apply for installation to steel framing).

- Consult applicable code compliance report for correct fasteners type and placement to achieve specified design wind loads.
- NOTE: Published wind loads may not be applicable to all areas where Local Building Codes have specific jurisdiction. Consult James Hardie Technical Services if you are unsure of applicable compliance documentation.
- Drive fasteners perpendicular to siding and framing.
- Fastener heads should fit snug against siding (no air space). (fig. A)
- Do not over-drive nail heads or drive nails at an angle.
- If nail is countersunk, caulk nail hole and add a nail. (fig. B)
- For wood framing, under driven nails should be hit flush to the plank with a hammer (For steel framing, remove and replace nail).
- Do not use aluminum fasteners, staples, or clipped head nails.

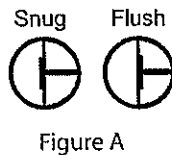


Figure A

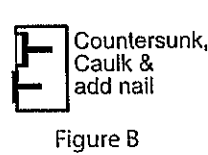


Figure B



CUT EDGE TREATMENT

Caulk, paint or prime all field cut edges.

CAULKING

For best results use an Elastomeric Joint Sealant complying with ASTM C920 Grade NS, Class 25 or higher or a Latex Joint Sealant complying with ASTM C834. Caulking/Sealant must be applied in accordance with the caulking/sealant manufacturer's written instructions or ASTM C1193.

PAINTING

DO NOT use stain on James Hardie® products. James Hardie products must be painted within 180 days for primed product and 90 days for unprimed. 100% acrylic topcoats are recommended. Do not paint when wet. For application rates refer to paint manufacturers specifications. Back-rolling is recommended if the siding is sprayed.

* The illustration (figure 11) was reprinted with permission of THE JOURNAL OF LIGHT CONSTRUCTION. For subscription information, call (800) 375-5981 or visit www.jlconline.com.

RECOGNITION: In accordance with ICC-ES Legacy Report NER-405, Hardiepanel™ vertical siding is recognized as a suitable alternate to that specified in: the BOCA National Building Code/1999, the 1997 Standard Building Code, the 1997 Uniform Building Code, the 1998 International One- and Two-Family Dwelling Code, the 2003 International Building Code, and the 2003 International Residential Code for One- and Two-Family Dwellings. Hardiepanel vertical siding is also recognized for application in the following: City of Los Angeles Research Report No. 24862, State of Florida listing FL#889, Dade County, Florida NOA No. 02-0729.02, U.S. Dept. of HUD Materials Release 1263c, Texas Department of Insurance Product Evaluation EC-23, City of New York MEA 223-93-M, and California DSA PA-019. These documents should also be consulted for additional information concerning the suitability of this product for specific applications.

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Additional Installation Information, Warranties, and Warnings are available at www.jameshardie.com



SECTION 07500
ROOFING AND FLASHING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Fully adhered EPDM sheet roofing, tapered and flat roof insulation, elastomeric flashing, copper siding, copper flashings, copper edge strips, tapered edge strips and roof drains.

1.02 CODES, REGULATIONS AND STANDARDS

A. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State and local codes, regulations and standards pertaining to work practices, hauling, disposal, protection of workers and visitors to the site, and persons occupying areas adjacent to the site. This includes modification of procedures to comply with changes to codes, regulations and standards which occur during the work of this contract. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State and local regulations. The Contractor shall hold the Owner and Owner's Representatives harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulations on the part of himself, his employees or his subcontractors.

1.03 QUALITY ASSURANCE

A. Roofing contractor to be approved in writing by the membrane manufacturer. Contractor shall be able to substantiate that he has been trained by the membrane manufacturer.

B. Roofing and flashing workmanship to comply with industry standards. The National Roofing Contractors Association's (NRCA) **ROOFING AND WATERPROOFING MANUAL** along with **ARCHITECTURAL SHEET METAL MANUAL** as published by Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) will be used to establish industry standards.

1.04 SUBMITTALS

- A. Sample fifteen (15) year watertight warranty for the EPDM membrane.
- B. Sample twenty (20) year material warranty for the EPDM membrane.
- C. Current EPDM membrane manufacturer's application specifications.
- D. Shop drawings of each flashing condition, such as eave, curb, vent, wall termination, fascia and siding. Show securement of panels and clips, spacing, type and number of fasteners.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in their original, unopened containers, clearly labeled with manufacturer's name. All material to be stored in waterproof trailers or sheds, up on raised platforms and under lock and key until use. Do not use materials damaged in handling or storage. Replace damaged material with new material. Store adhesives between 60 and 80 degrees F. Should they be exposed to lower temperatures, restore to room temperature for three to five days prior to use.

1.06 WARRANTY

- A. A ten (10) year watertight warranty and twenty (20) year material warranty shall be issued by the EPDM membrane manufacturer.
- B. The roofing contractor shall furnish the Owner with his personal two (2) year watertight warranty.

PART 2 PRODUCTS

2.01 ROOF INSULATION

- A. Tapered and flat roof insulation to be polyisocyanurate closed-cell foam core with manufacturer's standard facing laminated to both sides, complying with FS HH-I-1972/2, Class 1. The roof is to receive an average thickness of 8 ½", to achieve slopes as necessary to drain water, isocyanurate, refer to the drawings and specifications. Both 1/8" per foot and 1/2" per foot tapered isocyanurate will be required. Roof insulation to be ISO 95+ by Firestone, H-Shield by Hunter Panels or approved equal.
- B. Over all foam insulation, install one layer of 1/2" high density fiberboard roof insulation. The high density fiberboard roof insulation to be Structodek by Wood Fiber Industries, High Density Fiberboard by the Celotex Corp. or approved equal. **EPDM to be "Low Slope Fire Resistant" LSFR meeting U.L. - B. - FA.- 38.**
- C. Tapered edge strips to be 1-1/2" by 18" fiberboard. Use the tapered edge strips at the drains to create an additional sump for the drains.

2.02 MEMBRANE ROOF SYSTEM

- A. Membrane roofing to be fully adhered .060" EPDM sheet roofing furnished in twenty five foot (25') wide (or wider) rolls by Firestone, Carlisle or Versico. Roof membrane to be fully adhered to the 1/2" high density fiberboard roof insulation.
- B. Use the roof membrane for flashing of curbs and walls per the manufacturer's standard details. Use reinforced EPDM anchor strips to avoid splice joints at walls and edges.
- C. Adhesives, sealants, thinner, cleaner and accessories to be furnished by the membrane manufacturer.
- D. **Six inch (6") wide seam tape will be required for all field seams.**

2.03 ROOF DRAINS

- A. New roof drains shall be Zurn ZC-100-DP furnished with cast iron domes and "Top-Set" deck plates. Insulate bottom side of roof drain.

2.04 METAL FLASHING

- A. Edge strip to be formed using 16 ounce copper. Concealed clips to be formed using 20 ounce plain copper.
- B. Cap flashing to be formed using 16 ounce plain copper.

2.05 FASTENERS

- A. Use fasteners recommended by the membrane manufacturer to secure anchor bars and

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termination bars.

B. Fasteners used to secure roof insulation to the wood deck to be #14-10 Heavy Duty Roofing Fasteners with CR-10 coating, a minimum shank diameter of 0.170" and a thread diameter of 0.125". Pressure plates to be 3" diameter Galvalume plates. Screws and plates to be manufactured by Olympic Fasteners or approved equal. Length, size and accessories to be as required by the EPDM membrane manufacturer selected.

C. Copper flashing to be secured with annular-ring copper nails as shown on attached drawings.

PART 3 EXECUTION

3.01 PREPARATION OF SURFACES

A. Surfaces on which the roofing system is to be applied shall be clean, smooth, dry, free of fins, rot, sharp edges, loose and foreign materials, oil and grease.

3.02 ROOF INSULATION

A. Insulation shall be tightly butted with joints not more than 1/8" in width. Stagger joints with those in layer below. Fiberboard to be installed with a 1/16"-1/8" gap at all joints when board size is greater than 2' x 4'.

B. Fasten insulation to the roof deck with the appropriate screws and plates. Fastener quantity and layout must meet all requirements that may be imposed by the EPDM manufacturer to obtain their warranty.

C. Stagger joints in one direction for each course. For multiple layers, stagger joints in both directions between courses leaving no gaps, allowing a complete thermal envelope to be formed.

D. Provide tapered units to suit drainage pattern indicated.

E. Do not install more insulation in a day than can be covered with membrane before end of day or before start of inclement weather.

3.03 ROOF MEMBRANE

A. Adhere the .060" EPDM membrane to the 1/2" high density fiberboard in strict accordance with the manufacturer's specifications.

B. **Six inch (6") wide seam tape will be required for all field seams.**

C. Install an additional layer of roof membrane material, loosely applied, for additional protection at locations shown to receive concrete paver system.

3.04 FLASHING - - WALLS, PARAPETS, CURBS AND VENTS

A. Use the longest pieces of material which are practical. All flashing and terminations shall be done in accordance with the applicable manufacturer's details.

B. Care must be taken to set the elastomeric flashing so it does not bridge where there is a change of direction (i.e. where a parapet meets the roof deck). This can be accomplished by creasing the membrane into the angle change prior to adhering up the wall. Excess bridging will be cause for rejection and will be re-done at the contractor's expense.

C. Install termination bars at the top of all base flashing, fastening a minimum of 6" on center.

3.05 METAL FLASHING

A. Bottom edge of copper edge strips to be secured with continuous cleats. Nail top flange

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with annular-ring nails, three inches (3") on center. Strip top flange with 6" pressure sensitive flashing.

- B. Submit details of all proposed flashing conditions.

3.06 ROOF DRAINS

A. Install roof drains in accordance with the manufacturer's instructions. Review installation procedure with job-site inspector prior to installing drains.

B. Avoid target patches at the roof drains by installing new wood blocking, drains and tapered sumps prior to adhering the EPDM roof membrane.

3.07 TEMPORARY WATER CUT-OFF

A. Temporary water cut-offs are to be constructed at the end of each working day to protect the insulation, roofing, building and building interior from damage due to wind, snow and rain.

B. Temporary water cut-offs are to be detailed by the contractor and approved by the manufacturer and Owner.

3.08 CLEAN UP

A. Site clean-up shall be complete and to the satisfaction of the Owner.

B. All roofs, building, landscape and parking areas shall be cleaned of all trash, debris and dirt caused by or associated with this work.

C. Any areas stained, dirtied, discolored or otherwise damaged due to this work shall be cleaned, restored and replaced as required.

D. All debris shall be removed from the premises promptly and the construction area left clean daily.

3.09 INSPECTION AND TESTING

THE OWNER RESERVES THE RIGHT TO INSPECT AND TEST ALL CONSTRUCTION OPERATIONS AND MATERIALS.

A. Any defect or noncompliance discovered by inspection shall be reported to the contractor who shall promptly remove any defective material from the site.

B. The Owner reserves the right to inspect the work or parts of it as he chooses. His failure to inspect the work in progress shall not relieve the contractor of the responsibility for properly executing the contracted work, nor shall it impair the Owner's right to reject deficiencies he may subsequently discover.

PART 4 JOB CONDITIONS

A. Roofing to be applied in dry weather.

B. Completed roof areas shall not be trafficked. The work shall be coordinated to prevent this situation by working toward the roof edges.

C. This project is subject to compliance with all requirements of the Occupational Safety and Health Administration (OSHA). All work on this project must meet the requirements of all applicable state and local codes, laws and ordinances.

END OF SECTION

SECTION 07720

TYPE F ROOF SCUTTLE SPECIFICATION

I. PART ONE - GENERAL

1.01 SUMMARY

- A. Work included: Furnishing and installing factory fabricated roof scuttle

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM), 100 Bar Harbor Drive, West Conshocken, PA 19428-2959; (610) 832-9585, fax (610) 832-9555
 - 1. ASTM A 36-93a: Standard Specification for Structural Steel

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's product data for all materials in this specification.
- B. Shop Drawings: Show profiles, accessories, location, and dimensions.
- C. Samples: Manufacturer to provide upon request; sized to represent material adequately.
- D. Contract Closeout: Roof scuttle manufacturer shall provide the manufacturer's Warranty prior to the contract closeout.

1.04 PRODUCT HANDLING

- A. All materials shall be delivered in manufacturer's original packaging.
- B. Store materials in a dry, protected, well-vented area. The contractor shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.
- C. Remove protective wrapping immediately after installation .

1.05 SUBSTITUTIONS

- A. Proposals for substitution products shall be accepted only from bidding contractors and not less than (10) working days before bid due date. Contractor guarantees that proposed substitution shall meet the performance and quality standards of this specification.

1.06 JOB CONDITIONS

- A. Verify that other trades with related work are complete before installing roof scuttle(s).
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the construction documents, shop drawings, and manufacturer's installation instructions.
- D. Coordinate installation with roof membrane and roof insulation manufacturer's instructions before starting.
- E. Observe all appropriate OSHA safety guidelines for this work.

1.07 WARRANTY/GUARANTEES

- A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electrical motors, special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

II. PART TWO - PRODUCTS

2.01 MANUFACTURER

A. The BILCO Company, P.O. Box 1203, New Haven, CT 06505,
1-203-934-6363, Fax: 1-203-933-8478, Web: www.bilco.com

2.02 ROOF SCUTTLE

- A. Furnish and install where indicated on plans metal roof scuttle Type F, size width: 4'0" (1219mm) x length: 4'0" (1219mm). Length denotes hinge side. The roof scuttle shall be single leaf. The roof scuttle shall be pre-assembled from the manufacturer.
- B. Performance characteristics:
1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span or 20 psf wind uplift.
 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 3. Operation of the cover shall not be affected by temperature.
 4. Entire scuttle shall be weathertight with fully welded corner joints on cover and curb.
- C. Cover: Shall be 11 gauge aluminum with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
- D. Cover insulation: Shall be fiberglass of 1" (25.4mm) thickness, fully covered and protected by an 18 gauge aluminum liner.
- E. Curb: Shall be 12" (305mm) in height and of 14 gauge paint bond. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Posi-Flash[®] flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.
- F. Curb insulation: Shall be rigid, high-density fiberboard of 1" (25.4mm) thickness on outside of Curb.
- G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe.
- H. Hardware
1. Heavy pintle hinges shall be provided
 2. Cover shall be equipped with a spring latch with interior and exterior turn handles
 3. Roof scuttle shall be equipped with interior and exterior padlock hasps.
 4. The latch strike shall be a stamped component bolted to the curb assembly.
 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25.4mm) diameter red vinyl grip handle to permit easy release for closing.
 6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed. Springs shall have an electrocoated acrylic finish for corrosion resistance.
 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- I. Finishes: Factory finish shall be alkyd based red oxide primed steel.

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III. PART THREE - EXECUTION

3.01 INSPECTION

A. Verify that roof scuttle installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.02 INSTALLATION

- A. Submit product design drawings for review and approval to the architect or specifier before fabrication.
- B. The installer shall check as-built conditions and verify the manufacturer's roof scuttle details for accuracy to fit the application prior to fabrication. The installer shall comply with the roof scuttle Manufacturer's installation instructions.
- C. The installer shall furnish mechanical fasteners consistent with the roof requirements.

END OF SECTION

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FIRESTOPPING & SMOKE SEALS

SECTION 07860

1 General

1.1 SECTION INCLUDES

- .1 Comply with Division 1, General Requirements and Documents referred to therein.
- .2 It is the intent of this section of the specifications to establish a single, competent source to be responsible for providing all labour, materials, products, equipment and services, to supply and install the firestopping and smoke seal work for the entire project, at the following locations:

Openings in fire rated walls, floors and roofs both empty and those containing penetrations such as cables, conduits, cable pipes, ducts and similar penetrating items.

Gaps between fire-rated walls and exterior walls.

Openings at each floor level in fire rated shafts or stairwells.

Gaps between the tops of fire rated walls and underside of fire rated floor or roof assemblies.

Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Openings through Floors and Walls:

Fire Rated: Metal sleeves for fire rated openings through floors and walls shall be provided under applicable mechanical and electrical specification sections.

Non-Rated: Non-rated openings through floors and walls shall be sealed under applicable mechanical and electrical specification sections.

- .2 Firestopping and smoke seals within mechanical (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside bus ducts) shall be sealed under applicable mechanical and electrical specifications sections. Firestopping and smoke seals around outside of such mechanical and electrical assemblies, where they penetrate fire rated separations, are the responsibility of this section.

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1.3 RELATED SECTIONS

- .1 Division 15 - Mechanical: Mechanical work requiring firestopping.
- .2 Division 16 - Electrical: Electrical work requiring firestopping.

1.4 REFERENCE STANDARDS

- .1 ANSI/UL 1479 - Fire Tests Of Through-Penetration Firestops

1.5 SYSTEM DESCRIPTION

- .1 Firestopping Materials: Provide firestopping system(s) of sufficient thickness, width and density to provide and maintain a fire resistance rating, as indicated on drawings and in accordance with UL or FM design numbers.
- .2 Provide a seal completely filling all annular spaces to prevent the passage of flame, smoke and gases through the opening in the fire separation in which it is installed.
- .3 Material Compatibility: Provide materials which are compatible with all materials used in the system including materials used in or on penetrants as well as all construction materials used in conjunction or contiguous with the system.
- .4 Accessories: Provide components for each firestopping system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated systems. Accessories include but are not limited to the following items:

- Permanent forming/damming/backing materials.
- Temporary forming materials.
- Substrate primers.
- Collars.
- Steel sleeves.

1.6 SUBMITTALS

- .1 Manufacturer's Data: Submit manufacturer's specifications, installation instructions and product data for each material required, in accordance with Section 01300. Include manufacturer's certification, if requested and UL, WH, ULC, cUL or FM test reports to show compliance with the Contract Documents.
- .2 Shop Drawings: Submit shop drawings showing typical installation details including reinforcement, anchorage, fastenings and method of installation for each type of firestopping condition.
- .3 Samples: If requested, submit samples of each type of firestopping systems, smoke seals and accessories. Indicate location where material/system shall be utilized.

FIRESTOPPING & SMOKE SEALS

SECTION 07860

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1.7 QUALITY ASSURANCE

- .1 Manufacturer: Company specializing in manufacturing products of this Section with minimum three (3) years documented experience.
- .2 Applicator: Company having a minimum of three (3) years experience in the installation of materials specified herein on projects comparable to this Project. The firm shall have the written approval of the firestopping material manufacturer(s).

1.8 REGULATORY REQUIREMENTS

- .1 Conform to applicable local Building Codes for fire resistance ratings.
- .2 Provide materials, accessories and application procedures which have been listed by UL, FM or tested by a nationally recognized independent testing agency according the ANSI/UL 1479 or ASTM E814 to achieve the required fire protection rating.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Do not proceed with the installation of firestopping materials when temperatures or weather conditions exceed the manufacturer's recommended limitations for installation.
- .2 Ventilate solvent based firestopping per firestopping manufacturer's instructions by natural means or, where this is inadequate, forced air circulation.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to Site in manufacturer's sealed and labelled containers intact. Handle and store materials in accordance with manufacturer's instructions.

1.11 PROJECT/SITE CONDITIONS

- .1 Comply with manufacturer's recommended requirements for temperature, relative humidity and substrate moisture content during application and curing of materials.

1.12 SEQUENCING AND SCHEDULING

- .1 Do not install firestopping system(s) until Work within opening has been completed. Coordinate with other applicable Sections. Schedule work of other trades so that firestopping applications can be inspected prior to being covered by subsequent construction.

2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Provide firestopping silicone sealants, water-based sealants, mortars, or firestop devices from the following manufacturer:

A/D Fire Protection Systems Inc.

2.2 MATERIALS

- .1 Provide a complete system of asbestos-free firestopping and through-penetrations firestopping. Firestop systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ANSI/UL 1479 or ASTM E814 and listed by UL or FM and in addition are approved by jurisdictional authorities and the Consultant.
- .2 A/D FIREBARRIER Silicone Sealants: For use in openings 304.8 mm dia. or greater but not to exceed opening sizes for which they are intended, penetrations subject to movement, in control joints, in curtain wall joints, as a sealant for smoke barrier construction, fire and smoke dampers, head of wall details and fire doors in masonry or gypsum wall partitions.
- .3 A/D FIREBARRIER Mortar: For use in large openings, in static, non-moving, penetrations such as cable trays, electrical and communication bundles, conduit and non-combustible sleeves and rated insulated pipes.
- .4 Firestopping for Combustible Penetrating Items: For use in openings where either plastic pipe, non-rated insulated pipes or insulated cables are installed.
- .5 Firestop system ratings: Comply with Building Code (BOCA) requirements for locations and hourly ratings of F, FT, FH and FTH designations.

2.3 ACCESSORIES

- .1 Damming and backup materials, supports and anchoring devices: Non-combustible, to manufacturer's recommendations and in accordance with the tested system being installed as acceptable to jurisdictional authorities.
- .2 Retainers: Galvanized clips approved by manufacturer to hold A/D FIREBARRIER Mineral Wool insulation in place.
- .3 Primers: As required by firestopping manufacturer and compatible with selected system and contiguous materials.
- .4 Water: Potable.
- .5 Sealants for vertical joints: Non-sagging.

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- .6 Sealants and fluid seals at floor openings: Self-levelling.
- .7 Sealants and putty for vertical and overhead joints: Non-sagging.
- .8 Tape: Pressure sensitive masking tape as recommended by the firestopping manufacturer.

3 Execution

3.1 EXAMINATION

- .1 Examine substrates, openings, voids, adjoining construction and conditions under which the Work is to be installed. Confirm compatibility of surfaces scheduled to receive firestopping.
- .2 Verify that penetrating elements are securely fixed and properly located with the proper space allowance between penetrations and surfaces of openings.
- .3 Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Surfaces to receive firestopping shall be free of dirt, dust, grease, oil, rust, loose materials, form release agents, frost, moisture or any other matter which would impair the bond of firestopping material to the substrate of penetrating item(s).
- .2 Prime substrates in accordance with manufacturer's written instructions or recommendations. Confine primers to areas of bond; do not allow spillage or migration onto exposed surfaces.
- .3 Do not apply firestopping and smoke seals to surfaces previously painted or treated with sealers, curing compounds, water repellent or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure that anchoring devices, back-up materials, clips, sleeves, supports and other related materials used in the actual fire tests are provided.
- .5 Mask where necessary to prevent firestopping materials from contacting adjoining surfaces that will remain exposed upon completion of Work. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.
- .6 Installation is not to proceed until submittals have been completed.

3.3 INSTALLATION

- .1 Manufacturer's Instructions: Comply with UL or FM Listings and manufacturer's instructions for the type of material and condition of opening in each case. Consult with the manufacturer's technical representative to determine

proper procedure for conditions not fully covered by printed instructions. Record in writing any oral instructions received, with copy to manufacturer.

- .2 Install firestopping with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal. Tool or trowel exposed surfaces. Remove excess firestopping material promptly as the Work progresses and upon completion.
- .3 Damming: Provide leak-proof dams as required to seal openings and contain liquid sealants, putty or mortar until cured. Install damming in accordance with manufacturer's instructions.
- .4 Damming Boards: Install forming/damming materials and other accessories of type required to support fill materials during their application and in the position needed to produce the shapes and depths required to achieve fire ratings of through-penetration firestop systems.

Combustible Type: For temporary dams only. Remove after firestopping material has cured.

Non-Combustible Type: For temporary or permanent dams. Provide non-combustible type wherever damming material cannot be removed after applying firestopping materials.

- .5 Void Filler: Use materials recommended by the firestopping manufacturer to seal gaps created by non-combustible type damming boards and to seal around cables, conduits, pipes and where void filler material becomes part of the fire rated assembly.
- .6 Sealant: Install damming material or mineral wool as required. Apply sealant so air voids are not present and sealant is in full contact with penetrating items. Tool sealant to ensure substrate contact. Remove excess sealant in accordance with manufacturer's recommendations.
- .7 Mortar: Install damming material as required. Mix mortar in strict accordance with manufacturers instructions. Pump, trowel or hand pack mortar through openings to minimum thickness as recommended by manufacturer and as listed by UL or FM, to achieve required fire rating.
- .8 Firestopping Mineral Wool: Install firestopping by compressing material to the minimum required by UL or FM listing. Apply firestopping in sufficient thickness, depth and density so as to achieve the required fire resistance rating. Use impaling clips to support and secure firestopping where required by tested system.

3.4 FIELD QUALITY CONTROL

- .1 Notify Consultant when completed installations are ready for inspection prior to concealing or enclosing an area containing firestopping materials.

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- .2 Arrange for inspections by the Owners independent inspection and testing company, appointed and paid for by Owner.
- .3 Following field inspections, provide all repair as required to ensure compliance with the Contract Documents.

3.5 CLEANING AND PROTECTION

- .1 Upon completion of this work, remove all materials, equipment and debris from the site.
- .2 Leave work area and adjacent surfaces in a condition acceptable to the Consultant.
- .3 Leave installed work with sufficient protection to enable it to remain untouched until project turnover.

End of Section

SECTION 07900

JOINT SEALERS

1. GENERAL:

1.1 REFERENCES:

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. Section 01045 Cutting and Patching, SPECIFICALLY Section 2.1B Fire stopping & section 07860 fire stopping & smoke seals.

1.2 DESCRIPTION OF WORK: The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet requirements of these Specifications.

2. PRODUCTS:

2.1 CAULKING MATERIAL

- A. Tremco Dymonic; one part polyurethane on exterior walls for caulking joints at all junctions as necessary to obtain complete watertight construction.
- C. Tremco Latex 834 for general interior caulking.
- D. Standard Use low VOC adhesives & sealants
- E. Sonoborne Np-1.
- F. Volatile Organic Compound (VOC) emissions from adhesives and sealants must not exceed VOC limits of South Coast Air Quality Management District Rule #1168 AND sealants used as fillers must meet the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51

3. EXECUTION:

- 3.1 ALL POTENTIAL INFILTRATION cracks & joints to be caulked. Caulking shall be done only by workmen who are thoroughly experienced in this work. Exterior caulking shall be applied around windows, doors, vents, utilities, and any other infiltration "crack".
- 3.2 INTERIOR CAULKING shall be applied to seal all penetrations through top plates of interior walls, (due to electrical or plumbing), and at tubs, showers, counter tops, bottom of party walls GWB, and other as shown on Drawings. Note: Lessco boxes in exterior walls, flanges to be sealed, wire penetrations to be caulked.

3.3 IN GENERAL, caulking to be done prior to (in conjunction with) siding installation. See Drawings for any additional applications. Joints and spaces to be caulked shall be dry and free from dust. Finished caulking "bead" shall be neat and smooth, free of gaps and sags and run continuously. Complete all caulking work and allow to stand for the manufacturer's recommended time period before painting. Prime if required before finish coat of paint is applied.

Note: In panelized construction caulk all open joints in exterior wall studding.

END OF SECTION

STEEL DOORS AND FRAMES

SECTION 08100

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

- A. The CONDITIONS OF THE CONTRACT and all Sections of Division 1 are hereby made a part of this section.

1.02 DESCRIPTION OF WORK:

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this section. Extent of steel doors and frames required is indicated on drawings and in schedules.

- 1. Furnish and Install:

- a. Steel frames for hollow metal doors
 - b. Steel frames for wood doors
 - c. Steel sidelite, borrowed lite, and transom frames
 - d. Hollow metal doors

- 2. Install Only: Finish hardware for hollow metal doors as specified in Section 08710 Finish Hardware.

- B. Related work specified elsewhere:

- 1. SECTION 08210: WOOD DOORS
 - 2. SECTION 08710: FINISH HARDWARE
 - 3. SECTION 09900: PAINTING

1.03 QUALITY ASSURANCE; SUBMITTALS:

- A. General: Comply with requirements of SECTION 01300 - SUBMITTALS, MEETINGS & RECORD DOCUMENTS and SECTION 01400 - QUALITY CONTROL SERVICES.

- B. Manufacturer: Provide steel doors and frames complying with these specifications from one of the following:

- 1. CECO
 - 2. Curries
 - 3. Steelcraft

- C. Supplier: A recognized hollow metal supplier, with in-house fabrication facilities, who has been furnishing doors and frames in the project's vicinity for a period of not less than five years.
- D. Product Data: Submit four copies of manufacturers technical product data for each item. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and maintenance.
- E. Door Schedule: Submit final door schedule in manufacturer's standard format and as outlined below. Coordinate doors, frames and related work to ensure proper size, thickness, hand, function, and fasteners.

1. **NOTE: Contractor shall make all submittals for finish hardware, doors, frames and related items simultaneously, only after proper review and coordination by own staff beforehand.**
2. Final Door Schedule Content: Based on doors and frames in drawings, organize door schedule to indicate complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, hand, size and construction of each item.
 - b. Anchors and fastenings to related work.
 - c. Corner construction of welded and/or knocked down frames.
 - d. Location of door and frame cross-referenced to indications on drawings both on floor plans and in hardware schedule.
 - e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door construction and materials.
 - h. Gage and finish of all materials.
3. Shop Drawings: Submit separate detail drawings, referenced to door schedule, showing size, hand, construction, fasteners, anchors and all other details pertinent to the fabrication of doors and frames for this project.

1.04 APPROVAL OF SUBSTITUTIONS:

- A. Manufacturers and model numbers specified herein are to establish a standard of quality. If products other than those specifically identified herein are to be considered for this Project, they must be submitted for approval of the Architect not less than ten (10) calendar days prior to receipt of General Bids.
- B. Requests for approval of substitutions shall be in writing, accompanied by catalog cuts, technical information and physical samples.
- C. Approval of substitutions shall only be valid when issued by Architect to all bidders in the form of Addendum.

1.05 REFERENCES:

- A. ANSI A115 Series: Standards for Steel Doors And Frames.
- B. NFPA 80, NFPA 101.
- C. Other applicable building and life safety codes.
- D. Door and Hardware Institute: "Recommended Locations for Builder's Hardware.
- E. ANSI A117.1: American National Standard Providing Accessibility and Usability for Physically Handicapped People.
- F. Other applicable industry standards.

1.06 PRODUCT PACKAGING AND HANDLING:

- A. Tag each item or package separately, with identification related to final door schedule.
- B. All doors shall be packaged in full cartons and securely banded.
- C. Doors and frames shall be received by the contractor at the jobsite and handled in a manner so as not to be damaged. They shall be stored upright in a protected area on wood runners or skids and shall be covered with vented tarpaulins or plastic.

1.07 WARRANTY: Doors and frames specified for this Project shall be guaranteed against defects in material and workmanship for a period of one (1) year from date of Substantial Completion of Project.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Doors shall be manufactured from commercial quality cold-rolled steel sheets. Exterior doors shall be A60 hot-dipped galvanized.
- B. Frames shall be manufactured from commercial quality cold-rolled steel sheets. Exterior frames shall be A60 hot-dipped galvanized.
- C. Steel shall conform to ASTM standards A366 or A620 and A568 (uncoated), ASTM A526 or A642 and A525 (galvanized).
- D. All doors and frames shall be chemically treated for paint adhesion and prime painted to meet performance requirements of ANSI A224.1.

2.02 DOOR FABRICATION:

- A. Interior doors shall be 1-3/4" thick, manufactured from two 18 gage steel sheets. A one piece resin-impregnated honeycomb core with sanded edges shall be securely

bonded to both face sheets. Doors shall have mechanically interlocked vertical edges, flush face sheets, and hairline seam edges. The top and bottom of the door shall be closed flush by 16 gage steel channels (where concealed door bottoms are specified, bottom channel shall be reversed to allow insertion of door bottom into door web). At contractor option, in lieu of honeycomb cores, doors may be provided with a rigid polystyrene foam core, continuously bonded to the face sheets, and completely filling the door.

- B. Exterior doors shall be 1-3/4" thick, manufactured from two 16 gage galvanized steel sheets. The interior of the doors shall be completely filled with a foamed-in-place polyurethane core, chemically bonded to all interior surfaces. Doors shall have mechanically interlocked vertical edges, flush face sheets, and hairline seam edges. The top and bottom of the door shall be closed flush by 16 gage steel channels (where concealed door bottoms are specified, bottom channel shall be reversed to allow insertion of door bottom into door web).
- C. All doors shall be handed type with factory preparation for all concealed or mortised Finish Hardware scheduled. Door closer reinforcements shall be provided for all doors whether scheduled to received closer or not. Reinforce doors for all surface applied hardware.
- D. Non-handed doors, and/or filler plates for cutouts not required for scheduled hardware preparation shall NOT be acceptable.

2.03 FRAME FABRICATION:

- A. General: Frames shall be knocked down and field assembled or welded type at contractor option.
- B. Standard knockdown or welded frames shall be manufactured form 16 gage steel sheets with 2" face and 5/8" integral stop. Jamb depth to be determined by wall thickness in accordance with the drawings. Supply appropriate anchors for wall construction.
- C. Drywall frames shall be manufactured form 16 gage steel sheets with 2" face and 5/8" integral stop and double back bend to grip the partition firmly without marring the wall surface. Jamb depth to be determined by wall thickness in accordance with the drawings. Provide adjustable plumb anchors to insure square and plumb installation. Supply standard floor anchors for bottom of each jamb.
- D. Prepare frames for all concealed or mortised hardware and reinforce for all surface applied hardware.
- E. Provide plaster guards for all hardware cutouts.
- F. Prepare frames to receive pneumatic type silencers: two for each pair frame, three for each single frame.
- G. Exterior frames shall be 16 ga welded, galvanized with thermally broken jambs.

2.04 FIRE RATED ASSEMBLIES

- A. All labeled fire doors and frames shall be of a type tested in accordance with ANSI/UL-10b, ASTM E-152, NFPA-252, or UL-305, and shall provide the degree of fire protection, heat transmission, panic-loading capabilities, and/or smoke control as indicated on the label and required by the drawings.
- B. Labeled doors and frames shall bear the label of Underwriters Laboratories, Warnock Hersey, or Factory Mutual and shall meet all requirements of the labeling agencies current procedures and policies.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Doors and frames shall be assembled, installed, and erected plumb and in true alignment and in conformance with manufacturer's recommendations and final approved shop drawings. Preparation for surface applied hardware shall be performed on the jobsite. Frames shall be rigid and securely anchored in place. Doors shall be installed in a manner to achieve functional operation and appearance.
- B. Install hardware in compliance with 08710 FINISH HARDWARE.

END OF SECTION

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SECTION 08200

INTERIOR APARTMENT DOORS

A. GENERAL:

SCOPE: The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:

1. Furnishing and installing all door frames as called for on drawings or noted in Specifications.
2. Furnishing and installing all interior wood and exterior metal doors as specified.
3. Furnishing and installing hardware in accordance with Door Schedule, including locksets, closers, holders, knockers etc.

NOTE: The Contractor shall submit drawings on every item specified in this section. There shall be no substitutions without a specific written explanation from the subcontractor that the specific item is equal with the item specified by the Architect. All substitutions shall be approved by the Architect and the Owner.

B. PRODUCTS:

All doors and frames shall be of the material, type and finish as called for on Drawings or in these Specifications. All dimensions shall be as shown by Door Schedule on Drawings. Door identified by manufacturer's name and type of brand name may be substituted for others of equal quality only with the approval of the Architect. Doors delivered for installation shall be carefully stored to prevent damage or warping.

All Interior unit swing doors and sliding shall be 1-3/8" Atherton #550 moulded smooth panel doors by Door Craft Inc. and distributed by Brosco or equal. Units shall be prehung and primed. Verify finish and coordinate with painting specification.

Apartment Entry Door: To be 1 3/4 solid oak veneer with metal frame.

Hardware: See Hardware Schedule

C. EXECUTION:

Install doors after completion of all other work which would raise the moisture content of wood doors or damage door surfaces. Fit, hang and trim as required by the opening so the doors will close and not bind. Solid blocking at hinges and latch required. Provide even clearance of 1/8" at sides and top, 1/4" over thresholds, and 3/4" over floors. See also Section 06100 & 06200 Rough and Finish Carpentry.

Install doorstops for all swing doors.

At completion of work, door glass shall be cleaned, leaving no masking tape or any other visible marks on the surface; doors shall be free of any nicks, scratches or marks; all doors shall open and close freely; and all locksets shall operate with key, (if required) and hardware function properly.

END OF SECTION



SECTION 08210 - WOOD DOORS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

- A. The CONDITIONS OF THE CONTRACT and all Sections of Division 1 are hereby made a part of this section.

1.02 DESCRIPTION OF WORK:

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this section. Extent of wood doors required is indicated on drawings and in schedules.

- 1. Furnish and Install:

- a. Flush wood doors for steel frames
- b. Related work specified elsewhere:

- 1. SECTION 08100: STEEL DOORS AND FRAMES
- 2. SECTION 08700: FINISH HARDWARE
- 3. SECTION 09900: PAINTING

1.03 QUALITY ASSURANCE; SUBMITTALS:

- A. General: Comply with requirements of SECTION 01300 - SUBMITTALS, MEETINGS & RECORD DOCUMENTS; SECTION 01400 - QUALITY CONTROL SERVICES.
- B. Manufacturer: Provide wood doors complying with these specifications from one of the following:
 - 1. Weyerhaeuser
 - 2. Brosco
 - 3. Mohawk
- C. Supplier: A recognized wood door supplier, with in-house fabrication and warehousing facilities, who has been furnishing doors and frames in the project's vicinity for a period of not less than five years.
- D. Product Data: Submit four copies of manufacturers technical product data for each item. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and maintenance.
- E. Door Schedule: Submit final door schedule in manufacturer's standard format. Coordinate doors, frames and related work to ensure proper size, thickness, hand, function, and fasteners.
 - 1. **NOTE: Contractor shall make all submittals for finish hardware, doors, frames and related items simultaneously, only after proper review and coordination by own staff beforehand.**
 - 2. Shop Drawings: Submit separate detail drawings, referenced to door schedule, showing size, hand, construction, fasteners, elevation and all other details pertinent to the fabrication of doors and frames for this project.

1.04 APPROVAL OF SUBSTITUTIONS:

- A. Manufacturers and model numbers specified herein are to establish a standard of quality. If products other than those specifically identified herein are to be considered for this Project, they must be submitted for approval of the Architect not less than ten (10) calendar days prior to receipt of General Bids.
- B. Requests for approval of substitutions shall be in writing, accompanied by catalog cuts, technical information and physical samples.
- C. Approval of substitutions shall only be valid when issued by Architect to all bidders in the form of Addendum.

1.05 REFERENCES:

- A. Applicable AWI standards.
- B. NFPA 80, NFPA 101.
- C. Other applicable building and life safety codes.
- D. Door and Hardware Institute: "Recommended Locations for Builder's Hardware.
- E. ANSI A117.1: American National Standard Providing Accessibility and Usability for Physically Handicapped People.
- F. Other applicable industry standards.

1.06 PRODUCT PACKAGING AND HANDLING:

- A. Tag each item or package separately, with identification related to final door schedule.
- B. All doors shall be packaged in full cartons and securely banded.
- C. Doors and frames shall be received by the contractor at the jobsite and handled in a manner so as not to be damaged. They shall be stored upright in a protected area on wood runners or skids and shall be covered with vented tarpaulins or plastic.

1.07 WARRANTY: Doors and frames specified for this Project shall be guaranteed against defects in material and workmanship for a period of one (1) year from date of Substantial Completion of Project.

PART 2 - PRODUCTS

2.01 FLUSH WOOD DOORS:

- A. Doors shall be 1-3/4" thick with particle board cores bonded to stiles and rails.
- B. Provide standard 3-ply face veneer of plain slice oak.
- C. Where glass lites are required, provide manufacturer's standard wood molding to match face veneer on non-fire rated doors, and standard steel molding on fire rated doors.
- D. Factory prepare doors to receive concealed or mortise hardware as specified in 08700 FINISH HARDWARE.

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PART 3 - EXECUTION

3.01 INSTALLATION

- A. Doors and frames shall be assembled, installed, and erected plumb and in true alignment and in conformance with manufacturer's recommendations and final approved shop drawings. Preparation for surface applied hardware shall be performed on the jobsite. Frames shall be rigid and securely anchored in place. Doors shall be installed in a manner to achieve functional operation and appearance.
- B. Install hardware in compliance with 08700 FINISH HARDWARE.

END OF SECTION

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SECTION 08305

LADDER SAFETY POST SPECIFICATION

I. PART ONE - GENERAL

1.01 SUMMARY

- A. Work included: Furnishing and installing factory fabricated ladder safety posts
- B. Related Work: [Insert applicable specifications sections]

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM), 100 Bar Harbor Drive, West Conshocken, PA 19428-2959; (610) 832-9585, fax (610) 832-9555
 - 1. ASTM A 36-93a: Standard Specification for Structural Steel

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's product data for all materials in this specification.
- B. Shop Drawings: Show profiles, accessories, location, and dimensions.
- C. Samples: Manufacturer to provide upon request; sized to represent material adequately.
- D. Contract Closeout: Ladder Safety Post manufacturer shall provide the manufacturer's Warranty prior to the contract closeout, if applicable.

1.04 PRODUCT HANDLING

- A. All materials shall be delivered in manufacturer's original packaging.
- B. Store materials in a dry, protected, well-vented area. The contractor shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.
- C. Remove protective wrapping immediately after installation, if applicable.

1.05 SUBSTITUTIONS

- A. Proposals for substitution products shall be accepted only from bidding contractors and not less than (10) working days before bid due date. Contractor guarantees that proposed substitution shall meet the performance and quality standards of this specification.

1.06 JOB CONDITIONS

- A. Verify that other trades with related work are complete before installing ladder safety post(s).
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the construction documents, shop drawings, and manufacturer's installation instructions.
- D. Observe all appropriate OSHA safety guidelines for this work.

1.07 WARRANTY/GUARANTEE

- A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

II. PART TWO - PRODUCTS

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2.01 MANUFACTURER

A. The BILCO Company, P.O. Box 1203, New Haven, CT 06505; 1-203-934-6363, Fax: 1-203-933-8478

Internet address: <http://www.bilco.com>

For local representative, contact: Sweet's Buyline 1-800-892-1165 (#0032, #0034)

2.02 LADDER SAFETY POST

- A. Furnish and install ladder safety post Model LU-1. The ladder safety post shall be pre-assembled from the manufacturer.
- B. Performance characteristics:
 - 1. Tubular post shall lock automatically when fully extended.
 - 2. Safety post shall have controlled upward and downward movement.
 - 3. Release lever shall disengage the post to allow it to be returned to its lowered position.
 - 4. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" on center and clamp brackets to accommodate ladder rungs up to 1-3/4" in diameter.
- C. Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.
- D. Material of construction: Shall be steel Model LU-1.
- E. Balancing spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post. [For installation in corrosive atmospheres, Models LU-2, LU-3, and LU-4 incorporate a special alloy spring mechanism].
- F. Hardware: All mounting hardware shall be Type 316 stainless steel.
- G. Finishes: Factory finish shall be black enamel steel Model LU-1.

III. PART THREE - EXECUTION

3.01 INSPECTION

- A. Verify that ladder safety post installation will not disrupt other trades. Verify that the ladder rungs are dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.02 INSTALLATION

- A. Submit product design drawings for review and approval to the architect or specifier before fabrication.
- B. The installer shall check as-built conditions and verify the manufacturer's ladder safety post details for accuracy to fit the application prior to fabrication. The installer shall comply with the ladder safety post manufacturer's installation instructions.
- C. The manufacturer shall furnish fasteners necessary for installing ladder safety post on ladder.

END OF SECTION 08305

**SECTION 08360
SECTIONAL DOORS
511 Series Aluminum Sectional Doors**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions, and Division 1 General Requirements, apply to the work of this Section.

1.02 SUMMARY

A. The work of this Section includes upward-acting sectional doors.

B. Related Sections: Other specification sections which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 05500 - Miscellaneous Metal; metal framing and supports.
2. Section 08710 - Finish Hardware; key cylinders for locks.
3. Section 09900 - Painting; field painting.
4. Section 16100 - Electrical; wiring.

1.03 SUBMITTALS

A. Product Data: Submit manufacturers product data and installation instructions for each type of sectional door. Include both published data and any specific data prepared for this project.

B. Shop Drawings: Submit shop drawing for approval prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.

1.04. QUALITY ASSURANCE

A. Manufacturer: Sectional doors shall be manufactured by a firm with a minimum of five years experience in the fabrication and installation of sectional doors. Manufacturers proposed for use, which are not named in these specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past five years.

B. Installer: Installation of sectional doors shall be performed by the authorized representative of the manufacturer.

C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable

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to manufacturer of primary components.

D. Pre-Installation Conference: Schedule and convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Provide sectional doors by Overhead Door Corporation, Dallas, Texas; Telephone 800-887-3667 or 214-233-6611; Fax 214-233-0367.

2.02 ALUMINUM SECTIONAL DOORS

A. Trade Reference: 511 Series Aluminum Doors by Overhead Door Corporation.

B. Sectional Door Assembly: Stile and rail assembly secured with 1/4 diameter through rods. Units shall have the following characteristics:

1. Panel Thickness: 1-3/4"
2. Aluminum Panels: 0.050 thick, aluminum.
3. Stiles and Rails: 6063 - T6 aluminum.
4. Standard Springs; 10,000 cycles. (High cycles.)
5. Glazing: Tempered Glass

C. Finish and Color:

1. Powder Coating Finish: Color Midnight

D. Windload Design: ANSI/NAGDM 102 standards and as required by code.

E. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.

**SECTIONAL DOORS
08360-2**

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F. Lock: Interior galvanized single unit.

G. Weatherstripping: Flexible PVC on bottom section. (Jamb seals.) (Header seal.)

H. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.

I. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.

1. Entrapment Protection: Pneumatic sensing edge up to 18 wide.

2. Operation Controls: Push-button operated control stations with open, close, and stop buttons for mounting, for interior location.

3. Special Operation: Remote receiver with forty (40) remote transmitters. Timer to close.

PART 3 - EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

A. Strictly comply with manufacturers installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

B. Instruct Owners personnel in proper operating procedures and maintenance schedule.

3.03 ADJUSTING AND CLEANING

A. Test sectional doors for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Touch-up damaged coatings and finishes and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned.

End of Section

SECTIONAL DOORS

08360-3

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SECTION 08550

CLAD WOOD WINDOWS & DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clad wood windows.
- B. Clad wood doors.
- C. Glazing and accessories.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Openings in cast-in-place concrete.
- B. Section 06200 - Finish Carpentry: Interior wood casing.
- C. Section 07210 – Thermal Insulation
- D. Section 07460 - Siding and trim.
- E. Section 07900 - Joint Sealers: Perimeter joint sealant and backer rod.

1.3 REFERENCES

- A. AAMA/NWWDA 101/I.S.2-97 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors; 1997.
- B. AAMA 611-98 - Voluntary Specification for Anodized Architectural Aluminum.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 1998.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 1998.
- E. ASTM C 1036 - Standard Specification for Flat Glass; 2001.
- F. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 1997b.
- G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
- H. ASTM D 2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates; 1993 (Reapproved 2000).
- I. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 1998.
- J. ASTM E 774 - Standard Specification for the Classification of the Durability of

Sealed Insulating Glass Units; 1997.

- K. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- L. ASTM E 1886 - Standard Test method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
- M. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.
- N. WDMA I.S.4 - Water-Repellent Preservative Non-Pressure Treatment for Millwork; 2000.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Certification: Evidence of certification to specified ratings.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Impact Rated Windows and Doors:
 - 1. High Velocity Hurricane Zone: Eagle SeaStorm and Harbor Master Windows conform to ASTM E 330 for Static Air Pressure.
 - 2. Large Missile Impact and Cyclic Pressure Loading: Eagle Harbor Master Windows Dade County Approved and conforming to ASTM E 1886 and ASTM E 1996 for large missile impact and cyclic pressure loading.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver units to project site until ready to install, unless indoor storage area is available.
- B. Store products in manufacturer's unopened packaging until ready for installation.

1.7 WARRANTY

- A. Provide manufacturer's standard warranty for:
 - 1. Wood Members: 10 years.
 - 2. Aluminum Cladding Structural Performance: Lifetime.
 - 3. Exterior Aluminum Finish: Thermoset siliconized polyester finish 20 years.
 - 4. Exterior Aluminum Finish: Kynar finish 10 years.
 - 5. Anodized Aluminum Finish: 5 years.
 - 6. Insulating Glass: 20 years.

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7. Other Components: 10 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Eagle Window & Door, which is located at: 2045 Kerper Blvd. ; Dubuque, IA 52001; Toll Free Tel: 800-324-5354; Tel: 563-556-2270; Fax: 563-556-4408; Email: eagleinc@eaglewindow.com; Web: www.EagleWindow.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 WINDOWS AND DOORS - GENERAL

- A. Windows and Doors: Complying with AAMA/NWWDA 101/I.S.2-97; factory assembled and glazed, complete with weatherstripping, operating hardware and specified accessories.
1. Total Jamb Depth: As indicated on Drawings; provide factory installed jamb extensions.

2.3 NFRC certified thermal performance.

U value of .35 or less

Solar Heat Gain Coefficient (SHGC) of .45 or higher

Air Leakage Rate (AL) of .30 or less

2.4 CLAD WOOD WINDOWS

- A. Double Hung Windows:
1. Jamb Depth: 4-9/16 inches (115 mm).
 2. Stile Width: 1-5/8 inches (41 mm).
 3. Top Rail Height: 1-5/8 inches (41 mm).
 4. Check Rail Height: 1-5/8 inches (41 mm).
 5. Bottom Height: 3-3/4 inches (95 mm).
 6. Screens:
 - a. Screen Mesh: 18 by 16 charcoal colored fiberglass mesh.
 - b. Screen Frame: Aluminum, with corners mitered and secured with corner locks; spring-loaded. Color as follows:
 - 1) Match frame color.
 7. Double-Hung Jamb Liners, Hardware, and Weatherstripping:
 - a. Jamb Liners: Talon type; patent pending vinyl jamb liners; color as selected from manufacturer's standard colors.
 - 1) Jamb Liner Inserts: Exterior and interior inserts of vinyl; color as selected from manufacturer's standard colors.
 - 2) Weatherstripping: Compression bulb type at bottom of sash, head jamb, at check rail, and on side jambs.
 - 3) Locks: High-pressure zinc die cast lock/tilt mechanism designed to open and tilt sash in one operation.
 - 4) Balances: Factory installed, concealed in jambs; block and tackle assemblies as appropriate for sash weight; two on each sash.
 - b. Pivot Locking: Each venting sash provide two specially designed mechanisms that permit sash to be tilted 90 degrees inward from bottom pivot and positively held in place for washing.

8. Hardware Finishes:
 - a. Window Hardware Exposed to View on Interior when window is closed. Finish in color selected from manufacturer's standard selection as follows:
 - 1) White.
 - b. Finish of Hardware Exposed to Weather or Concealed from View When Window is Closed: Manufacturer's standard finish.

2.5 CLAD WOOD DOORS

- A. Ascent In-Swinging French Doors and Sidelights:
 1. Style: Standard, one glazed panel.
 2. Center Post Double Doors: Rating HGD-C45, maximum size 79 by 98 inches (2007 by 2489 mm).
 3. Jamb Depth: Adjustable 6-9/16 inches (167 mm); adjustable from 5-9/16 inches to 7-9/16 inches (141 mm to 192 mm)
 4. Panel Configuration:
 - a. Traditional Panel 8 inch (203 mm) bottom rail height.
 5. Provide hinged screen; screen frame with spring latch and door closer and charcoal colored fiberglass mesh. Screen frames to:
 - a. Match Frame color
 6. Swinging Door Hardware and Weatherstripping:
 - a. Inswing Door Sill: Low-rise saddle type, extruded aluminum with thermal break.
 - 1) Sill Finish: Mill aluminum
 - 2) Sill Finish: Bronze anodized.
 - b. Weatherstripping: High performance compression weatherstripping on frame stop; six finger sweep weatherstripping on bottom of door.
 - c. Locks: Three-point concealed locking, all bolts operated by single mechanism; keyed deadbolt with interior turn knob placed above handle.
 - 1) Operation: Automatic locking upon closing door.
 - 2) Operation: Manual activation of locking mechanism.
 - 3) Provide U.S. standard key cylinders keyed alike.
 - 4) Provide U.S. standard key cylinders keyed differently.
 - 5) Allow for U.S. standard key cylinder to be furnished by others.
 - d. Handle Set: Provide handles and trim plates both sides; style as follows.
 - 1) Capri
 - e. Provide matching dummy trim on inactive leaves.
 - f. Hinges:
 - 1) Type: Commercial grade hinges.
 - 2) Provide 3 hinges on each leaf up to 96 inches (2440 mm) tall.
 - g. Exposed Hardware Finish:
 - 1) Satin Chrome.
- B. Wood Frame and Sash Members: Select kiln dried wood, water and insect repellent and preservative treated in accordance with WDMA I.S.4; wood members not fastened or adhered to cladding.
 1. Wood Species: Douglas fir.
 2. Windows: Frames laminated veneer lumber (LVL), sash solid wood.
 3. Doors: Frames finger jointed, panel veneer-wrapped.
 4. Frame Corners: Block mitered, stapled, and sealed with silicone.
 5. Sash Corners: Mortised and tenoned, glued, mechanically fastened, and sealed with silicone.
 6. Curved Members: Solid laminated wood bonded with water resistant glue;

interior surfaces veneered and suitable for stained or painted finish.

7. Interior Finish: Factory applied clear satin finish polyurethane top coat over natural wood.
- C. Aluminum Cladding: Aluminum extrusions, 0.055 inch thick on both frame and sash, one piece in any one length; with mitered corners mechanically fastened with corner locks and stainless steel screws; sash cladding applied by sliding onto wood members, not fastened or adhered to wood.
1. Standard Finish: Factory-applied Thermoset siliconized polyester enamel coating complying with AAMA 2604, warranted for 20 years against cracking, checking, peeling, flaking, blistering and loss of adhesion, for 10 years against chalking in excess of number 8 rating in accordance with ASTM D 4214, and for 10 years against color change of more than 5 Delta E units in accordance with ASTM D 2244.
 2. Frame Color:
 - a. Black (128).
 3. Sash Color: Different color as follows:
 - a. Black (128).
 4. Provide matching exterior trim in profiles as indicated on the drawings.

2.6 MATERIALS

- A. Insulated Glazing: Sealed insulating glass; glass of thickness recommended by manufacturer for size and application; rated CBA in accordance with ASTM E 774.
1. Overall Thickness: 5/8 inch (16 mm), except 3/4 inch (19 mm) for doors, sidelights, transoms, geometrics, and circle top windows.
 2. All windows, without Decorative glass or between-the-glass blinds, shall be covered with a protective film applied to the interior and exterior lites to protect against damage and aid in final cleaning.
 3. Doors and Sidelights: Both lites fully tempered, complying with ASTM C 1036 quality Q3 and ASTM C 1048, Kind FT.
 4. Windows, Unless Indicated as Impact Resistant: Inboard and outboard lite annealed, complying with ASTM C 1036 quality Q3.
 5. Type: High Performance Low-E4; Titanium Dioxide and Silicone Dioxide hydrophilic low-emissivity coated with Argon gas blend fill and a translucent protective film.
 - a. Low-Emissivity Coating: Magnetron sputtering vapor deposition (MSVD) type applied to No.2 surface.
 - b. Performance at Center of Glass: NFRC validated:
 - 1) Thermal Transmission: U-value of 0.24.
 - 2) Solar Heat Gain Coefficient (SHGC): 0.39.
 - 3) Visible Light Transmittance (Vtc): 70 percent.
 - 4) Ultraviolet Transmittance (Tuv): 14 percent.
 - 5) Krochmann Damage Weighted Fading Function (Tdw): 31 percent.
- B. Muntins: Muntin bars in air space; muntin width, pattern, and color as selected from manufacturer's full line (Between-the-Glass muntin bars). muntin width as follows:
1. Flat, 5/8 inch (16 mm).
 2. Profiled, 5/8 inch (16 mm)
- C. Interior Trim and Casings: Profiles as indicated on the drawings; same species as interior frame and sash; finger jointing is acceptable for opaque finishing.
- D. Structural Mullion Reinforcement: As indicated on the drawings or required to comply with local code requirements; provide drip cap at horizontal zero mullions.

- E. Metal Trim Accessories: Type and configuration as required to make a complete, weatherproof installation; same finish as exterior frame.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. After installation adjust units for proper operation, without binding, sticking, or racking.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08600
POLYVINYL CHLORIDE (PVC) WINDOWS
DOUBLE HUNG

PART 1 – GENERAL

1.1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in text by basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

L-S-125B Screening, Non-metallic, Insect
DD-G-45-1D Glass, Float or Plate, Sheet

1.1.2 American Architectural Manufacturers Association (AAMA);

AAMA/NWWDA Specifications for PolyVinyl Chloride (PVC) Windows
101/I.S.2-97

Test method for rate of Air Leakage through Exterior windows, Curtain walls and doors

Test method for Structural Performance of Exterior Windows, Curtain walls and doors

Test method for Water Penetration of Exterior windows, Curtain walls and doors by Uniform Static Air Pressure Difference

Specifications for Sealed Insulating Glass Units
AAMA 1503-98 Voluntary test method for Condensation Resistance of Windows, Doors, and Glazed wall sections

AAMA 1503-98 Voluntary test method of Thermal Transmittance of Windows, Doors, and Glazed wall sections

1.1.3 American Architectural Manufacturers Association (AAMA) Certification Program for Vinyl Windows

1.2 SUBMITTALS: Submit to Contracting Officer for Approval.

1.2.1 Certified Test Reports: Submit for air infiltration, water resistance, and uniform loading in accordance with the above referenced specification.

1.2.2 Catalog Data: Shall describe each type of window, hardware, fastener, accessory, operator, screen, and finish. Submit color chart of factory finished color.

1.2.3 Certification of Compliance: Submit certificates that identical windows have been successfully tested and meet the requirements specified herein for air infiltration and water penetration.

- 1.2.4 DELIVERY AND STORAGE: Deliver windows to project site in an undamaged condition. Use care in handling and hoisting during transportation and at the job site. Store windows and components out of contact with the ground, under a watertight covering, so as to prevent damage to the windows. Damaged windows shall be repaired to an “as new” condition as approved. If windows cannot be repaired, a new unit shall be provided.
- 1.2.5 PROTECTION: Finished surfaces shall be protected during shipping and handling using manufacturer’s standard method.
- 1.2.6 CERTIFICATION: Window units shall be tested and certified for performance with the above referenced test methods. All window units shall bear sticker certifying conformance with AAMA/NWWDA 101/I.S.2-97, AAMA 1503-98 and Energy Star.
- 1.3 CERTIFIED FABRICATOR: Windows shall be fabricated by an AAMA Certified Fabricator.
- 1.7 WARRANTIES:
 - 1.7.1 Windows shall be fully warranted against any defects in material or workmanship under normal use and service for a period of 20 years from date of acceptance on commercial projects and lifetime warranty to original homeowner on residential projects. 5 years factory labor included.
 - 1.7.2 PVC finish shall be warranted against chipping, peeling, cracking, or blistering for a period of 20 years from date of acceptance.
 - 1.7.3 Insulated Glass Units shall be fully warranted against visual obstruction resulting from film formation or moisture collection between the interior glass surface, excluding breakage, for a period of 20 years from date of acceptance on commercial projects and lifetime warranty to original homeowner on residential projects. 5 years factory labor included.
 - 1.7.4 Contractor shall provide a written service warranty that clearly spells out how requests for service shall be handled, by whom, under whose responsibility and shall include the time frame for handling these service requests. A labor warranty providing service on the windows shall cover a period of not less than 10 years, and shall be provided in writing. A copy of the product and labor warranty must accompany other applicable warranties and be presented with bid.
- 1.8 PERFORMANCE REQUIREMENTS: Thermopane double Glazed Low E² insulating glass standard on new construction series, Argon filled.
 - 1.8.1 Test for air infiltration shall be in accordance with AAMA/NWWDA 101/I.S.2-97. On a test, the air rate shall not be greater than 0.1 cfm per square foot of sash.
 - 1.8.2 Test for water penetration shall be in accordance with AAMA/NWWDA 101/I.S.2-97 under a static pressure difference of 5.25 psf
 - 1.8.3 Test for Thermal Performance shall be in accordance with AAMA 1503-98 the thermal transmittance due to conduction shall not exceed 0.33 BTU/HR/FT²/F

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- 1.8.4 Test for Condensation Resistance Factor (CRF) shall be in accordance with AAMA 1502.7 the CRF shall not exceed 65.
- 1.8.5 Uniform Load Structural Test, with the window closed and locked, shall be in accordance with AAMA/NWWDA 101/I.S.2-97 On a test at a static pressure difference of 90 psf* with first the exterior (positive) pressure applied and then the interior (negative) pressure applied.
- 1.8.6 Solar Heat Gain Coefficient: 0.61
- 1.8.7 U-Factor: 0.30.

PART 2 – PRODUCTS

- 2.1 MATERIALS: Prime windows shall conform to the requirements of specifications listed above. Provide windows of combinations, types and sizes indicated or specified. Each window shall consist of a unit including sub-frame, frame, sash, hardware, mullions, trim, casing, insect screen, and fasteners complete. Window units shall be prime windows of the type specified. Dimensions shown are minimum.
- 2.1.1 Double-Hung Windows Extruded PVC units, produced from commercial quality virgin powder dry blend UPVC (unpalsticised polyvinyl chloride), conforms to Grade H-R 35** of ASTM D – 4099 from sections in one piece, straight, true and smooth. Provide multi-chambered PVC extruded frames and sash in accordance with the manufacturers standard practice. Make fusion welded frame joints strong enough to develop full strength of members, with a wall thickness of .070 “. Head and jamb members shall have integral screen stops. Make interior horizontal top surfaces of both meeting rails flat and in the same plane. Meeting rails have an integral interlock with two lines of pile weatherstrip provided. Upper and lower sash shall have the same glass size. Sash shall have fusion welded mitered corners with a wall thickness of .070“. **Double Hung window standard is Paradigm Standard Double Hung Window manufactured by Paradigm Window Solutions, Portland, ME 04103.**
- * As tested in 36x60 window unit, 75 psf as tested in 44x60 window unit.
 - * As tested in both 36x60 and 44x60 window units.
- 2.1.1.1 Balance Mechanism (DH): Provide two stainless steel, 1/2" thickness constant force coil spring balances for each sash. Enclose balance springs in rustproof cases, with jamb liner covers, from the top of the bottom sash to the head of the window unit. Balance covers shall be finished to match window frame finish and easily removable for field service. Balances shall also have an interlocking Pivot Bar, for integral frame alignment with sash for keeping window frames straight and true during installation.
- 2.1.1.2 Locking Device (DH): Provide each window over 32 inches in width with two cam-action sweep sash locks, and windows under 30 inches in width with one lock. The lower sash shall have one continuous, integral lift rail at the bottom of the sash. The upper sash shall have a continuous, integral pull-down member on the sash top rail. Provide two tilt latches in the top of each sash for tilting in sash for cleaning. The tilt latches shall be integrally mortised into the sash top rails for a clean appearance.

- 2.1.2 Glass and Glazing: Pilkington Energy Advantage low e with a unit u-value of 0.34, unit SHGC of 0.61, and VLT of 0.57 (with argon). Sash shall be in factory glazed ¾" insulating glass conforming to ASTM-E-774 with TruSeal Swiggle seal spacer, manufactured by TruSeal Industries Inc., Cleveland, OH 44122. Glazing shall be integral glazing type system with architectural back bedded glazing tape and designed to maintain a watertight seal between glass and sash frame.
- 2.1.3 Caulking and Sealing: As specified or recommended by window manufacturer.
- 2.1.4 Weather-stripping: All sash units shall be triple weather-stripped where the sash meet the jamb using silicone treated pile with a mylar center fin bonded to backing.
- 2.1.5 Insect Screening: Fed. Spec. L-S-125, Type II, Class 2 (plastic coated or impregnated fibrous glass yarn) of standard color as approved, mesh 18 X 16
- 2.1.6 Color – selected by Architect from manufacturer's standard colors.
- 2.2 FABRICATION
- 2.2.1 Weathering Surfaces: All frame members shall be multi-chambered PVC extrusions utilizing double wall design without the need for reinforcement. Frame corners shall be fusion welded. Sash members shall be multi-chambered PVC extrusions utilizing double wall design at all glazing locations. Horizontal sash members shall be mitered and fusion welded to vertical sash members.
- 2.2.2 Drips and Weep Holes: Provided as required to return water to the outside.
- 2.2.3 Glazing Thickness: Design glazed windows and rabbets suitable for glass thickness specified above.
- 2.2.4 Fasteners: All fasteners are to be stainless steel type, corrosion resistance. Use flathead, cross-recessed type, exposed head screws with standard threads on windows, trim, and accessories. Screw heads shall finish flush with adjoining surfaces. Self-tapping sheetmetal screws are not acceptable for material more than 1/16 inch in thickness. All sheetmetal screw fasteners shall penetrate into a screw boss consisting of at least three layers of PVC profile for secure fastening and reduce pull out.
- 2.2.5 Provisions for Glazing: Design sash for outside double-glazing and for securing glass with manufacturer's standard glazing systems. Provide glazing channels of adequate size and depth to receive and properly support the glass and glazing accessories.
- 2.2.6 Accessories: Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.
- 2.2.7 Weather-stripping: Provide for ventilating sections of all windows to insure a weathertight seal meeting the infiltration tests specified herein. Use easily replaceable factory applied weather-stripping of manufacturer's stock type, as specified above. Use EPDM covered open cell foam

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weatherstrip for compression contact between the sill and the sash. For sliding surfaces, use silicone treated pile, with a mylar center fin bonded to a plastic-backing strip. Do not use neoprene or polyvinylchloride weather-stripping where they will be exposed to direct sunlight.

- 2.2.8 Finishes: Exposed surfaces shall be factory finished. All windows for each building shall have same finish.
- 2.2.9 Screens: Provide one insect screen for each operable ventilating unit. Design screens to fit closely around entire perimeter of each ventilator or opening, to be rewirable, easily removable from inside building, and interchangeable for same size ventilators of similar type windows, with no exposed fasteners and latches. Provide all guides, stops, clips, bolts and screws as necessary, for a secure and insect tight attachment to window. Provide continuous extruded aluminum screen frame for screen strength, and a center tie bar on taller units to prevent frame compression.
 - 2.2.9.1 Screen Frames: Provide same quality and color finish as the window units. Frames shall have extruded sections not less than .4375" by 1.25" by 0.050 inch thick and shall have removable vinyl splines. hardware, attachment devices, and accessories shall be manufacturer's standard and of same quality, material and finish as hardware of window unit.
 - 2.2.9.2 Screening: Install screening with weave parallel to frame and stretch sufficiently to present a smooth appearance. Conceal edges of screening in the spline channel.

PART 3 – EXECUTION

3.1 INSTALLATION

- 3.1.1 Method of Installation: Install in strict accordance with the window manufacturer's printed instructions and details, except as specified otherwise herein. Install windows without forcing into prepared window openings. Insulate perimeter of window frame with acceptable approved insulation material, as recommended by window manufacturer. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt, and building materials by keeping ventilators tightly closed and locked to frame. Bed screws in sill members, joints at mullions, contacts of windows with sills, built in fins, and sub-frames in approved sealant. Install windows in a manner that will prevent entrance of water. Provide sill angle flashed in sealant at windowsills.
- 3.1.2 Anchors and Fasteners: Make ample provision for securing units to each other, and to adjoining construction. Contractor to prepare window for jamb screen installation.
- 3.1.3 Adjustments after Installation: After installation of windows adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary.
- 3.1.4 Protection: Where surfaces are in contact with, or fastened to wood, or dissimilar materials, the surface shall be protected from dissimilar materials as recommended by the manufacturer.

Surfaces in contact with sealant after installation shall not be coated with any type of protective material.

- 3.2 **CLEANING:** Clean interior and exterior of window units of mortar, plaster, paint spattering spots, sealants, and other foreign matter to present a neat clean appearance and to prevent fouling of weather-stripping surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace with new windows all stained, discolored, or abraded windows that can not be restored to their original condition.

END OF SECTION

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SECTION 08710 - FINISH HARDWARE

PART 1 –GENERAL

1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 DESCRIPTION OF WORK

- A. The work of this section includes, but is not limited to, the following:
 - 1. Providing hardware for all doors, except doors provided with their own hardware.
 - 2. Providing the services of a qualified hardware consultant to prepare detailed schedules of hardware required for the project.

1.03 RELATED WORK

- A. Carefully examine all of the Contrast Documents for requirements which affect the work of this section. Other specifications sections which directly relate to the work of this section include, but are not limited to, the following:
 - 1. Section 08100 – Hollow Metal Doors and Frames; work requiring template coordination, metal astragals for fire-rated doors.
 - 2. Section 08210 – Wood Doors; work requiring template coordination, metal astragals for fire-rated doors.

1.04 INTENT

- A. A major intent of the work of this section is to provide hardware for every door in the project, except as indicated, so that each door functions correctly for its intended use. Provide only hardware that complies with applicable codes and requirements of authorities having jurisdiction including requirements for barrier-free accessibility.

1.05 QUALITY ASSURANCE

- A. Hardware supplier shall have in his employ one or more members of the Door and Hardware Institute to include at least one Certified Architectural Hardware Consultant in good standing, who shall be responsible for preparation of the Finish Hardware Schedule. This Consultant shall be acceptable to the Architect and is to ensure that the intent requirement of this specification is fulfilled, and certify that the work of this section meets or exceeds the requirements specified in this section and the requirements of authorities having jurisdiction.

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- B. Hardware supplier shall warrant and guarantee, in writing, that hardware supplied is free of defective material and workmanship. Supplier shall further warrant and guarantee for a period of one year from Owner's Use and Occupancy that the hardware shall function in a satisfactory manner without binding, collapse, or dislodging of its parts, provide the installation is made to the manufacturer's recommendations.
- C. The hardware supplier shall repair or remedy, without charge, any defect of workmanship or material for which he is responsible hereunder.

1.06 SUBMITTALS

- A. Submit the following in accordance with SECTION 01300-SUBMITTALS:
 - 1. Schedule: Submit to the Architect six (6) copies of the complete hardware schedule within the fourteen (14) days after receipt of contract award. Submit therewith complete catalog cuts and descriptive data of all products specifically scheduled therein. No materials shall be ordered or templates issued until the hardware schedule has been approved by the Architect. Form and detail of hardware schedule shall be in vertical format in conformance to the door and hardware industry standards. All hardware sets shall be clearly cross-referenced to the hardware set numbers listed in the specifications.
 - 2. Samples: If requested, submit to the Architect for approval, a complete line of samples as directed. Samples shall be plainly marked giving hardware number used in this specification, the manufacturer's numbers, types and sizes. The Architect will deliver approved samples to the project site to be stored. Samples will remain with the Architect until delivery of all hardware to the project is complete, after which time they will be turned over to the General Contractor for incorporation into the work.
 - 3. Keying System Submission: Before cylinders are ordered, submit a complete proposed keying system for approval. This should be done after a keying meeting has been held with the owner's representative.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of hardware shall be made to the project by the Hardware Supplier in accordance with the instructions of the General Contractor.
- B. The finish hardware shall be delivered to the jobsite and received there by the General Contractor. The General Contractor shall prepare a locked storage room with adequate shelving, for all hardware. The storage room shall be in a dry, secure area, and shall not include storage of other products by other trades.

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- C. The General Contractor shall furnish the Hardware Supplier with receipts for all hardware and accessory items received, and shall send copies of these receipts to the Architect, if requested.

1.08 REGULATORY REQUIREMENTS

- A. Conform to all applicable codes. Provide all throws, projections, coatings, knurling, opening and closing forces, and other special functions required by State and Local Building Codes, and all applicable Handicap Code requirements.
- B. For fire rated openings, provide hardware complying with NFPA 80 and NFPA 101 without exception. Provide only hardware tested by UL for the type and size of door installed and fire resistance rating required.

1.09 SPECIAL REQUIREMENTS

- A. Hardware Supplier shall determine conditions and materials of all doors and frames for proper application of hardware.
- B. The Hardware Schedule shall list the actual product series numbers. Bidders are required to follow the manufacturers' catalog requirement for the actual size of door closers, brackets and holders. All door opening sizes are as noted on the Door Schedule and all hardware shall be in strict accordance with requirements of height, width, and thickness.

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PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Hinges	McKinney Stanley	Scranton, PA New Britain, CT
Locksets	Schlage Sargent	Colorado Springs, CO New Haven, CT
Exit Devices	Sargent Von Duprin	New Haven, CT Indianapolis, IN
Door Closers	Sargent LCN	New Haven, CT Princeton, IL
Door Stop	Glynn Johnson Ives Rockwood	Indianapolis, IN New Haven, CT Rockwood, PA
Push/Pulls	Rockwood Burns Ives	Rockwood, PA Erie, PA New Haven, CT
Protective Plates	Rockwood Burns Ives	Rockwood, PA Erie, PA New Haven, CT
Thresholds/ Weatherstripping/ Rain Drips	NGP Pemko Reese	Memphis, TN Memphis, TN Rosemount, MN
Silencers	Ives Glynn Johnson Rockwood	New Haven, CT Indianapolis, IN Rockwood, PA

2.02 MATERIALS AND QUALITY

- A. All hardware shall be of the best grade of solid metal entirely free from imperfections manufacturer and finish.
- B. Qualities, weights, and sizes given herein are the minimum that will be accepted. It is the responsibility of the Hardware Supplier to supply the specified size and weight of hardware and the proper function of hardware in each case and to provide UL approved hardware at all fire rated doors.

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- C. Provide, as far as possible, locks of one lock manufacturer and hinges of one hinge manufacturer. Modifications to hardware that are necessary to conform to construction shown or specified shall be provided as required for the specified operation and functional features.

2.03 HARDWARE DESIGNATIONS

- A. All items of hardware are referenced by manufacturer's names and numbers. The manufacturer's names and numbers are used to define the function, design, and the quality of the material to be supplied.

Substitution of products other than those listed shall be submitted to the Architect at least ten (10) days PRIOR to the bid date. The Architect shall be the sole judge of any proposed substitution.

2.04 TEMPLATES

- A. Hardware supplier shall immediately, but not later than three (3) days after approval of his Schedule by the Architect, furnish the General Contractor with complete template information necessary for the fabrication of doors, frames, etc. No templates shall be furnished prior to the approval of the hardware schedule.

2.05 HARDWARE FOR LABELED FIRE DOORS, EXIT DEVICES AND SMOKE DOORS

- A. Hardware shall conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Labeling and listing by UL Building Materials Directory, for class of door being used will be accepted as evidence of conformance to these requirements. Install minimum latch throw as specified on label of individual doors. Provide hardware listed by UL except where heavier materials, larger sizes, or better grades are specified herein under paragraph entitled "Hardware Sets". In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements. Specific hardware requirements of door or frame manufacturers which exceed sized or weights of hardware herein listed shall be provided with no additional charge.

2.06 KEYS AND KEYING

- A. The hardware supplier shall review the specific hardware functions with the Architect and owner at the time of the keying review, to assure the appropriateness of each of the hardware functions. Failure to make this review does not relieve the hardware supplier from providing the proper functions.

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- B. Key System: All cylinders shall be masterkeyed to a new masterkey system.
 - 1. Master keys, Grandmaster Keys: Furnish six (6) keys for each set, if required.
 - 2. Furnish three (3) change keys for each cylinder keyed differently; six (6) change keys for each set keyed alike, and in sets where only (2) cylinders are keyed alike, four (4) change keys will be required.
 - 3. All keying is to be done at the factory to avoid duplication of the new cylinders.
 - 4. Master Keys shall be sent to the Owner by registered mail, return receipt required.
 - 5. Supply a bitting list for all change keys and master keys to the Owner.

2.07 FASTENERS

- A. Manufacture hardware to conform to published templates, generally prepared for machine screw installation.
- B. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Furnish exposed screws to match the hardware finish, or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, except as otherwise indicated.
- C. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard manufactured units of the type specified are available with concealed fasteners. Do not use thru-bolts unless specifically approved by the Architect.
- D. All hardware shall be installed only with fasteners supplied by manufacturers of specific products.

2.08 PACKING AND MARKING

- A. All hardware shall have the required screws, bolts and fastenings necessary for proper installation and shall be wrapped in the same package as the hardware item for which it is intended and shall match finish of hardware with which to be used.
- B. Each package shall be clearly labeled indicating the portion of the work for which it is intended.

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2.09 ENVIROMENTAL CONCERN FOR PACKING

- A. The hardware shipped to the jobsite is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping. If non-biodegradable packing such as plastic, plastic bags or large amounts of Styrofoam is utilized, then the Contractor will be responsible for the disposal of the non-biodegradable packing to a licensed or authorized collector for recycling of the non-degradable packing.

2.10 FINISH HARDWARE DESCRIPTION

- A. Hardware items shall conform to respective specifications and standards and to requirements specified herein.

B. MATERIALS AND FINISH MATERIALS AND FINISHES SHALL BE:

- 1. Interior Butts: 26D
- 2. Door Closers: Sprayed to match hardware finish.
- 3. Exit Devices: 32D
- 4. Kick, Push Plates: 32D
- 5. All other hardware shall be: 26D, or as scheduled.

C. HINGES

- 1. Number of hinges per door, two hinges for doors up to and including five feet in height and an additional hinge for each two and one half feet or fraction thereof.
- 2. Hinges shall be as follows:

Exterior	McKinney	TA2314	4 ½ x 4 ½ NRP
	Stanley	FBB191	4 ½ x 4 ½ NRP
Interior	McKinney	TA2714	4 ½ x 4 ½
	Stanley	FBB179	4 ½ x 4 ½
Elec	McKinney	TA2714-CC4	
	Stanley	CEFBB179	

D. DOOR CLOSERS:

- 1. Door closers shall have fully hydraulic, full rack and pinion action. Cylinder body shall be 1-1/2" in diameter, and double heat treated pinion shall be 11/16" in diameter.
- 2. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

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3. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.
4. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
5. Closer arms (and metal covers when specified) shall have a powder coating finish.
6. Provide drop, mounting plates, where required.
7. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel or track type arms.
8. All door closers shall be adjusted by the installer in accordance with the manufacturer's templates and written instructions. Closers with parallel arms shall have back-check features adjusted prior to installation.
9. Closers shall conform to all applicable code requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.
10. Door closers meeting this specification are as follows:

	LCN	Sargent
Exterior	1461-CUSH	1431 – CPS
	1461-H-CUSH	1431 – CPSH
Interior	1461	1431 – 0
	1461	1431 – P10

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E. EXIT DEVICES:

1. Shall be Von Duprin or Sargent as follows:

Function	Von Duprin	Sargent
A	CD99NL-OP	16-8804
B	CD99EO	16-8810
C	99L	8813ET
D	99L-BE	8815ET
E	99EO-F	12-8810
F	99L-F	12-8813ET
G	99L-F-BE	12-8815ET
H	CD9927EO	16-8710
I	9927L	8713ET
J	9927L-BE	8715ET
K	CD9927EO x LBR	16-PP/PR8710
L	9927L x LBR	PP/PR8713ET
M	9927L-BE x LBR	PP/PR8715ET
N	9927EO-F	12-8710
O	9927L-F	12-8713ET
P	9927L-F-BE	12-8715ET
Q	9927EO-F x LBR	12-PP/PR8710
R	9927L-F x LBR	12-PP/PR8713ET
S	9927L-F-BE x LBR	12PP/PR8715ET
T	CD9927TP	16-8710 x 306
U	EL99L-F	56-12 8813 ETL
V	EL9927EO-F	56-12 8710
W		56-12-8713 ETL

NOTE: Lever design shall match lock trim

F. HEAVY DUTY LEVER HANDLE CYLINDRICAL LOCKS:

1. Locksets for this project shall be heavy duty cylindrical key-in-lever handle type locksets.
2. Locksets shall be 2 3/4" backset with 1/2" throw latchbolt, with deadlocking latch, and a cylindrical housing of steel with a zinc dichromate finish.
3. Locksets shall be fastened by thru-bolts, thru the 3 1/2" diameter inside rose back plate into the threaded studs in the outside rose back plate. Thru-bolts shall be placed in separate bolt holes, thru the door and outside the cylindrical case at 180 deg. from each other.
4. The inside and outside rose scalps shall be 3 1/2" diameter wrought brass or bronze. When assembled, all thru-bolts in the face of the door shall be concealed from view. The lever handles shall be solid cast in the same finish as the rose.

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- 5. The ½' throw latchbolt shall be listed and approved for use by Underwriters Laboratories.
- 6. Strikes shall be curved lip ANSI A115.2 4 7/8" x 1 ¼" wrought brass or bronze.
- 7. The following locksets shall be considered acceptable for this project:

Schlage	"ND" Series	RHO Design
Sargent	10 Line	LL Design

- 8. Lock functions as indicated in the hardware schedule shall be as follows:

Function	Schlage	Sargent
C(Office)	50	05
D(Passage)	10	15
E(Vestibule)	60	16
H(Privacy)	40	65
I(Dummy)	170	93
J	73	54

G. STANDARD DUTY LEVER HANDLE CYLINDRICAL LOCKS:

- 1. Locksets for this project shall be standard duty cylindrical key in lever handle type locksets.
- 2. Locksets shall be 2 ¾" backset with ½" throw latchbolt, with deadlocking latch, and a cylindrical housing of steel with a zinc dichromate finish.
- 3. Locksets shall be fastened by thru bolts, thru the 3 ⅜" diameter inside rose back plate into the threaded studs in the outside rose back plate. Thru bolts shall be placed in separate bolt holes, thru the door and outside the cylindrical case at 180° from each other.
- 4. The inside and outside rose scalps shall be 3 ⅜" diameter wrought brass or bronze. When assembled, all thru bolts in the face of the door shall be concealed from view. The lever handles shall be solid cast in the same finish as the rose.
- 5. Cylinders for lever handle cylindrical locks shall be 6 pin tumbler, solid brass, with nickel silver keys. Two keys shall be supplied with each lock or cylinder. See "Keying Section 2.06B" for masterkey information.
- 6. The ½" throw latchbolt shall be listed and approved for use by Underwriters Laboratories.
- 7. Strikes shall be curved lip ANSI A - 115.2 4 7/8" x 1 ¼" wrought brass or bronze.
- 8. The following locksets shall be considered acceptable for this project:

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Schlage	AL Series	SAT Design
Sargent	6500 Series	KL Design

9. All locksets and cylinders for this project, shall be by the same manufacturer and shall be manufactured in the United States of America by a reputable builders hardware manufacturer.

10. The following is a list of lock functions as indicated under "hardware set:

FUNCTION	SARGENT	SCHLAGE
(1S)	04	80
(2S)	05	53
(3S)	15	10
(4S)	37	70
(5S)	65	40

H. PUSH PLATES, DOOR PULLS, PUSH/PULL BARS:

1. Shall be as manufactured by Rockwood, Burns or Ives.

a. Push plates shall be 4" x 16" x .050 thickness unless otherwise listed in hardware sets.

Rockwood	70 Series
Burns	50 Series
Quality	40 Series

b. Door pulls shall be 1" x 10"

Type A

Rockwood	BF111
Burns	BF26C
Quality	BF163-10"

c. Push/pull bars

Type A (Wide Stile Doors)

Rockwood	BF11147 x T1006 Mounting
Burns	BF26C x 442 x Sim. Mounting as Above
Quality	BF 482 x Sim. Mounting as Above

d. Pulls

Rockwood	BF157
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I. KICK PLATES, ARMOR PLATES, MOP PLATES:

1. Kick plates shall be 8 in. high. Armor plates shall be 34 in. high. Mop plates shall be 4 in. high. All plates shall be 2 in. less the width of door. Plates shall be .050 thickness, bevel 4 edges, screws shall be oval head counter-sunk.

J. STOPS

1. Shall be furnished at all doors. Wherever and opened door or any item of hardware thereon strikes a wall, at 90 degrees. Provide wall bumpers, unless otherwise indicated in hardware sets.
2. Where wall bumpers cannot be effectively used, a floor stop shall be furnished and installed.
3. Provide roller bumpers for each door where two doors interfere with each other in swinging.

Manufacturer	Wall Bumpers	Floor Stops	Roller Bumpers
Rockwood	409	440, 442	456
Ives	407 ½	436B, 438B	470 Series
Glynn Johnson	WB 50XT	FB13, FB14	RB-3

K. THRESHOLDS, WEATHERSTRIP, SEAL:

1. Thresholds shall be as detailed and furnished on all doors where shown on drawings. Thresholds shall be aluminum unless otherwise indicated. Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants".
2. Weatherstripping shall be furnished on all exterior doors unless otherwise indicated.

Product	Pemko	Reese	NGP
Threshold	as detailed		
Brush Seal	45062AP	970	A626A
Auto. Door Bottom	430CR	330	420
Door Sweep	345AV	353	101AV
Set Astragals	351C x 351CP	95 x 95P	140 x 140P
Astragal	357SP	183S	139SP
Rain Drip	346C	R210A	16A

3. Smoke seals for interior smoke doors

Jamb Seal	S88	797W	5050
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Door Sweep 315N 772 200NA

L. FLUSH BOLTS:

1. Shall be self-latching or automatic type at label doors, manual flush bolts at non-label doors.

		Glynn Johnson	Door Controls	Rockwood
Manual	HM	FB6	780	555
	WD	FB6W	790	557
Self Latching	HM	FB51P	845	1845
	WD	FB61P	945	1945
Automatic	HM	FB31P	842	1842
	WD	FB41P	942	1942

M. ELECTRIC STRIKES:

1. Electric strikes equal to HES model #9500.

N. VIEWERS/KNOCKER:

1. Combination viewer/knocker to be equal to Ives Model #U763 x U700

O. MAGNETIC DOOR HOLDER:

1. Electro-magnetic door holder to be equal to Rixson wall mounted unit Model #998

P. EXIT ALARM:

1. Exit alarm code-complaint, battery alarmed panic hardware with deadbolt equal to Detex Model #ECL-230D

PART 3—EXECUTION

3.01. INSPECTION
53 Danforth
Portland, ME

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1. It shall be the general contractors responsibility to inspect all doors openings and doors to determine that each door and door frame has been properly prepared for the required hardware. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

3.02 PREPARATION

1. All doors and frames, requiring field preparation for finish hardware, shall be carefully mortised, drilled for pilot holes, or tapped for machine screws for all items of finish hardware in accordance with the manufacturers templates and instructions.

3.03 INSTALLATION/ADJUSTMENT/LOCATION

1. All materials shall be installed in a workmanlike manner following the manufacture's recommended instructions.
2. Exit Devices shall be carefully installed so as to permit friction free operation of crossbar, touch bar, lever. Latching mechanism shall also operate freely without friction or binding.
3. Door Closers shall be installed in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening indicated on the hardware schedule. Arm position shall be shown on the instruction sheets and required by the finish hardware schedule.
4. The adjustments for all door closers shall be the installer's responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and the latching speed valves, shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the correct delayed action cycle or hydraulic back check valve shall also be adjusted so as the opening cycle. All valves must be properly adjusted at the time of installation. Each door closer has adjustable spring power capable of being adjusted, in the field from size 2 thru 6. It shall be the installers' responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closed.
5. Installation of all other hardware, including locksets, push-pull latches, overhead holders, door stops, plates and other items, shall be carefully coordinated with the hardware schedule and the manufacturer's instruction sheets.
6. Locations for finish hardware shall be in accordance with dimensions listed in the pamphlet "Recommended locations for Builders' Hardware" published by the Door and Hardware Institute.

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3.04 FIELD QUALITY CONTROL

1. Upon completion of the installation of the finish hardware, it shall be the responsibility of the finish hardware supplier to visit the project and to examine the hardware for each door on which he has provided hardware and to verify that all hardware is in proper working order. Should he find items of hardware not operating properly he should make a report, in writing, to the general contractor, advising him of the problem and the measures required to correct the problem.

3.05 PROTECTION

1. All exposed portions of finish hardware shall be carefully protected, by use of cloth, adhesive backed paper or other materials, immediately after installation of the hardware item on the door. The finish shall remain protected until completion of the project. Prior to acceptance of the project by the Architect and owner, the general contractor shall remove the protective material exposing the finish hardware.

3.06 CLEANING

1. It shall be the responsibility of the general contractor to clean all items of finish hardware and to remove any remaining pieces of protective materials and labels.

3.07 INSTRUCTIONS AND TOOLS

1. It shall be the responsibility of the finish hardware supplier to provide installation and repair manuals and adjusting tools, wrenches, etc... for the following operating products.
 - a. Locksets (all types)
 - b. Exit Devices (all types)
 - c. Door Closers

3.08 HARDWARE SETS

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1. Each Hardware Set listed below represents the complete hardware requirements for one opening. (Single Door or Pair of Doors). Furnish the quantities required for each set for the work.

HW 1

Doors #107, 102

Each Leaf Shall Have: Hinges, Lockset (Function B), Door Closer, Door Stop, Silencers

HW 2

Doors #108

Each Leaf Shall Have: Hinges, Exit Device (Function B), Door Closer, Threshold, Weatherstrip, Door Bottom

HW 3

Doors #200, 206, 300, 305, 400, 407, 500, 505, 109

Each Leaf Shall Have: Hinges, Lockset (Function D), Door Closer, Kick Plate, Door Stop, Threshold, Smoke Seals, Door Sweeps

HW 4

Doors #106, 104, 105, 103

Each Leaf Shall Have: Hinges, Lockset (Function A), Door Closer, Door Stop, Threshold, Smoke Seals, Door Sweeps

HW 5

Doors #101

Each Leaf Shall Have: Hinges, Lockset (Function A), Door Closer, Electric Strike, Kick Plate, Door Stop

HW 6

Doors #100

Each Leaf Shall Have: Hinges, Lockset (Function F), Door Closer, Threshold, Weatherstrip, Door Bottom, Kick Plate

HW 7

Doors #110, 111, 112

Each Leaf Shall Have: Cylinders to Suit Lock

HW 8

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Doors #201, 301, 401, 501

Each Leaf to Have: Hinges, Lockset (Function B), Door Closer, Smoke Seal, Door Sweep, Door Stop, Threshold

HW 9

Doors #202, 302, 402, 502

Each Leaf Shall Have: Hinges, Lockset (Function D), Door Closer, Kick Plate, Magnetic Holder, Door Stop, Smoke Seal, Door Sweep, Threshold

HW 10

Doors #207

Each Leaf Shall Have: Hinges, Exit Alarm, Door Closer, Threshold, Weatherstrip, Door Bottom

HW 11

Doors #203, 204, 403, 404

Each Leaf Shall Have: Hinges, Lockset (Function A), Flush Bolts, Door Closer, Door Stops, Smoke Seals, Door Sweeps, Threshold

HW 12

Doors #205, 303, 304, 503

Each Leaf Shall Have: Hinges, Lockset (Function A), Door Closer, Door Stops, Smoke Seals, Door Sweeps, Threshold

HW 13

Doors #504

Each Leaf Shall Have: Hinges, Lockset (Function D), Door Closer, Kick Plate, Door Stop, Smoke Seals, Door Sweeps, Threshold

HW 14

Doors #405

Each Leaf Shall Have: Hinges, Lockset (Function C), Door Closer, Kick Plate, Door Stop, Smoke Seals, Door Sweeps, Threshold

HW 15

Doors #406

Each Leaf Shall Have: Hinges, Lockset (Function H), Door Stop

HW A

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Door Type #01 (Apartment Entrance)

Each Leaf Shall Have: (2) Spring Hinges, (1) Hinge, Lockset (Function J), Smoke Seals, Door Sweep, Door Stop, Viewer/Knocker
(Provide (2) Viewers on H C Apartments)

HW B

Door Type #02 (Bathroom, Bedroom)

Each Leaf Shall Have: Hinges, Lockset (Function 5S), Door Stop

HW C

Door Type #03 (Closet)

Each Leaf Shall Have: Hinges, Lockset (Function 3S), Door Stop

HW D

Door Type #04, 05, 06 (Bifold)

Each Leaf Shall Have: All Hardware by Door Supplier

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Clear tempered glass.

- B. Related Sections:
 - 1. Section 08400 - Entrances and Storefronts: Glazed doors and storefronts.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.

- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM C1036 - Standard Specification for Flat Glass.
 - 2. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 3. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.

- C. Consumer Product Safety Standards for Architectural Glazing. CPSC 16 CFR, Part 1201.

- D. Flat Glass Marketing Association (FGMA):
 - 1. FGMA - Glazing Manual and Glazing Sealing Systems Manual.

1.3 SUBMITTALS

- A. Procedures for submittals.
 - 1. Product Data:
 - a. Glass: Structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
 - b. Glazing compound: Provide chemical, functional, and environmental characteristics, limitations, special application requirements.
 - 2. Samples:
 - a. Glazing: Submit one sample 12 x 12 inches (300 x 300 mm) in size of each type of glazing, illustrating tinting, and finish of glazing materials. Label each sample indicating kind, quality and manufacturer.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Identification: Each unit of tempered glass shall be permanently identified by the manufacturer. The identification shall be etched or ceramic fired on the glass and be visible when the unit is glazed.

- B. Perform Work in accordance with FGMA Glazing Manual.

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- C. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect Products.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install glazing when ambient temperature is less than 40 degrees F.
 - 2. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WARRANTY

- A. Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Include coverage for cracking, breakage, and replacement of same.
 - a. Warranty Period: 1 year.
 - 2. Include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.
 - a. Warranty Period: 10 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Falconer Glass Industries.
 - 2. Libbey-Owens-Ford Company, Toledo, OH (800) 526-6557.
 - 3. PPG Industries, Pittsburgh, PA (412) 434-2858.
 - 4. Viracon, Owatonna, MN (800) 533-2080.

- C. Product options and substitutions. Substitutions: Permitted.

2.2 GLASS MATERIALS

- A. Glass Type 1 - Clear Tempered Insulated Glass Units, Low E: Double pane units of clear tempered glass.
 - 1. Glass Thickness, Inner: 5/16 inch.
 - 2. Glass Thickness, Outer: 5/16 inch.
 - 3. Unit Thickness: 1 inch (25 mm) thick units.
- B. Glass Type 2 - Clear Tempered Glass Units. Single pane units with clear tempered glass.
 - 1. Glass Thickness, Inner: 1/4 inch (6 mm).

2.3 GLAZING COMPOUNDS

- A. Polysulphide Sealant: Two component, chemical curing, non-sagging type; cured Shore A hardness of 15-25.

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B. Silicone Sealant: Single component, chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining; cured Shore A hardness of 15-25.

1. Color: Clear.

C. Acrylic terpolymer compounded especially for glazing; non-hardening, non-staining, and non-bleeding.

2.4 GLAZING ACCESSORIES

A. Setting Blocks: Resilient blocks of 70 to 90 Shore A durometer hardness; compatible with glazing sealant.

B. Spacers: Resilient blocks of 40 to 50 Shore A durometer hardness; self adhesive on one side; compatible with glazing sealant.

C. Filler Rods: Closed cell or jacketed foam rods of polyethylene, butyl, neoprene, polyurethane, or vinyl; compatible with glazing sealant.

D. Joint Cleaners, Primers, and Sealers: As recommended by glazing sealant manufacturer.

E. Gaskets: ASTM D2000, SBC 415 to 3BC 620; extruded or molded neoprene or EPDM, black.

F. Mastic: Non-solvent type adhesive as recommended by mirrored glass manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01700 - Execution Requirements: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

1. Verify that openings for glazing are correctly sized and within tolerance.

2. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

3.3 GLAZING

A. Install glazing from interior only. No exterior glazing permitted. No glazing removal permitted from exterior.

B. Locate setting blocks at quarter points of sill; set in sealant if heel or toe bead is required.

C. Install spacers inside and out except where preshimmed tape or glazing gaskets are to be used.

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- D. Set each piece in a series to other pieces in pattern draw, bow, or other visually perceptible characteristics.
- E. Provide glazing sealants and gaskets as required for particular glazing application. Coordinate with other Sections for material compatibility.
- F. Gaskets:
 - 1. Provide adequate anchorage, particularly for driven-in wedge gaskets.
 - 2. Miter and weld ends of channel gaskets at corners to provide continuous gaskets.
 - 3. Seal face gaskets at corners with sealant to close opening and prevent withdrawal of gaskets from corners.
- G. Do not leave voids in glazing channels except as specifically indicated or recommended by glass manufacturer. Force sealant into channel to eliminate voids. Tool exposed surfaces to slight wash away from joint. Trim and clean promptly.
- H. Do not allow sealant to close weeps of aluminum framing.
- I. Provide filler rod where sealants are used in the following locations:
 - 1. Head and jamb channels.
 - 2. Colored glass over 75 united inches in size.
 - 3. Clear glass over 125 united inches in size.

3.4 CONSTRUCTION

- A. Interface with Other Work: Coordinate glazing with installation of entrances and storefronts specified in Section 08400.

3.5 FIELD QUALITY CONTROL

- A. Inspect preparation and installation of glass.

3.6 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

3.8 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

SECTION 09250

GYPSUM BOARD

1. GENERAL

1.1 REFERENCES:

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. NOTE: Selection of Finish colors and patterns in overall color scheme to be made by Architect. Contractor to notify Architect prior to commencing Gypsum Board work, to allow adequate time for color selections, Owner's approval and material ordering lead time.

1.2 DESCRIPTION OF WORK: The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:

- A. Drywall installation as required by Drawings and noted in these Specifications.
- B. Taping and finishing all walls and ceilings, except where other kind of finish is specified.

2. PRODUCTS

2.1 Acceptable Manufactures

- American Gypsum
- Atlantic Group Limited
- Celotix Corporation
- Continental Gypsum Company
- James Hardie Gypsum
- Lafarge Gypsum
- United States Gypsum Company

2.2 NOTE: GWB types are shown as U.S.G. brand names "Sheetrock", "Firecode", "Firecode C", "M.R. Board" and "Shaftwall". Substitutions must have equal U.L. and STC ratings. See Drawings for Specific assembly.

2.3 EXTERIOR & INTERIOR WALLS & CEILINGS: See rated & non rated assemblies and wall types on the drawings. Note: Exterior Gypsum Ceilings to be "Aqua-Tough" Interior Panels 5/8 inch thickness installed per manufactures recommendations with screw application.

2.4 NOTE: Type M.R. in bathrooms, walls and ceiling.

2.5 RESILIENT CHANNEL: USG-RC-1

2.6 USG Drywall Suspension System.

2.7 Corner Bead _____

3. EXECUTION

3.1 THE DRYWALL CONTRACTOR shall inspect all areas affected by his work to ascertain that all work is complete and has been accepted. Defective installations shall be corrected before finished surfaces are painted or sprayed with acoustical material.

3.2 DRYWALL INSTALLATION. Install drywall as shown on plans, noted in the UL Specifications, and as set forth in U.S.G. Handbook. Installation of non-UL rated drywall assemblies on steel studs shall comply with the following minimum requirements:

A. Spacing for attachment members shall not exceed 24" o.c. for walls and 16" o.c. for ceilings. All drywall shall be screwed with approved drywall screws made specifically for the purpose and of length adequate for wall types. On walls, screws shall not be placed more than 16" apart for 16" o.c. framing or 12" apart for 24" o.c. framing. Screw all edges 12" o.c. maximum. See Structural Drawings S3.2 and S3.3 for shear walls sheathing attachment.

B. The drywall contractor may use a few drywall nails to temporarily secure a sheet of drywall before securing with drywall screws. In this event, the drywall nails must be countersunk prior to taping. Corner beads shall be used on all corners and casing beads used whenever Gypsum Board abuts dissimilar material. Caulking to also be applied at these junctions. At all party and unit/corridor walls, Gypsum Board to be set in caulking (for sound).

C. Drywall shall be laid vertically or horizontally. No tapered joints at floor base. See Structural Drawings for shear walls.

D. Gypsum Sheathing Application

Apply 24" wide sheathing horizontally with tongue edge up. Install supplementary bracing as required by applicable code. Fasten sheathing with nails spaced 8" o.c. along each stud.

Apply 48" wide sheathing vertically with bottom edge bearing on foundation or subfloor. Install supplementary bracing (and adhesive) as required by applicable code. Fasten sheathing to studs and plates with nails 8" o.c.

E. Exterior Ceilings and Soffits

Apply SHEETROCK Brand Exterior Gypsum Ceiling Board (perpendicular to supports) (parallel to supports) with end joints over supports and with 1/16" to 1/8" space between butted ends of boards. Use maximum practical lengths to minimize end joints. Fasten boards to supports with screws spaced 12" o.c. or nails spaced 8" o.c. Where specified,

cover joints with wood battens securely fastened to framing. Finish joints, trim and fasteners with SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound applied according to directions.

F. Joint System

Prefill Application

- a. Mix SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound according to directions on bag. Do not overmix, or use extremely cold water or cold joint compound.
- b. Prefill all "V" grooves formed by abutting tapered eased edges of SHEETROCK Brand Gypsum Panels, SW Edge, with SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound using a flexible 5" or 6" joint finishing knife or Ames Pre-Fill Tool. Fill "V" joint flush and wipe off excess compound beyond the "V" groove, leaving a clear depression to receive tape. Allow prefill to harden prior to the next application (tape or embedding coat).

SHEETROCK Brand Joint Tape

- a. Mix joint compound in strict accordance with manufacturer's recommendations.
- b. Apply joint compound in a thin uniform layer to all joints and angles to be reinforced. Immediately apply SHEETROCK Brand Joint Tape centered over joint and seated into compound. Sufficient compound—approx. 1/64" to 1/32"—must remain under the tape to provide proper bond. Follow immediately with a thin skim coat to embed tape, but not to function as a second coat. Fold and embed tape properly in all interior angles to provide a true angle. The tape or embedding coat must be thoroughly dry prior to application of second coat. (Exception: DURABOND Setting-Type and EASY SAND Lightweight Setting-Type Joint Compounds need only have hardened prior to application of next coat.)
- c. Apply second coat of joint compound over embedding coat, filling panel taper flush with surface; cover tape and feather out at least 2" beyond first coat. On joints with no taper, cover the tape and feather out at least 4" on either side of tape. Allow second coat to dry thoroughly prior to application of finish coat. (Exception: DURABOND Setting-Type and EASY SAND Lightweight Setting-Type Joint Compounds need only have hardened prior to second coat application.)
- d. Spread finish coat evenly over and extend at least 2" beyond second coat on all joints and feather to a smooth uniform finish. Do not allow finished joint to protrude beyond plane of the surface. Where necessary, sand lightly between coats and following the final application of compound to provide a smooth surface ready for decoration. When sanding, take care not to roughen face paper.

SHEETROCK Brand Fiberglass Drywall Tape

- a. Mix joint compound in strict accordance with manufacturer's recommendations.
- b. Center and apply SHEETROCK Brand Fiberglass Drywall Tape directly over joint, pressing tape firmly so that it adheres evenly to surface. To eliminate wrinkles and ensure maximum bond, press entire length of taper with drywall knife. Avoid overlapping tape at intersections. Cut tape with drywall knife.
- c. Cover with a layer of SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound, forcing compound through the tape with

a drywall knife/trowel to completely fill and level the joint. Failure to completely fill the joint may result in cracking. Let dry and sand lightly as required.

- d. Apply second coat of SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound or SHEETROCK Brand Drying-Type Joint Compound (powder or ready mixed), feathering approximately 2" beyond first coat. Let dry and sand lightly as required.

Finishing Fasteners

- a. Apply a setting-type, all-purpose, or lightweight all-purpose compound to fastener depressions as the first coat. Follow with a minimum of two additional coats of topping or all-purpose compound, leaving all depressions level with the surface. (Exception: Setting-type and lightweight all-purpose joint compounds need only one additional coat.)

G. SHEETROCK Brand Paper Faced Drywall Metal Bead and Trim

Application and Finishing

- a. Apply compound to both sides of corner, extending 2" on each side for outer corners, 1-1/2" for inside corners. Cut bead to desired length; align tightly to ceiling and press firmly with fingers along length of corner to set. Do not bend bead. Run taping knife over corner at a 45° angle with even pressure. Remove excess compound using knife to eliminate air bubbles under paper. Allow to dry.
- b. For outer corners, apply another coat of compound to both sides, feathering out 5"-6" on each side. Let dry; sand lightly as necessary. For inner corners, apply fill coat to one side, feathering out 1". Let dry. Apply fill coat to other side using same procedure. Let dry. Sand lightly where necessary.
- c. For outer corner, apply finishing coat, feathering 8" from nose of bead. Draw knife along one side of bead with one edge resting on nose of bead and other on surface of wallboard. Repeat for other side. Let dry. Sand and prime. For inner corners, apply finishing coat to one side, feathering 1" past previous coat. Let dry. Apply finishing coat to other side. Let dry. Sand and prime.

H. Other Bead and Trim

Installation

- a. Reinforce all vertical and horizontal exterior corners with corner bead fastened with nails or 9/16" galvanized staples 9" o.c. on both flanges along entire length of bead.
- b. Where partition or ceiling terminates against masonry or other dissimilar material, apply metal trim over gypsum panel edge and fasten with nails or galvanized staples 9" o.c.

Finishing

- a. Apply first coat to all bead and trim and properly feather out from ground to plane of surface. Compound must thoroughly dry prior to application of second coat (exception: SHEETROCK Brand Setting-Type [DURABOND] and Lightweight Setting-Type [EASY SAND] Joint Compounds need only have hardened prior to application of next coat.)
- b. Apply second coat in same manner as first coat, extending compound slightly beyond face of panel. Compound must be thoroughly dry prior to application of finish coat (exception: Setting-Type joint compounds need only have hardened prior to application of next coat.)

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- c. Apply finish coat to all bead and trim, extending compound slightly beyond the second coat and properly feathering from ground to plane or surface (exception: Only two coats of SHEETROCK Brand Setting-Type [DURABOND] or Lightweight Setting-Type [EASY SAND] Joint Compound or SHEETROCK Brand Lightweight All Purpose Joint Compound Ready Mixed [PLUS 3] are needed.) When dry, sand finish as necessary to provide a flat smooth surface ready for decoration. When sanding, take care not to roughen face paper.

Note: Gypsum board to be installed behind all tubs and shower units which results in double gypsum board on some bathroom walls. See bathroom drawing sheet.

I. Ceiling suspension system:

1. Space hangers not over 48 in. o.c. in direction of main runner channels, and within 6 in. of ends of main runner runs and of boundary walls, structural steel, partitions, and similar interruptions of ceiling continuity. Install additional hangers at ends of each suspension member and at ceiling equipment not separately suspended, 6 in. from vertical surfaces. Do not splay wires more than 5 in. in a 4 ft. vertical drop. Wrap wire a minimum of three times horizontally, turning ends upward.
2. Attach hangers directly to ceiling structure, or to supplementary framing members supplied and installed under this section. Hangers may not be suspended from mechanical or electrical equipment such as ductwork, conduit or piping.
3. Install 1-1/2 in. main runner channels spaced not over 48 in. o.c. within 6 in. of wall. Position channels for proper ceiling height, level and secure, with hanger wire saddle-tied along channel. Provide 1 in. clearance between runners and abutting walls and partitions. At channel splices, interlock flanges, overlap ends 12 in., and secure each end with double-strand 18 ga. tie wire.
4. Erect 3/4 in. metal furring channels at right angles to main runner channels or main support members. Space furring not over 16 in. o.c., and within 6 in. of wall. Provide 1 in. clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to supports with double strand 18 ga. tie wire. At splices, next furring channels at least 8 double-strand 18 ga. tie wire.
5. At openings interrupting main or furring channels, install additional cross-reinforcing as required, to restore lateral stability of ceiling framing system.
6. Finished installations shall be level to within 1/4 in. in 10 ft.

3.3 ON SURFACES TO BE PAINTED: tape and cement all joints and screw locations with three coats of compound, then sand to smooth finish, acceptable to paint.

3.4 DURING WORK PROGRESS, remove all excess materials and debris resulting from operations, which may disrupt the work of other trades, and after completion leave the premises broom clean.

END OF SECTION

SECTION 09300

TILE

1. GENERAL

1.1 REFERENCES

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. Cast-in-Place Concrete: Section 03300
- C. Joint Sealants: Section 07900
- D. Gypsum Drywall: Section 09250
- E. American National Standards Institute (ANSI)

1.2 DESCRIPTION OF WORK: Extent of Tile Work is shown on the drawings.

1.3 QUALITY ASSURANCE

- A. Tile materials and installation shall comply with recommendations of Tile Council of America Handbook for Tile Installation, and ANSI Standard Specification Series A108, A118, A136, and A137, as applicable.
- B. The use of asbestos shall not be permitted in any product specified in this Section.

1.4 SUBMITTALS

- A. Submittals under this Section shall include manufacturers' data and installation instructions on all specified products; manufacturer's standard color range; and full size tile of each type and color of tile specified.
- B. At job completion, supply two copies of manufacturers' maintenance instructions; and 1 percent minimum of all types and colors of material provided under this Section as replacement stock, neatly packaged and clearly labeled.

2. PRODUCTS

2.1 TILE

- A. Manufactured by Daltile, style "Terra Antica" Porcelain tile, size 12" x 12" , ¼ inch thick, cove outcorner, SS36C9T 6" x 12", color to be selected by Architect, located on 1st floor lobby areas and elevator lobbies, see plans.

- B. Provide all matching trim necessary for finished installation, including stretcher pieces, cove bases, square inside corners, bullnose trim at outer corners and where tilework projects from jambs.
- C. Where floor tile terminates against dissimilar flooring material, provide aluminum threshold beveled as required for field conditions, centered under door or within frame, unless noted otherwise.
- D. Colors to be chosen by Architect from manufacturer's full range of colors.

2.2 SETTING AND GROUTING MATERIALS

- A. Volatile Organic Compound (VOC) emissions from adhesives and sealants must not exceed VOC limits of South Coast Air Quality Management District Rule #1168 AND sealants used as fillers must meet the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51
- B. Factory-mixed materials shall be by Boiardi Elastiment, C-Cure, H. B. Fuller, Laticrete, L&M Surco, Upco, or other manufacturer approved by tile manufacturer. Setting bed, grout, and additive materials shall be by same manufacturer.
- C. Tile shall be thin-set, using one of following:
 - 1. Dry-set mortar: factory mixture of portland cement, sand, and water-retentive additives, mixed with water in field, complying with ANSI A118.1, as recommended by manufacturer for particular type of tile used.
 - 2. Latex-portland cement mortar: factory mixture of portland cement and sand, with powdered PVA polymer or liquid PVA, styrene butadiene, or acrylic latex admixture added in field, complying with ANSI A118.4.
- D. Grout tile with factory-formulated portland cement, dry-set, or latex portland cement grout (either acrylic or styrene butadiene powder or liquid additive), complying with ANSI 118.6. On-job sand-portland cement mixture may also be used, complying with ANSI A108.1. Color to be selected from manufacturer's standard range.

2.3 Concrete Sealer: Provide manufacturer's recommended sealer compatible with concrete floor.

3. EXECUTION

3.1 INSTALLATION

- A. Provide floor protection to existing buildings when renovating or adding on.
- B. Before beginning installation inspect surfaces to receive tile for excessive dampness, irregularity, loose material, oily or waxy areas impeding adhesion, or other conditions which would prevent proper installation. Verify that surfaces are flat to within 1/4 in. in 10 ft., with no vertical irregularities exceeding 1/16 in. high. Seal concrete floors if recommended or

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approved by the manufacturer. Broom clean substrate before beginning installation. Commencement of work constitutes acceptance of floor condition.

- C. Expansion joint location and construction shall conform to drawings and ANSI A108, Paragraph A-3.4, including requirement for joints over cold-pour, saw-cut, control, and structural joints. Sealant materials and installation procedures are specified in Section 07900, Joint Sealants.
- D. Mix dry-set and latex-portland cement mortars in accordance with manufacturer's instructions.
 - 1. For dry-set mortars, add dry ingredients to water. Mix thoroughly and allow mortar to stand 15 minutes, then re-mix. Do not add water, additional mortar, or other ingredients after slaking period.
 - 2. For latex-portland cement mortars, use brand of pre-packed dry mortar mix specified by latex manufacturer. Add dry mortar to correct amount of latex, as specified by manufacturer, and mix thoroughly to obtain complete and visually uniform wetting of dry mortar mix. When directions require dilution of latex with water, this shall be done with adequate mixing before dry mortar mix is added. Slake for 15 minutes and re-mix before using.
 - 3. Spread mortar with notched trowel of type recommended by manufacturer. Setting compound shall be of such consistency that ridges formed by trowel shall not flow or slump. Cover surface uniformly without bare spots. Apply setting compound only to as much area as can be covered with tile before mortar skins over. Remove dried mortar, and apply new material. Protect mortar from foot traffic and dirt.
- E. Press individual tiles or tile sheets into mortar, maintaining accurate joint alignment and spacing. Beat in tile with rubber-faced block to obtain maximum contact between tile back and setting compound. Remove paper and glue from paper-mounted ceramic mosaics before mortar is firmly set, and align individual tiles. Immediately remove setting compound from faces or front edges of tiles.
- F. Center and balance tile areas. Smooth cut edges. Jagged or flaked edges or split tiles are prohibited. Cuts shall be no smaller than half size, located on outer edges of field. Make corners of all tile flush and level with corners of adjacent tile, with due allowance to tolerances for tile as specified in ANSI A137.1.
- G. Keep all joint lines straight and of even width, including miters. Finish floor and wall areas shall be flat and plumb, with no variations exceeding 1/4 in. in 10 ft. from required plane.
- H. Allow sufficient time for setting compound to cure before grouting, 48 hours minimum. Remove spacers or ropes from joints. Using a grout of type and mix specified under PRODUCTS, force maximum amount of grout into joints. Clean joints of cushion edge tile to depth of cushion.
- I. Fill joints of square-edge tile flush with surface. Fill all gaps and skips. Do not permit mortar to show through grouted joints. Finished grout shall be uniform in color, smooth and without voids, pinholes or low spots.

- J. After mortar joints have cured, clean unglazed tile with proprietary acidic preparation such as Sure-Klean Grout and Tile Cleaner, in strict accordance with manufacturer's instructions. Apply solutions to test patches before cleaning.

END OF SECTION

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SECTION 09510

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Acoustical ceiling panels.
 - 2. Exposed grid suspension system.
 - 3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.
- B. Related Sections:
 - 1. Section 01350, Special Environmental Requirements
 - 2. Section 09250 - Gypsum Board
 - 3. Section 09120 - Suspension System Framing and Furring for Plaster and Gypsum Board Assemblies
 - 4. Division 15 Sections - Mechanical Work
 - 5. Division 16 Sections - Electrical Work
- C. Alternates
 - 1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products which have not been approved by Addenda, the specified products shall be provided without additional compensation.
 - 2. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 - 4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - 7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 8. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
 - 9. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.

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10. ASTM E 1264 Classification for Acoustical Ceiling Products.
 11. ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
 12. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 13. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.
- B. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.
- B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
- C. Shop Drawings: Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.
- D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
- E. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
- B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
 1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
 - a. Flame Spread: 25 or less
 - b. Smoke Developed: 50 or less
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.7 PROJECT CONDITIONS

- A. Space Enclosure:

All ceiling products and suspension systems must be installed and maintained in accordance with Armstrong written installation instructions for that product in effect at the time of installation and best industry practice. Prior to installation, the ceiling product must be kept clean and dry, in an environment that is between 32oF (0o C) and 120oF (49o C) and not subject to Abnormal Conditions.

Abnormal conditions include exposure to chemical fumes, vibrations, moisture from conditions such as building leaks or condensation, excessive humidity, or excessive dirt or dust buildup.

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HumiGuard Plus Ceilings: Installation of the products shall be carried out where the temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry. The ceilings must be maintained to avoid excessive dirt or dust buildup that would provide a medium for microbial growth on ceiling panels. Microbial protection does not extend beyond the treated surface as received from the factory, and does not protect other materials that contact the treated surface such as supported insulation materials.

1.8 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.
 - 2. Grid System: Rusting and manufacturer's defects
 - 3. Acoustical Panels with BioBlock Plus or designated as inherently resistive to the growth of micro-organisms installed with Armstrong suspension systems: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.
- B. Warranty Period Humiguard:
 - 1. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is thirty (30) years from date of substantial completion.
- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

Part 2-PRODUCTS

2.1 MANUFACTURERS

A. Ceiling Panels:

- 1. Armstrong World Industries, Inc.

2.2.0 ACOUSTICAL CEILING UNITS

A. Acoustical Panels Type ACT-1:

- 1. Surface Texture: Medium
- 2. Composition: Mineral Fiber
- 3. Color: White
- 4. Size: 24in X 24in X 5/8in
- 5. Edge Profile: Beveled Tegral for interface with Suprafine XL 9/16" Exposed Tee.
- 6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, 0.55.
- 7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, 35

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8. Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton N/A.
9. Emissions Testing: Section 01350 Protocol, < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
10. Flame Spread: ASTM E 1264; Class A (UL)
11. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.85.
12. Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
13. Antimicrobial Protection: BioBlock Plus - Resistance against the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.
14. Acceptable Product: Fine Fissured, 1734 as manufactured by Armstrong World Industries.

2.3.0 SUSPENSION SYSTEMS

- A. Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).
 1. Structural Classification: ASTM C 635 Intermediate Duty.
 2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
 3. Acceptable Product: Suprafine XL 9/16" Exposed Tee as manufactured by Armstrong World Industries, Inc.
- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least three design load, but not less than 12 gauge.
- D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.
- E. Accessories

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

- A. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

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- B. Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.
- C. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.
- D. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.
- E. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09650

RESILIENT FLOORING AND VINYL BASE

1. GENERAL:

1.1 REFERENCES: Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.

1.2 DESCRIPTION OF WORK

A. SCOPE: The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:

B. Extent of Vinyl Composition Tile Flooring and Vinyl Base as shown on the drawings.

1.3 SUBMITTALS

A. Submittals under this Section shall include:

1. Manufacturers' data and installation instructions on all specified products;
2. Color range;
3. Samples of vinyl composition tile flooring and vinyl base
4. Shop drawings indicating materials, pattern number, tile number, and manufacturer.

2. PRODUCTS:

2.1 VINYL COMPOSITION TILE: Shall be “Mannington Brushworks” 1/8” gauge.

2.2 VINYL BASE MOLDING – shall be Johnsonite Cover Base 4”, 1/8 gauge. Submit color for Architect’s approval. See Architectural Drawings for locations.

2.3 ADHESIVES: shall be as recommended by the manufacturer.

Volatile Organic Compound (VOC) emissions from adhesives and sealants must not exceed VOC limits of South Coast Air Quality Management District Rule #1168 AND sealants used as fillers must meet the requirements of the Bay Area AirQualityManagementDistrictRegulation8,Rule51

3. EXECUTION:

- 3.1 INSTALLATION shall be done by skilled craftsmen using the adhesives recommended by the manufacturer and in accordance with the manufacturer's instructions. The flooring contractor shall examine the subfloors and report all defects which have to be corrected before the application of flooring starts. Concrete floors shall be smooth, free of any grooves and depressions, and brushed clean of any foreign matter. Install all resilient flooring with joints tight, floor true, level and even with no bubbles, pops or other visible defects. Cut to and around all permanent fixtures keeping vinyl tight to fixtures. Vinyl also shall be installed under fixtures such as baseboard heating, and glued tight. Wrap vinyl base around exterior corners.
- 3.2 DURING WORK PROGRESS, remove all excess materials, extraneous mastic, and debris resulting from operations, which may disrupt the work of other trades. The Contractor shall be responsible for keeping the floors clean, unstained and undamaged until the final completion of the building.

END OF SECTION

SECTION 09680

CARPET

1. GENERAL

1.1 REFERENCES: Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.

1.2 DESCRIPTION OF WORK:

- A. Installation of "Roberts Strips" for carpeting.
- B. Installation of Carpeting as shown on plans or noted in these Specifications.

1.3 QUALITY ASSURANCE

- A. Finished installation shall comply with fire test specified in applicable Building Code.
- B. Architect/Engineer shall review first finished space for workmanship. Accepted space shall serve as project standard.
- C. All carpets will meet UM44D
- D. Carpet to meet CRI Low Emission Label Standard.

1.4 SUBMITTALS

- A. Submittals under this Section shall include:
 - 1. Manufacturer's specifications and installation instructions on all specified products.
 - 2. Samples: one piece, 18" x 18", of each color and type of carpet provided.
- B. Deliver to Owner, neatly packaged and labeled, all usable carpet scraps over 2 sq. ft. or 8 in. in least dimensions: 1 percent of each type and color of carpet provided, in 12 ft. wide rolls; and 1 percent of each type of edge strip provided, in standard lengths.
- C. Provide written maintenance program.

2. PRODUCTS

Floor areas designated for carpeting shall be covered with material meeting following specifications:

- A. Construction: Tufted level loop or textured loop. Continuous filament nylon with anti-microbial processing, permanent static control, 3.0 K.V. meeting test method AATCC 134-1969.

- B. Dye Method: 1st Choice: 100% solution dyed; 2nd Choice: At least 70% solution dyed, remaining to be yarn dyed.
- C. Gauge: Minimum 1/8.
- D. Stitches per inch: Minimum 9.
- E. Face Weight: Minimum 28 oz.
- F. Pile Height: 3/16 inch minimum.
- G. Primary Backing: 100% Polypropylene.
- H. Secondary Backing: Action back or unitary back with 20 lb. Tuft lock if floors are rough, contain moisture, or are exposed to concentrated same directional traffic.
- J. All carpet must meet UM44d. SEE MSHA'S GREEN BUILDING STANDARDS FOR FURTHER REQUIREMENTS.

2.1 CARPET shall be as follows:

- A. Units - Shaw Potential III 26oz on classic back, see specification on page 5 of this section.
- B. Common Areas - Shaw Scholar II 28oz on unitary backing, see specification on page 6 of this section.

2.2 CARPET must carry stamp confirming conformance to above and submitted to Architect for approval.

2.3 Volatile Organic Compound (VOC) emissions from adhesives and sealants must not exceed VOC limits of South Coast Air Quality Management District Rule #1168 AND sealants used as fillers must meet the requirements of the Bay Area.
AirQualityManagementDistrictRegulation8,Rule51

2.4 Carpet systems must meet or exceed Carpet & Rug Institute (CRI) Green Label Indoor Air Quality Test Program.

3. EXECUTION:

3.1 JOB CONDITIONS:

- A. Examine Subfloor for dampness, loose material, excessive irregularity, oily or waxy areas impeding adhesion, or other conditions which would prevent proper installation. Verify that no incompatible curing compound has been used on newly-poured concrete. Commencement of work constitutes acceptance of subfloor.
- B. Allow newly-poured concrete to cure as long as possible before installation of carpet, a minimum of 7 days, 28 days preferable. Perform bond and moisture tests in accordance with carpet manufacturer's instructions, to verify that concrete is sufficiently cured, dried and then sealed.

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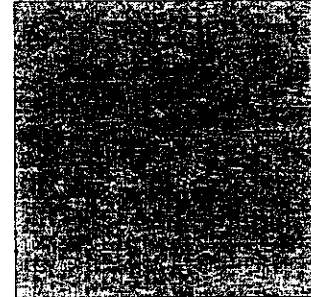
- C. Broom-clean or vacuum surfaces to receive carpet, before beginning installation. Apply primer-sealer to plywood or concrete sub-floor, if recommended by carpet or adhesive manufacturer.
- D. Before proceeding with complete installation of carpet, install a representative sample area of each type of carpet provided over each type of substrate, to test for compatibility of adhesive to substrate at glue-down installation, and verify general appearance of finished installation. If sample is securely bonded after 72 hours, final installation may proceed.

3.2 INSTALLATION

- A. Install carpet by direct glue-down unless noted otherwise. Install Entry carpet in accordance with the manufacturer's recommendations.
- B. Field measure each space to receive carpet. Do not scale drawings. Before beginning installation, verify that floor telephone and electrical outlets have been installed.
- C. At glue-down installations, apply manufacturer's recommended adhesive in accordance with manufacturer's instructions, observing proper safety precautions. Apply adhesive in a uniform film with a steel trowel and proper size notches for correct coverage. Avoid applying excess quantities so that adhesive bleeds through joints. Apply adhesive only in area which dries or films over. Avoid soiling adjacent walls and floors with adhesive. Promptly remove any spillage. Broom or roll carpet to remove air bubbles and insure bond.
- D. Install carpet wall to wall unless noted otherwise. Fit carpet neatly into breaks, recesses, closets and alcoves, against bases, around pipes and penetrations, under saddles and thresholds, and around permanent cabinets and equipment. Install Schluter metal strip wherever carpet edge does not abut vertical surface, of appropriate configuration to provide smooth transition to adjacent material. Allowable variation from level for finished installation: 1/4 in. from level in any direction when tested with 10 ft. straight-edge.
- E. Seams shall be flat, free from puckering, without twists, free from frayed edges. Coat edges with seam adhesive at glue-down installation, hot-melt tape at cushion, and as recommended by manufacturer. Patterns at seams shall match exactly. Cut raw edges on a slight angle with surface yarns extending outward over backing material so that surface yarns mingle neatly at seams.
- F. Seams shall be in accordance with approved seaming shop drawings and samples. No seams will be accepted perpendicular to openings such as doors, stairs, and entries. Seams at doors shall be centered directly under doors. Seam at corridor change of direction shall follow inner wall line across corridor.
- G. Provide removable cut-out pieces over flush equipment requiring access such as telephone and power outlets. Cut-outs shall be neatly edged and securely held in place with double-edged tape all around.

- H. Remove adhesive spots from carpet immediately with solvent. Trim loose pieces of face yarn with sharp scissors. Upon completion of installation, remove rubbish, selvages, wrapping paper, small scraps, etc., and vacuum with commercial-type vacuum cleaner. Remove soiling, by shampoo if necessary. Cover finished work with kraft paper or polyethylene until Substantial Completion.
- I. At completion of job, remove protective paper, vacuum or shampoo again if required.

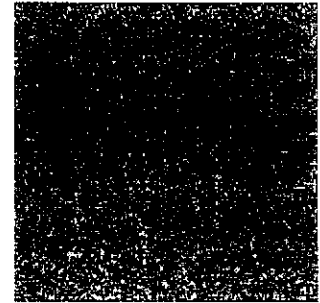
style number	5A068
color name	PROMISING
color number	88222
product type	broadloom
size	broadloom 12 foot
construction	level loop
dye method	solution dyed
fiber product	100% Solution Q Solution Dyed Nylon
protective treatment(s)	ssp® shaw soil protection
primary backing	POLYPROPYLENE
secondary backing	<u>classicbac™</u>
gauge	1/8
face weight	26 oz.
stitches per inch	08.83
finished pile thickness	0.128
average density	7,313 ozs./yd3
pattern repeat	
flammability	ASTM E-648 flooring radiant panel class I, ASTM E-662 NBS smoke chamber less than 450
electrostatic propensity	less than 3.5 KV, permanent conductive filament
warranty	<u>ten year commercial limited warranty for solution q sd nylon, ten year commercial limited warranty for classicbac backing system</u>
collection	
coordinating products	
recommended installation	direct glue
post consumer recycled content	0
post industrial recycled content	0
green label certification #	15488878
green label plus certification #	GLP8472
testing documents:	<u>view testing documents</u>



Specifications are subject to nominal manufacturing variances. Material supply and/or manufacturing processes may necessitate specification changes without notice.

Scholar II Uni

style number	60514
color name	FINAL EXAM
color number	14300
product type	broadloom, performance broadloom
size	broadloom 12 foot
construction	pattern loop
dye method	solution dyed
fiber product	<u>100% eco*solution q (r) premium branded nylon</u>
protective treatment(s)	ssp® shaw soil protection, antistatic
primary backing	SYNTHETIC
secondary backing	<u>unitary</u>
gauge	1/10
face weight	28 oz.
stitches per inch	09.66
finished pile thickness	0.144
average density	7,000 ozs./yd3
pattern repeat	
flammability	ASTM E-648 flooring radiant panel class I, ASTM E-662 NBS smoke chamber less than 450
electrostatic propensity	less than 3.5 KV, permanent conductive filament
warranty	<u>lifetime commercial limited warranty for ecosolution q sd nylon, ten year commercial limited warranty for unitary backing system</u>
collection	
coordinating products	
recommended installation	
post consumer recycled content	0
post industrial recycled content	11.2
green label certification #	23252271
green label plus certification #	GLP2271
testing documents:	<u>view testing documents</u>



Specifications are subject to nominal manufacturing variances. Material supply and/or manufacturing processes may necessitate specification changes without notice.

SECTION 09900

PAINTING

1. GENERAL

1.1 DESCRIPTION OF WORK

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:
 - 1. Painting or staining all interior and exterior surfaces as called for in the Finish Schedule on Drawings or in these Specifications.
 - 2. Painting interior walls, door trim, window trim, etc.
 - 3. Staining and varnishing rails as called for on Drawings.
 - 4. Painting all exterior doors as specified.
 - 5. Painting and finishing any other work requiring finishing left unfinished by others.
 - 6. Walls painted accent as called for on Drawings.
 - 7. Frames and exterior doors.
- C. Volatile Organic Compound (VOC) emissions from paints & coatings must not exceed the VOC limits of Green Seal's Standards GS-11 requirements.
 - 1. Non-flat: 150 g/l
 - 2. Flat: 50 g/l

NOTE: All colors to be selected by Architect. The Contractor shall submit to the Architect, for approval, color samples of stain finishes, See general Note Section 09250.

1.2 SUBMITTALS

- A. Issue submittals in accordance with Section 01300, Submittals.
- B. Submit as follows:

1. Manufacturer's data, application instructions, and color chips on all specified products.
2. Paint schedule covering all surfaces to be painted.
3. Contractor to provide 4' x 8' test panels in finished spaces for up to 3 trials for each required color selection. Test panel colors to be selected by Architect. Final color to be approved by Architect from test panels.
4. Provide as maintenance material, a minimum of one gallon of each type and color of paint used on job, in labeled and well-sealed containers, for future touch-up. Also provide typed list of each type and color of paint used on job, including name of distributor from whom paint may be obtained.

2. PRODUCTS

2.1 General

- A. Paint: Acceptable manufacturers, unless specific manufacturer is noted: California Products Corporation, Benjamin Moors, Pratt & Lambert, Sherwin-Williams, Tnemec.
- B. All products used shall be manufacturer's top quality product for each type of finish specified.

2.2 MATERIALS

- A. Where primer is called for, use primer recommended by manufacturer for particular combination of substrate and finish coat. Where painting over shop-applied primers, verify that finish paint proposed for field application is compatible with shop primers actually used.
- B. Exterior Doors: Steel-Clad: Benjamin Moore Ironclad Retardo
- C. All Gypsum Walls and Ceilings to be painted: Primer - Benjamin Moore Vinyl Latex Primer Sealer.
- D. Finish-Walls - Benjamin Moore Moorcraft Latex Eggshell.
- E. Finish Ceiling – Flat Ceiling White Latex
- F. Interior exposed softwood woodwork as noted on Drawings: One (1) coat Primer; two (2) finish coats Semigloss Latex. All Hardwood: three (3) coats urethane.
- G. Wood Door Frames & Trim, & Miscellaneous interior wood trim: Benjamin Moore Wood Primer and two (2) coats Latex Semigloss.

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- H. Exterior Cement Board Clapboards & Trim – (2) coats latex exterior grade paint within 180 days of installation. Note: seal all cut edges.
- I. Interior garage gypsum board walls - alkyd primer and alkyd eggshell enamel.
- J. Exterior steel railings, balconies Sherwin Williams Alkyd Systems
- K. All Concrete block.

3. EXECUTION

3.1 JOB CONDITIONS

- A. Store materials in sealed containers. Provide a fire extinguisher in storage room. Remove flammable rags and waste from building at end of day.
- B. Do not perform exterior work in rain or when precipitation is forecast imminently; or in hot, dry, or windy weather which would cause finish to cure too rapidly, or be marred by windstorm dust; or at temperatures below 40 degrees F.
- C. Maintain temperature at interior locations between 50 and 75 degrees F, maximum 80 percent relative humidity, while paint is being applied. Provide adequate ventilation, by mechanical means if necessary, for drying of paint and prevention of condensation and mildew. Do not apply finish in areas in which dust is being generated.
- D. Protect finished surfaces and equipment not being painted with masking tape, canvas drop cloths, polyethylene sheets, etc. Items such as lighting switch covers, fixture canopies, and door handles shall be temporarily removed, carefully stored, and replaced after painting, or carefully covered during painting operations.

3.2 PREPARATION

- A. Preparation of newly-installed materials to receive finish painting is specified under those Sections installing materials. This includes, but is not necessarily limited to: touch-up of damaged shop coats; taping, sealing and sanding of drywall; patching masonry; sanding finish wood; and cleaning off grease, oil, dirt, mildew, factory-applied protective coatings, and other foreign materials.
- B. At wood surfaces to be painted, scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried. Caulk all interplay between wood trim, door frames and base boards with gyp board.

- C. Before beginning work under this Section, verify that preparation of substrates under other Sections has been done as specified. Thoroughly remove water, dirt, and dust with clean cloths, brooms, or brushes. Allow masonry mortar joints to cure as long as possible before beginning paint application, 7 days minimum, 28 days preferably.

3.3 APPLICATION

- A. Apply all materials in accordance with the manufacturer's recommendations.
- B. Apply materials with suitable brushes, rollers, and spraying equipment. Keep application equipment clean, dry, and free from contaminants. Thoroughly stir materials before applying, and periodically during application.
- C. Rate and method of application and drying time between coats shall be strictly in accordance with manufacturer's recommendations.
- D. Prepare field test panels in accordance with paragraph 1.4-B.3 of this Section for each type and color of finish specified. Request review of first completed room, color scheme, special items, etc., which shall serve as project standard after approval.
- E. Touch-up shop applied primers before field painting.
- F. Do not apply first coat until surface is dry to touch. Moisture content of surface shall be within limitations recommended by paint manufacturer.
- G. Leave all parts of moldings and ornaments clean and true to detail, without excessive paint in corners and depressions. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping. Paint surfaces visible through grilles one coat flat black.
- H. Finish coats shall be smooth, free of brush marks, streaks, laps or pile-up of paint, and skipped or missed areas. Refinish whole wall if unacceptable finish is extensive or of such a nature that it cannot be repaired by normal touch-up.
- I. After completion of painting work, remove spilled or spattered paint. Touch-up and repair finishes damaged in any way by work under this Section. Protect finished surfaces.

3.4 Exterior

- A. Exterior and interior - Steel-Clad door: Two (2) coats exterior enamel over factory primer. Doors shall be laid flat if sprayed. Doors may be rolled or brushed in place, however with no visible brush marks, drips or imperfections.

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B. All exterior metal work (steel) to include railings, brackets, grids and deck.

a. Alkyd Systems
Gloss Finish

1st Coat: S-W All surface Enamel Primer, A11w210

2nd Coat: S-W All Surface Enamel, A11 Series

3rd Coat: S-W All Surface Enamel, A11 Series

(4 mils wet, 1.6 mils dry per coat)

3.5 Interior

A. Interior Painting: Paint shall be applied in the following number of coats, primer and finish. Tint all primers to match finish color.

1. One (1) fully applied finish coat of even coverage. NOTE: Contractor to adequately cover M.R. (Blueboard) or other colored drywall by primer or finish coat as necessary to eliminate any visible "bleed through".

2. Drywall: All interior walls to receive paint: one (1) coat latex base primer-sealer, two (2) finish coats latex eggshell. Ceiling: One (1) coat primer and two (2) coats latex flat.

B. Interior Window Sill, Door Frames & Trim, and Miscellaneous Interior Wood Trim- one (1) coat primer and two (2) coats finish for all soft wood. Contractor to verify with construction manager as to window type.

C. All hardwood to receive three (3) coats urethane. Apartment entry doors, three (3) coats urethane.

D. Interior garage – Gyp-board Surfaces Only - One (1) coat alkyd primer and sealer. One (1) coat alkyd eggshell enamel.

E. Exterior siding & trim – Two (2) coats latex exterior grade paint within 180 days of installation.

F. Concrete block stairwells – Coat Primer, Two (2) finish coats, eggshell finish.

G. NOTE: Painting Contractor to verify that interior apartment doors are prefinished.

END OF SECTION



SECTION 10550

POSTAL SPECIALTIES (MAILBOXES)

1. GENERAL

1.1 DESCRIPTION OF WORK

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. The extent of work shall be as shown on Drawings and called for in these Specifications. The work under this section of Specifications includes furnishing and installing the items listed as indicated on Drawings.

2. PRODUCTS:

- 2.1 Mailboxes shall be manufactured by Auth – Florence Versatile 4 Mailbox Suite G, black, front horizontal loading, installed to Postal Regulations. Provide for forty-seven (47) mailboxes. Refer to Drawings for configurations per building.
- 2.2 The lock on each compartment door shall be keyed to the resident's door. It shall be a pin tumbler type with spring bolt. Provide Locking Device 2090. Provide a “Key Keeper” by entry door for mailman.

3. EXECUTION:

- 3.1 Mailboxes shall be framed into wall as shown on drawings. Care shall be taken to insure tight fit and that Vertical Placement (Ht. to boxes) meets Postal Regulations. Properly secure, block and align unit as shown in manufacturer's installation guidelines. All work shall be done in first-class manner insuring high-grade finish.
- 3.2 NOTE: The Contractor shall submit drawings on every item specified in this section. There shall be no substitutions without a written explanation from the subcontractor that the specific item is equal with the item specified by the Architect. All substitutions shall be approved by the Architect and the Owner.

END OF SECTION

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SECTION 10800

TOILET AND BATH ACCESSORIES

1. GENERAL

- 1.1 REFERENCES: Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- 1.2 DESCRIPTION OF WORK: The extent of work shall be as shown on Drawings and called for in these Specifications. The work under this section of Specifications includes furnishing and installing the items listed as indicated on Drawings.

2. PRODUCTS:

- 2.1 TOWEL BARS AND TOILET PAPER HOLDERS: shall be Taymor size as shown on Drawings. Toilet Paper 01-9409, 05-PB9407, Towel Bar 9400 Series.
- 2.2 SOAP DISH: shall be equal to NuTone HM-621, or be integral with sink.
- 2.3 DOUBLE HOOK FOR BATHROOM DOOR: shall be equal to Taymor 01-9402, 05 PB9402.
- 2.4 SHOWER CURTAIN ROD: bath shall be equal to NuTone HM-382. Curtains are not included.
- 2.5 GRAB BARS: Stainless steel, 1 ¼ " diameter, concealed mounting with snap flange, satin finish; Bobrick B-5806 Series, lengths as shown on drawings.
- 2.6 ALL APARTMENT UNITS: Surface Mounted Medicine Cabinet: Commodore VM 224 M.
- 2.7 NOTE: Blocking for all accessories and grab bars must be provided. See Section 06100 - Rough Carpentry.
- 2.8 NOTE: The contractor shall submit shop drawings on every item specified in this section. There shall be no substitutions without a written explanation from the subcontractor that the specified item is equal with the item specified by the architect. All substitutions shall be approved by the Architect and the Owner.

3. EXECUTION:

- 3.1 All work shall be done by experienced craftsmen in first-class manner and high-grade finish.
- 3.2 All installations shall be in accordance with layout shown on plans and in strict conformity with the manufacturer's recommendations and secured into blocking or other framing with screws of adequate length and size to properly support accessories. Grab bars must be able to sustain a 300# direct load pulling down or out on it.

END OF SECTION

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SECTION 11450

RESIDENTIAL EQUIPMENT AND KITCHENS

1. GENERAL:

1.1 REFERENCES

- A. Drawings and general provisions on Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. Rough Carpentry: Section 06100
- C. Finish Carpentry: Section 06200
- D. Gypsum Drywall: Section 09250

1.2 DESCRIPTION OF WORK

- A. The extent of work shall be as shown on Drawings and called for in these Specifications. The work under this section of Specifications includes furnishing and installing the following items as indicated on Drawings.
- B. Kitchen Cabinets - wall hung and base and countertops according to layout on drawings.
- C. Bathroom Vanities and Countertops
- D. Refrigerator
- E. Kitchen Ranges and Range Hoods
- F. Plastic Laminate on wall adjacent to range.
- G. Dishwasher

1.3 SUBMITTALS

- A. Submit manufacturer's product data and installation recommendations for all specified products.
- B. Architect reserves the right to require samples of all products to be submitted. Acceptable samples will be returned and may be used in the work.

C. Submittals for countertops shall be in accordance with Section 06200, Finish Carpentry.

2. PRODUCTS

2.1 Kitchen Cabinets:

- A. Shall be of wood construction, with wood finished reverse beveled doors, self closing hinges, adjustable shelves, dual tracks for drawers with nylon guides.
- B. Cabinets to be Extreme Series by Armstrong. Countertops to be postform plastic laminate. Cabinet front panels to be Rutledge Maple Series by Armstrong. Kitchen counter tops to be rounded edge preformed plastic laminate color by Architect.

2.2 Bathroom Vanities: shall be equal to "Oasis Marble Tops" with built in bowl available through FW Webb Co. (207) 784-4575. Coordinate with plumber for drilling holes to receive faucet. Base cabinet to be "Extreme" Series by Armstrong.

2.3 Unit Refrigerator shall be Kenmore Model #46-61752, Energy Star, frost free, refrigerator-freezer, 17 cu. Ft, white.

2.4 Unit Kitchen Range to be; Kenmore Model #22-96002, white, self clean, radiant. Handicap units Kitchen Range to be Kenmore Model # 22-46582, slide in, up front controls, white, self clean, coil. Range cords, (43) #22-49614 3 wire, 50 amp, 4 feet.

2.6 Unit Dishwasher to be Kenmore Energy Star Model #22-15242, white, 110v Power Cord #22-16006.

3. EXECUTION:

3.1 INSTALLATION

- A. All installation shall be done in a quality first-class manner according to Drawings and layouts shown, and shall be according to manufacturer's recommendations.
- B. Kitchen cabinets and vanities: shall be installed by experienced cabinet installers in a craftsmanlike manner, as though this were really "cabinets". Securely screw cabinets to blocking in the walls. Blocking shall be in place at top and bottom of wall and base cabinets (see Rough Carpentry Sec. 06100), and screws shall be long enough to penetrate blocking 1-1/4" minimum. Cabinets shall be level and plumb. If leveling cabinets puts them visually out of line with other elements (wall line, window sill, door casing, etc.) Architect shall be notified. Countertops shall be tight to the wall and joints caulked. Cabinets shall be tight to each other and in line. All doors and drawers to open freely. Work shall be left clean and right.

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- C. Refrigerators and ranges: Shall be set in place properly hooked up and leveled. Ranges to be installed with tip over clips.
- D. Range hoods shall be new secured in place by means of screws hidden from view.
- E. The contractor shall check and make necessary adjustments to insure that all installed items operate faultlessly.
- F. Touch up any dings, scratches or other marks with color matching original.
- G. Contractor to coordinate installation of items in this Section with that of related mechanical trades: 15000 Plumbing and HVAC; 16000 Electrical.
- H. All work under this SECTION shall be guaranteed to the Owner IN WRITING for a period of at least one (1) year. Appliance Warranty and Operation Manuals to be provided to Owner with typed listing of appliance # correlated to Apt. #.

END OF SECTION

SECTION 12500

WINDOW TREATMENT

1. GENERAL:

1.1 REFERENCES: Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.

1.2 DESCRIPTION: The extent of work shall be as shown on Drawings and called for in these Specifications. The work under this section of Specifications includes furnishing and installing the following items:

A. Shades for each window in residential units as described.

1.3 SUBMITTALS: Contractor to submit product data on shades and blinds

2. PRODUCTS:

2.1 Window shades: Black-Out Shade

A. 12 oz. 4-ply opaque darkening shade available from Reo Window Shade Company, Portland, Maine (207) 773-7992.

1. Construction – 4- Ply fiberglass (1 ply fiberglass, 3 ply vinyl)

REQUIREMENTS	521-E FEDERAL SPECS	BUTLER 4-Ply Opaque
Finished weight – oz/sq		12.0
Breaking strength – lbs. in.	Warp 130 Fill 120	meets/ or exceed meets/ or exceed
2. Flame Resistance (U.S. Government Specification CCC-C 521E and NFPA 701 Small Scale)		
After Flame Seconds	Warp 2.0 Fill 2.0	meets/ or exceed meets/ or exceed
Char Length Inches	Warp 4.0 Fill 4.0	meets/ or exceed meets/ or exceed
		No evidence of holes, breaking or cracking
Adhesion		Vinyl Films Inseparable
Meets Federal Spec. CCC-C521E		

2.2 Spring wood rollers to be pine 1" for up to 46" wide 1 ¼" for over 46" wide.

3. EXECUTION:

- 3.1 All work to be done by experienced craftsman in first-class manner and high-grade finish. All installations shall be in accordance with layout shown on plans and in strict conformity with the manufacturer's recommendations.
- 3.2 Window Shade holding hardware shall be installed to provide level and secure system for attaching window shade and rods. Work shall be free of dents, dings and other damage to finish (paint, etc.) and clean.
- 3.3 Solid backing is required for all window treatment hardware. Hardware attached otherwise will not be acceptable.
- 3.4 The Contractor shall furnish all wood blocking within wall, filler pieces, angles, mouldings and other finish items necessary for complete installation of the equipment.
- 3.5 The Contractor shall check and make necessary adjustments to insure that all installed items operate faultlessly.

END OF SECTION

SECTION 14240

HYDRAULIC ELEVATOR

1. GENERAL:

1.1 REFERENCES: Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. 110 volt branch circuit to the terminals of the elevator controller for car light supply and 110 volt light and outlet in the elevator pit, complete with switch adjacent to the pit ladder as shown on Elevator Drawings.
- B. Any cutting, patching or painting of walls and grouting under thresh-holds and hoistway frames.
- C. Adequate supports for guide rail brackets.
- D. Sill support angles.
- E. Electrical current during erection and testing of equipment.
- F. Necessary recesses to accommodate doors, sills, (min. 2-1/2" deep) and signal equipment such as indicators, push buttons, hall lanterns, etc.
- G. Pit access ladder.
- H. General Contractor to receive, handle and store in the building approximately ten (10) tons of elevator materials.
- I. Smoke sensors in each elevator lobby and elevator machine room complete with necessary wiring to elevator controller. A shunt trip circuit breaker with heat detectors will also be provided as required.

1.3 REGULATORY AGENCIES: Perform all work in accordance with the National Electrical Code, American Standard Safety Code and such state and local codes as may be applicable.

1.4 SUBMITTALS: Shop Drawings-

- A. Submit six (6) blue print copies of elevator layout drawings to the Architect for approval.

- B. Upon completion submit to Owner, warrantee operating manual and maintenance information.

1.5 GUARANTEE:

- A. Elevator Contractor shall guarantee that materials and workmanship of apparatus installed by him under these Specifications shall be first class in every respect; and that he will make good any defects not due to ordinary wear and tear or improper use which may develop within one (1) year from date of completion and installation.
- B. In addition to the other requirements, inspection, tests and remedies herein provided upon completion of elevator installation and before final approval and final payment, Elevator Contractor shall make, in speed test with full maximum load on elevator to determine whether elevator equipment as installed meets the speed, capacity and all other requirements of the Specifications.
- C. In event equipment does not meet all requirements of Specifications, Elevator Contractor shall promptly remove from the premises all work condemned by Architect as failing to conform to the contract and shall bear all expense of making good all work of other Contractors destroyed or damaged by such removal or replacement. If Elevator Contractor does not remedy such condemned work within a reasonable time, fixed by written notice from Architect, General Contractor may correct such condemned work at expense of Elevator Contractor and withhold such cost from final payment under contract price. In the event the remainder due under Contract price is insufficient to cover such a cost, Elevator Contractor shall, immediately upon request, reimburse General Contractor in full.

1.6 PERMITS, TAXES AND LICENSES: All permits, inspection fees and licenses necessary for the execution of the work shall be secured and paid for by the Elevator Contractor.

1.7 TEMPORARY USE: The General Contractor, Sub-contractors, Owner or others will not be permitted use of the elevators during construction except under a written agreement as stipulated by the Elevator Contractor.

2. PRODUCTS:

2.1 ACCEPTABLE MANUFACTURES:

- A. Except as otherwise specified herein, or specifically approved by Architect, the Elevator Contractor shall be regularly engaged in installation of elevators of type specified herein, and shall be able to demonstrate at least three (3) installations of this type made by him within the State of New Hampshire which have provided satisfactory operation for a period of one (1) year prior to the date of receipt of General Bids, for this project.

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- B. Demonstrate that he has provided satisfactory maintenance service for elevators of type specified and that he has maintained a complete maintenance organization comprised of regularly employed inspectors and mechanics within the State of New Hampshire for a period of at least one (1) year prior to the date of receipt of General Bids.
- C. Provide 1 year maintenance warrantee for insuring problem free operation of elevator, and make available complete ongoing maintenance service package.
- D. Elevator shall be equal to Canton Elevator Company, or approved equal. Elevator shall meet latest ANSI handicapped requirements and New Hampshire State Elevator Code.
- E. Delivery of elevator systems shall be guaranteed by Manufacturer to be on site sixteen (16) weeks after receipt of approved Shop Drawings. Shop Drawings shall be submitted to the General Contractor for review by the Architect within ten (10) days of Sub-Contractors award.

2.2 MATERIALS AND FABRICATIONS:

- A. Description of equipment -
 - Capacity: 2500 lbs.
 - Speed: 125 fpm
 - Operation: Selective Collective
 - Inside Cab Dim 6'-8" x 4'-3" inside dim.
 - Travel: Approximately (43'- 2-1/8") as shown on Drawings
 - Power supply: 208 v 3 phase, 60 cycle.
 - Machine Location: As shown on Drawings
 - Stops & Openings: Five (5) stops
 - Car Enclosure: High pressure laminate interior panels, overhead fluorescent lighting above egg crate suspended ceiling, stainless steel front return, and stainless steel car door. Handrail on side walls. Carpeted floor by others.
 - One (1) set Protection pads and hooks.
 - Include: ADA compliant telephone

	Fan Emergency Lighting Proximity detectors, door protection
Hoistway Door Frames:	Hollow metal U.L. "B" labeled door, square frame
Door Size & Type:	Single slide side open 3'-6" W x 7'-0"H (clear opening) finish to be baked enamel; color to be selected from standard selection charts
Door Operation:	D.C. Power Operation
Signals:	Illuminated halo buttons, (Braille) alarm bell, in car location. Hall position indicator at main floor level. In – Car Direction Lantern
Special Features:	Special handicap provisions Door Hold Key Service Independent Operation Key Switch
Motor HP:	3 Phase Power 40 HP Max
Starter	Solid state soft start

B. Jack unit:

1. The jack unit shall be designed and constructed in accordance with the applicable requirements of the American Standard Safety Code for Elevators A-17. It shall be of sufficient size to lift the gross load the height specified. It shall be factory tested to insure adequate strength and freedom for leakage. No brittle material, such as gray cast iron, shall be used in the jack construction.
2. The jack unit shall consist of the following parts: a plunger of heavy polished steel tubing accurately turned; a stop ring shall be electrically welded to the plunger to positively prevent plunger leaking its casing made of steel tubing and provided with a pipe connection and air bleeder; Brackets shall be welded to jack casing and supporting the elevator on pit channels.
3. A sealed PVC cylinder protection system shall be installed. The system shall provide a means to monitor the space between the PVC sleeve and cylinder wall and evacuate unwanted fluids, so as to prevent such fluids from remaining in contact with the cylinder.

4. A standard wellhole with steel pipe casing to retain the hole shall be provided. All drilling spoils are to be removed by the general contractor. Water for drilling, if required, will be provided by others also. Should obstructions such as rock, boulders, debris, water, quicksand or any other condition other than normal soil or clay be encountered, additional time to drill the hole will be treated as a change order. Work cease until a change order is issued.

C. Car:

1. Platform and Sling: The platform and sling have a fabricated frame of formed and structural steel shapes, gusseted and rigidly welded. Flooring shall be wood top floor laid over wood sub-floor. Finished flooring shall be provided, by others, on top of the car platform.
2. The sling shall consist of heavy steel channel stiles properly affixed to a steel cross head and bolster, with adequate bracing members, to remove all strain from the car enclosure.
3. Steel bumper plates shall be affixed to bottom of bolster channels; and a platen plate with clamps and car screws shall be furnished for fastening sling to plunger.

- D. Car doors: The car entrance shall be provided with horizontal sliding doors. Panel rigidity to be obtained by suitable steel reinforcements. Doors shall be hung on sheave hangers with polyurethane tires and sheaves not less than 2-1/2" diameter running on a polished steel track, and guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.

- E. Alarm bell: An emergency alarm bell shall be located in conformance with ANSI A-17 Code requirements, and connected to a plainly marked push button in the car. Alarm bell shall be connected to the emergency lighting power pack.

- F. Guide and Guide Shoes: Guides for the elevator car shall be planed steel elevator guide rails, properly fastened to the building structure with steel brackets. The car stile shall be fitted at top and bottom with sliding guide shoes.

G. Power Unit:

1. (Oil pumping and control mechanism) shall be compactly and neatly designed with all of the components listed below combined in a self-contained unit; structural steel outer base with tank supports; floating inner base for mounting motor pump assembly; over head oil reservoir with tank cover and controller compartment with cover; metal drip pan; oil-hydraulic pump; electric motor; and oil control unit with the following components built into a single housing: a high pressure relief valve, a check valve, an automatic unloading up start valve, a lowering and leveling valve,

and a magnetic controller, or a self contained submersible of manufactures standard type.

2. The pump shall be especially designed and manufactured for oil-hydraulic elevator service. It shall be of positive displacement screw type, inherently designed for steady discharge with minimum pulsations to give smooth and quiet operation. Output of pump shall not vary more than ten percent (10%) between no load and full load on elevator car.
 3. Motor shall be especially designed for oil-hydraulic elevator service, of standard manufacturer and of duty rating to comply with herein specified speeds and loads.
 4. Oil control unit shall consist of the following components, all built into a single housing. Welded manifolds with separate valves to accomplish each function will not be acceptable under this Specification. All adjustments shall be accessible and shall be made without removing the assembly from the oil lines:
 - a. Relief valve shall be externally adjustable and shall be capable of bypassing the total oil flow without increasing back pressure more than ten percent (10%) above that required to barely open the valve.
 - b. Up start and stop valve shall be externally adjustable, and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, insuring smooth up starts and up stops.
 - c. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
 - d. Lowering valve and leveling valve shall be externally adjustable for drop-away speed, lowering speed, leveling speed and stopping speed to insure smooth "Down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling when slow down is initiated.
 5. Electric controller shall be of the full magnetic type or solid-state integrated circuitry. Silver to silver contacts shall be utilized on all relays and contractors. Thermal overload relays to be provided to protect the motor. All component switches to be mounted in a steel panel designed for wall to floor mounting. Shall have built in diagnostics, no proprietary tools required to service unit.
- H. Mainline Strainer: A mainline strainer of the self-cleaning type, equipped with a 40-mesh element shall be furnished and installed in the oil line.
- I. Failure Protection: The electrical control circuit shall be designed so that if a malfunction should occur, due to motor starter failure, oil becoming low in the system,

or the car failing to reach a landing in the up direction within a predetermined time, the elevator car will automatically descend to the lowest terminal landing. If power operated doors are used, the doors will automatically open when the car reaches the landing to allow passengers to depart. The doors will then automatically close and all control buttons, except the "door open" button in the car station, shall be made inoperative.

- J. Sound Isolating Coupling: Install a minimum of two in the oil line in the machine room between pump and jack.
- K. Oil-Hydraulic Silencer (muffler device): Install in oil line near power unit. It shall contain pulsation-absorbing material inserted in a blowout-proof housing arranged for inspecting interior parts without removing unit from oil line. Rubber hose without blowout-proof features will not be acceptable.
- L. Vibration Pads: Mount under the power unit assembly to isolate the unit from the building structure.
- M. Automatic Terminal Limits: Place electric limit switches in the hatchway near the terminal landing; designed to cut off the electric current and stop the car should it run beyond either terminal landing.
- N. Automatic Self-leveling: Provide elevator with a self-leveling feature that will automatically bring the car to the floor landings. This self-leveling shall, within its zone, be entirely automatic and independent of the operating device, and shall correct for over travel or under travel. The car shall also be maintained approximately level with the landing regardless of the load.
- O. Buffers: Furnish and install substantial buffers under the car in the elevator pit. They shall be mounted on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor and substantial extensions will be provided, if required. Buffers shall comply with ANSI A-17.1 Code requirements.
- P. Car Top Inspection Station: A car top inspection station with an "emergency stop" switch and with constant pressure "up-down" direction buttons shall make the normal operating devices inoperative and give the inspector complete control of the elevator.
- Q. Door Operation: Furnish and install a direct current motor driven heavy-duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and door-operating mechanism shall be arranged for manual operation in event of power failure. The leading edge of the car door shall be provided with a retractable reversal edge arranged to automatically return car and hoistway doors to the open position in the event the doors are obstructed during closing cycle. Doors will then resume closing cycle.

Doors shall automatically open as the car arrives at the landing and shall automatically close after an adjustable time interval or when the car is dispatched to another landing. Direct drive geared operators, A.C. controlled units with oil checks, or other deviations for the above are not acceptable.

- R. Interlock: Equip each hoistway entrance with an approved type interlock tested as required by Code. The interlock shall be designed to prevent operation of the car away from the landing until the doors are locked in the closed position as defined by Code and shall prevent opening the doors at any landing from the corridor side unless the car is at rest at the landing or is in the leveling zone and stopping at the landing. Interlocks shall bear Underwriter's Laboratories "B" label of approval.
- S. Hoistway Door Unlocking Device: Provide hoistway door unlocking devices as specified by the ANSI A-17.1 Code to permit authorized persons to gain access to hoistway when elevator car is away from the landing.
- T. Door Hangers and Tracks: For each hoistway sliding door, furnish and install sheave type two point suspension hangers and tracks complete. Sheaves shall be 2-1/2" in diameter and have polyurethane tires with ball bearings properly sealed to retain grease. Hangers shall be provided with an adjustable slide to take the up-thrust of the doors. Tracks are to be drawn steel shapes, smooth surface and shaped to conform to the hanger sleeves.
- U. Hoistway Entrances: Hoistway entrances of the hollow metal, horizontal sliding type shall be furnished and installed complete at each of the hoistway openings. Note that entrances must be at least minimum legal width for wheelchair use, meeting ANSI A-17.1.
 - 1. Entrances shall be manufacturer's standard design and shall bear Underwriter's Laboratories "B" labels. They shall consist of frames, sills, doors, hangers, hanger supports, hanger covers, fascia plates, and all necessary hardware. Finish to be baked on prime enamel for finish painting in the field by others.
 - 2. The entire front wall of the hoistway is to be left open or a rough opening provided which is 12" greater in width and 6" greater in height than the finished opening, until after entrances are installed. After guide rails are set and lined, the entrance frames shall be installed in perfect alignment with the guide rails. Finish walls will then be completed by others.
- V. ADA telephone shall be furnished with wiring from elevator cab to the machine room and telephone box. Wiring to be coordinated with Electrical Contractor and tied into outside phone system.
- W. Operation (Selective Collective Automatic Push-button): Control of the elevator car shall be automatic in operation by means of a push-button in the car marked for each of

the landing levels served and an "up-down" button at each intermediate landing with a call button at each terminal landing, wherein all stops registered by the momentary pressure of landing or car buttons shall be maintained until the car answers the call. An emergency stop switch shall be provided in the car push-button station which, when in the off position, will render the elevator inoperative, and which will enable attendant or passenger to stop the car at any point during its travel. Opening of this switch shall not cancel registered calls, and when the switch is closed the car will continue to answer calls that have been registered. Each landing station shall contain an illuminated push-button which shall "light-up" when pressed to indicate that a call has been registered to bring the car to that particular landing. A time delay non-interference feature shall be incorporated in the control mechanism to allow simple time for opening and closing car and hoistway doors before it is again placed in motion.

X. Special Emergency Service:

1. Special Emergency Service Operation shall be provided in compliance with the latest revision of the ASME/ANSI A17.1 or CAN3-B44 Code.
2. Special Emergency Service Phase I to return the elevator non-stop to a designated floor shall be initiated by an elevator smoke detector system or a keyswitch provided in a lobby fixture.
3. The smoke detector system is to be furnished by others. The elevator contractor shall provide contacts on the elevator controller to receive signals from the smoke detector system.
4. A keyswitch in the car shall be provided for in-car control of each elevator when on Phase II of Special Emergency Service.
5. If an elevator is on independent service when the elevator is recalled on Phase I operation, a buzzer shall sound in the car and a message indicator will be activated.

END OF SECTION

**SECTION 15400
PLUMBING**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings, Addenda, General Provisions of Contract, including Division 1 General and Supplementary conditions and General Requirements apply to work specified in this Section.

1.02 DEFINITIONS

- A. ADA: Designed to meet the requirements of the Americans with Disabilities Act.
- B. Adaptable: Designed so in the future it can be easily adapted to meet most of the essential requirements of the Americans with Disabilities Act with minor additions and adjustments, such as change of height of counter or addition of a lift seat.
- C. Concealed: Shall mean in walls, in chases, above ceilings, within enclosed cabinets, otherwise enclosed.
- D. Equal: Shall mean essentially the same as that product specified, but a model of a different manufacturer
- E. Exposed: Shall mean in finished spaces, in closets, under counters, behind and/or under equipment and/or otherwise visible.
- F. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- G. Materials: Shall mean any product used in the construction, including but not limited to: fixtures, equipment, piping and supplies.
- H. Others: Shall mean provided by sections other than this section. If not purposely assumed by another section, shall be provided by the General Contractor.
- I. Piping: Shall mean pipe, fittings, hangers and valves.
- J. Provide: Shall mean the furnishing and installing of materials.
- K. Reviewed equal: Shall mean that the Architect or a designated Consultant, not the contractor, shall make final determination whether materials are an equal to that which is specified.
- L. Substitution: Shall mean materials of significantly different physical, structural or electrical requirements, performance, dimensions, function, maintenance, quality or durability, than that specified.

1.03 ALTERNATES

There are NO alternates that apply to this section of the project.

1.04 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation, and perform all operations required to install complete plumbing systems in the building, in accordance with these specifications and applicable drawings.
2. Provide the following:
 - a. Sanitary, waste and vent systems.
 - b. Domestic hot and cold water system.
 - c. Storm water system
 - d. Pipe, valve and fittings
 - e. Water specialties
 - f. Drainage specialties
 - g. Circulating pumps
 - h. Sump pumps
 - i. Plumbing fixtures and accessories
 - j. Insulation
 - k. Installation and/or connections to fixtures/equipment provided by others.
3. Specifications and accompanying drawings do not indicate every detail of pipe, valves, fittings, hangers, fixtures and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.
4. Before submitting proposal, This Contractor shall be familiar with all conditions. Failure to do so does not relieve This Contractor of responsibility regarding satisfactory installation of the system.

B. Related Work Described Elsewhere

1. Temporary Water, Light and Power - Division 1
2. Water and Fire Services - Division 2
3. Site Utilities - Division 2
4. Excavation and backfill – Division 2
5. Concrete Bases - Division 3
6. Setting of sleeves in masonry (sleeves provided by This Contractor) - Division 3
7. Carpentry Work - Division 6
8. Firestopping except as specified in this section, Division 7.
9. Flashing of Vents and Roof Drains - Division 7
10. Furnishing of Toilet Room Accessories - Division 8
11. Installation of Access Panels - Division 8
12. Finished Painting - Division 9, except as specified in this section.
13. Electrical conduit and wiring, except as noted within - Division 16

C. Commissioning

- 1. A commissioning agent has been retained by and works directly for the Owner. The commissioning agent’s primary responsibility shall include ensuring the plumbing systems function as designed. A full scope of the agent’s duties may be provided on request.
- 2. This contractor shall provide documentation on plumbing fixtures and equipment that may be requested by the commissioning agent with notification provided to the Architect of such.
- 3. Should the commissioning agent requested changes or alterations to the systems, said changes or alterations must be authorized by the Architect or Engineer of record prior to work. See par. 1.19, “CHANGE ORDERS”.
- 4. The scope of the plumbing contractor’s responsibility regarding commissioning shall be (but not limited) to:
 - a. Attending commissioning meetings when requested.

1.05 PERMITS

- A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.
- B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner’s maintenance manual.

1.06 CODES AND ORDINANCES

- A. All work performed under this Section of the Specifications shall be done in accordance with applicable Federal Laws, Maine State Laws, Uniform Plumbing Code, Subsurface Wastewater Disposal Rules, and local plumbing codes and ordinances. The following standards are also to be followed when applicable:

ADA	Americans With Disabilities Act
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
BOCA	Building Officials & Code Administrators International, Inc.
NFPA	National Fire Protection Association (a.k.a. NFC, National Fire code)
NEMA	National Electrical Manufacturer’s Association
OSHA	Occupational Safety and Health Act
UL	Underwriter’s Laboratories

- B. If an obsolete code section or standard is specified, the latest replacement issue of each Code or standard for the application, in effect at the time of bidding, shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.07 QUALITY ASSURANCE

- A. Use sufficient qualified workmen and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of the system throughout. Work performed shall conform to manufacturers recommendations, good standard practice and industry standards.
- B. Any work deemed unacceptable by the Engineer, Architect or Clerk of the Works shall be redone correctly, at no additional cost to the owner.

1.08 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD drawings will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD 2006 and may be provided in either the 2000 or 2004 file formats. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files.

All contract documents are copyrighted material. No portion of materials may be reproduced or duplicated except as indicated in the release form. Where release forms are not required (Adobe based files), materials may be printed for use by the intended recipient only and may not be reproduced or copied in any other manner unless written permission is obtained.

1.09 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise.

- A. Any proposal for substitution of Plumbing equipment shall be made in writing PRIOR TO OPENING OF BIDS, see Division 1. Submit full details for consideration and obtain written approval of the Architect. The phrase "or approved equal" shall be intended to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "approved equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.
- B. Approval by Architect for such substitution shall not relieve the Plumbing Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work

- C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.
- D. Materials and equipment determined as an “approved equal” and /or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. manufacturer, model, etc.) specified.
- E. Any additional cost resulting from the substitution of equipment shall be paid by this Contractor.

1.10 PLANS AND SPECIFICATIONS FOR SUPPLIERS

This Contractor shall provide his Suppliers, and any related subcontractors, with a copy of the specification pages, and letter sized photocopies of equipment details and schedules, that pertain to the item to be supplied.

1.11 SHOP DRAWINGS & SUBMITTALS

- A. As soon as possible after award of Contract (but not longer than 21 calendar days), before any material or equipment is purchased, Plumbing Contractor shall submit to the Architect no less than ten (10) copies of shop drawings for approval. If shop drawings are not submitted within the allotted time frame all substitutions included the late shop drawings will be invalid and the equipment specified must be provided. Any costs resulting from delays in the project schedule due to failure to submit shop drawings related to this section in a timely manner shall be the responsibility of the Plumbing Contractor.
- B. Each item shall be properly identified, preferably by fixture/equipment tag number (such as WC-3), and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.
- C. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with requirements of the drawings and specifications. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.
- D. Should any materials or products be purchased and/or installed without prior review and comment the contractor shall be required to remove or replace those products and/or materials if directed by the Architect at his own expense. If the materials are not removed (or replaced) or if the project is delayed as a result the Architect reserves the right to order the withholding of payment until the situation is resolved in a manner satisfactory to the Architect.
- E. Plumbing shop drawings shall be separate from Mechanical shop drawings. All submittals shall have a clear area on the front no less than 4inches x 3inches to be reserved exclusively

for the Engineers' shop drawing stamp or they will be refused for re-submittal.

- F. It is desirable for shop drawings to be submitted electronically, including all documentation outlined in paragraph "A" above. Hard copies of shop drawings must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.
- G. Review must be obtained on all items specified in Section 2 Products or shown on the drawing, and any significant items implied or otherwise required but not specified.
- H. Format
 - 1. Related items shall be stapled or Bound together as a package. The number of copies of each package shall be as listed above. Examples of packages of related items include:
 - a. Hangers and Supports
 - b. Identification
 - c. Insulation
 - d. Valves
 - e. Piping
 - f. Plumbing Fixtures with accessories
 - g. Drainage Specialties
 - h. Water Specialties
 - i. Pumps
 - 2. If due to circumstances beyond his control, the contractor is unable to include all the related items in the submitted package, he shall insert in its place a plain sheet of paper with a notation stating that the item will be submitted separately.

1.12 PRODUCT HANDLING

Use all means necessary to protect materials before, during and after installation, and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.13 AS-BUILT DRAWINGS

Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of all blueprints furnished for this job. On this special set of blueprints, record *completely and accurately* all differences between the work as actually installed and the design as shown on the drawings. These record prints must be kept up to date by recording all changes within one week of the time that the changes are authorized. At the completion of the work, this set of drawings shall be delivered to the Architect for the Owner electronically in the form of CAD drawings. If a complete record of changes is not made and electronic CAD drawings not provided by the Plumbing Contractor, a record shall be made by the Engineers, and *the cost of the record shall be paid by the Plumbing Contractor*. Copies of the plumbing CAD drawings may be made available electronically to the Contractor if desired. Drawings shall be dated accordingly and clearly identified as "AS-BUILT". Contact the Architect directly or the Engineer via e-mail at mechsyst@maine.rr.com. Specify required CAD format when requesting the files. CAD drawings were generated using AutoCAD 2006 and utilize both paper space and model space with external

references to various other drawings. Files will be compressed and will require “WinZip” (<http://www.winzip.com>) for extraction. A release form will be provided which must be signed and returned to the Engineer prior to transfer of files.

1.14 MAINTENANCE MANUAL

On completion of this portion of the work, and as a condition of its acceptance, submit for review two copies of a manual describing the system. Plumbing equipment manuals shall be separate from mechanical manuals. All manuals shall be original copies, not photocopies, or they will be refused for resubmittal. Prepare manuals in durable 3-ring binders approximately 8.1/2” by 11” in size with at least the following:

- A. Project name on the spine and front cover, and identification on the front cover stating the project name, general nature of the manual, and name, address and telephone number of the General and Plumbing Contractors.
- B. Neatly typewritten index.
- C. Complete instructions regarding operation and maintenance of all equipment involved.
- D. Complete nomenclature of all frequently replaceable parts and supplies, their part numbers, and name, address and telephone number of the vendor.
- E. Copy of all guarantees and warranties issued, and dates of expiration.
- F. Shop drawings and equipment/fixtures manufacturer’s catalog pages. Clearly indicate the precise item included in this installation and delete, cross out or otherwise clearly indicate, all manufacturers’ data with which this installation is not concerned.

1.15 OBJECTIONABLE NOISE AND VIBRATION

All equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping or ducts, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Contractor at no extra cost to the Owner.

1.16 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer’s guarantee and warranty for the period specified, shall be included in Contractor’s base bid.

1.17 DEVIATIONS, DISCREPANCIES AND OMISSIONS

- A. The drawings are intended to indicate only diagrammatically the intent, extent, general character and approximate locations of plumbing work. Work indicated, but having details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. This shall include but not limited to:

1. All items that are required to meet all applicable codes, laws and legally adopted referenced standards.
 2. Piping for cold and hot water supply, drain, vent, gas, etc to each plumbing fixture/equipment shown on the drawings or scheduled as required.
 3. Shut-off valves on lines feeding individual fixtures without integral stops.
 4. Minor single phase electrical or control wiring between plumbing provided items that require it, unless indicated on the Division 16 Electrical Drawings.
 5. Plumbing related items indicated on the drawings of other trades.
 6. Items indicated on one plumbing drawing but not shown on a corresponding drawing.
 7. Items implied or noted on the plumbing drawings but not shown.
 8. All plumbing related items clearly shown in dark print on the Plumbing drawings but not included in the specification (See paragraph 2.01), unless it is noted as being provided by the owner or other contractor or unless other sections assume the responsibility.
- B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on the drawings, or in the specifications, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.

1.18 WORKPLACE SAFETY

- A. The Trade Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods, and for any damage, which may result from their failure of their improper construction, maintenance, or operation.
- B. All Trade Subcontractors shall notify the General Contractor of any flammable, combustible and/or toxic materials intended for use on the project and shall furnish the General Contractor literature pertinent to the use and control of such materials.

1.19 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by the Architect or Engineer of record.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Unless otherwise indicated, the materials to be furnished under this contract shall be new and the standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest standard design that complies with the specification requirements.
- B. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise. An entire product line may be rejected if one or more of the products submitted is not an equal to that specified.
- C. All products shall be manufactured within the United States, unless specified otherwise, and supplied locally (within the State) wherever possible. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.
- D. Unspecified items shall be by the same manufacturer and level of quality and as similar items specified, whenever possible. Whenever items have no similarity to those specified in this section, provide the equivalent item as specified in other Division 15 Sections. When no similarity exists in other sections, the Contractor shall submit for review an appropriate commercial/institutional quality item, complete to perform the functions intended, using his best discretion. The Architect or a designated Consultant, not the contractor, shall make final determination whether materials are of suitable quality and perform the functions intended.

2.02 MOTORS AND ELECTRICAL WORK

- A. Provide and erect all motors, temperature controls, limit switches as specified.
 - 1. Power supply to switches, fused switches, outlets, motor starters, to line terminals of equipment, and all related wiring and fuses to properly connect and operate all electrical equipment specified shall be furnished and installed under Division 16, "ELECTRICAL" (Electrical Contractor). Coordinate all wiring between Mechanical/Plumbing and Electrical to provide a complete and operating system.
 - 2. All wiring provided under this section shall be in accordance with the latest rules and regulations of the National Fire Underwriters, National Electric Code, and Local Codes Division 16. Install all wiring under the supervision of the Electrical Contractor. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section.
 - 3. Temperature Control Systems: Electric wiring shall be furnished and installed by Temperature Control Contractor under supervision of Electrical Contractor. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section.
- B. All motors 1/2 HP and smaller shall be wired for 120 volt, 1 phase, 60 Hz; motors larger shall be wired for 208t, 3 phase, 60 Hz, unless specifically indicated otherwise.

2.03 PAINTING

Painting shall be provided for all steel/iron equipment supports, steel/iron fuel piping, exposed flanges, fittings and valves within boiler rooms, basements and outside and where specified elsewhere within this section. Painting shall consist of no less than two (2) coats of rust inhibiting paint, Rust'O'leum or approved equal. Paint shall be capable of withstanding temperatures of up to 250°F. Colors shall be as follows:

Equipment supports	Flat black
Fuel Gas Piping outside	Match exterior finish or per gas supplier requirements.

2.04 HANGERS AND SUPPORTS

A. General

1. All hangers and supports shall be especially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.
2. Piping specified herein shall not be supported from piping of other trades.
3. All steel hangers shall be factory painted.
4. Hangers shall be heavy-duty steel adjustable clevis type, plain for steel, cast iron and plastic pipe, and copper plated for piping in direct contact with copper tubing (i.e. copper hot water piping) shall be equal to Carpenter & Paterson Inc., Fig. 100 (Fig. 100CT copper plated).
5. Hangers shall go outside of insulation for cold water piping. Each hanger shall be furnished with metal shield; Fig. 100 SH.
6. Exposed vertical risers ¾ inch and smaller shall be supported at 6 foot intervals between floor and ceiling with split ring type hangers; copper plated for piping in direct contact with copper tubing equal to Carpenter & Paterson Inc., Fig.81 (Fig. 81CT copper plated). **ALL PIPING DROPS TO FIXTURES SHALL BE ANCHORED SOLID TO WALL WITH A STEEL SUPPORT BRACKET WITH ADJUSTABLE CLIP, ESPECIALLY PIPING TO FLUSH VALVES**
7. Piping suspended from walls and partitions shall be supported by steel support bracket with adjustable clips equal to Carpenter & Paterson Inc., Fig. 69. All attachments to bar joists shall be from top chord.

B. Hanger Rods & Attachments

1. Hanger rods shall be galvanized all thread rod. Rod size shall be as follows:

<u>Pipe Size</u>	<u>Rod Size</u>
3/8" to 2"	3/8"
2.1/2" to 3.1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

2. All nuts for hanger rods and hangers to be galvanized steel.
3. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks and compound anchor shields and bolts in poured concrete.
4. Provide toggle bolts with rod couplings for fastening in the pre-cast concrete plank decks.
5. Provide and install angle iron supports for pipe hangers in locations as required. Angle iron supports shall be adequate size for span and piping or equipment.
6. Hot and cold water piping at each fixture shall be securely fastened in wall with split ring type hanger fastened to studs within wall.

2.05 IDENTIFICATION

- A. Tag each new pump /equipment, and switch with 2½ inches x ¾ inch rectangular engraved nameplates with white letters on black, #2060-20 by Seton Name Plate Corp. or reviewed equals. Nameplates shall be mechanically fastened to equipment (adhesives are not acceptable). Embossed labels are not acceptable.
- B. Identify all new water and drain piping with “Set Mark” snap-around pipe markers by Seton Name Plate Corporation or reviewed equal. Markers shall include both identification and arrows indicating direction of flow. Markers shall be placed on pipe segments 5 feet and longer, and spaced no less than 10 feet apart. Heating hot water piping shall be labeled differently from Domestic hot water piping. On parallel runs of piping, plumbing markers shall be grouped together, and grouped with heating markers whenever practical.

<u>Legend</u>	<u>Background/Letter Color</u>
“Cold Water”	Green/ white letters
“Domestic 120°F Water”	Yellow/ black letters
“Domestic 120°F Return”	Yellow/ black letters
“Domestic 140°F Water”	Yellow/ black letters
“Plumbing Vent”	Green/ white letters
“Sanitary Drain”	Green/ white letters
“Roof Drain”	Green/ white letters

- C. Tag all new valves with Seton #M4506 1½ inch square brass tags and #6 bead chains, stamped with the following identification: “CW”, “HW”, “HWR” or “140HW”. Tag shall be consecutively numbered. DO NOT DUPLICATE EXISTING VALVE IDENTIFICATION NUMBERS. Fixture stops, control valves or valves adjacent to equipment, the use of which is obvious, are not to be tagged.
- D. Provide valve charts identifying valve number, valve identification and service (i.e. Apt. 203, HW). Mount charts in Boiler Room and Mechanical Room in 8½ inch x 10 inch and 8½ inch x 11 inch self-closing aluminum frame with plastic windows. Provide additional copies for maintenance manuals.

2.06 INSULATION

A. Insulation shall be provided for water piping, except exposed connections to fixtures. Insulation systems shall have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less.

B. Cold Water

1. Insulate all cold water piping above grade with a minimum one half (1/2) inch thick fiberglass heavy density sectional pipe insulation system with minimum of 7 lb. density and 450° temperature rating having a factory applied vapor barrier laminate all service ASJ jacket. Insulation jacket to have pressure sealing lap adhesive. Provide additional sealing of jacket with flare type stainless steel staples. Staples shall not penetrate more than 1/2 the insulation thickness.
2. Shields of 28 gauge metal approximately 8 inches long and forming an arc of approximately 120 degrees to fit insulation shall be provided at each hanger for cold water piping. Shields to be provided by this Contractor. Hangers shall be provided large enough to be outside covering.

C. Hot Water & H.W. Recirculating

Insulate all hot water piping with 1-inch thick fiberglass heavy density sectional pipe insulation system and a 450° temperature rating with all service ASJ jacket. Longitudinal jacket flaps to be secured with flare type staples. For Recirculating return piping may use 1/2" thick insulation as specified above.

D. Fittings

1. All fittings and valves shall be covered with a one piece PVC insulated fitting cover secured.
2. The ends of insulation on exposed pipes at valves, flanges, unions, etc., shall be finished neatly with covering to match jacket and secure with mastic.
3. Valves, flanges and unions on hot water piping shall not be insulated.

E. Installation

All insulation work shall be executed by skilled insulation workmen regularly in the trade.

F. Covering

Wherever insulation is exposed in finished areas, it shall be carefully and neatly covered with a white PVC plastic covering material. Covering shall be applied in no less than 4 foot lengths with shingle joints. Longitudinal joints shall be on the top or back sides so as to be out of sight and sealed with adhesive materials provided with the jacketing. Material shall be butted to finish walls or Insulation. Jacketing material shall be Zeston pre-cut, pre-curved 0.030 thickness. Or reviewed equal.

2.07 VALVES

A. General

1. Valves shall be provided as shown and as required to make the installation and its apparatus complete in operation; locate to permit easy operation, replacement and repair.
2. All valves must be so constructed that they may be repacked under pressure while open.
3. Check valves shall be installed in all lines where flow may reverse from intended direction.
4. Valves shall have name and/or trademark of manufacturer as well as working pressure stamped or cast on valve body.
5. Valves shall comply with Manufacturer’s Standards Society (MSS) specifications and be so listed.

B. Types and Manufacturers

All valves shall be of one manufacturer and by one of the manufacturers listed. The following list is provided as a means of identifying the quality and type required.

1. Gate Valves 3 inches in size and smaller

Shall have bronze bodies, rising stem, solid wedge, union bonnet, rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1169	1151
Stockham	B-124	B-120
NIBCO	S-134	T-134
Hammond	IB648	IB629

2. Globe Valves 2 inches in size and smaller

Shall have bronze bodies, union bonnet, renewable composition disc for service intended, rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1590-T	590-T
Stockham	B-24-T	B-22-T
NIBCO	S-235-Y	T-235-Y
Hammond	IB423	IB413T

3. Angle valves

Same general description and manufacturers as globe valves above, only outlet at 90 degree angle from inlet.

4. Ball valves 1¼ inches in size and smaller

Shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blowout proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "full port". Rated for 400# WOG and 350°F:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	BA-350S	BA-300S
Apollo	82-200	82-100
Watts	B-6081	B-6080
NIBCO	-----	-----
Hammond	8614	8604

5. Ball valves 1½ inches in size and larger

Shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blowout proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "conventional port". Rated for 400# WOG and 350°F:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Apollo	70-200	70-300
Watts	B-6000-SS	B-6001-SS
NIBCO	S-585-66	T-585-66
Hammond	8514	8503

6. Check Valves 2 inches in size and smaller

Shall be horizontal swing type with bronze body, Teflon disc. Rated for 125# WSP, 200# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1509-T	509-T
Stockham	B-310-T	B-320-T
NIBCO	S-413-Y	T-413-Y
Hammond	IB945	IB904

7. Spring loaded check valves 2" and smaller:

Bronze body, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, Teflon seat unless only bronze available.

	<u>Solder or Screwed Ends</u>
ConBraCo	61 series
Grinnell	3600SJ
Mueller	203BP
Nibco	S480Y
Val-Matic	S1400 series.

8. Drain Valves

Shall be conventional ball valves and provided with hose nipples and threaded metal cap on chain. Watts B-6001-CC or reviewed equal.

9. Balancing Valves

Shall be Watts CSB-61-S. For ¾" pipe, initially set dial at 30. For ½" pipe initially set dial at 60. Or reviewed equal.

2.08 DOMESTIC WATER PIPING

A. Water and Fire Service Lines

1. Provide water and fire service lines from where the site work ends. Coordinate interface with site utilities. Match site work materials until inside building.

B. Interior

1. All hot and cold water piping above finish floor (not buried) shall be Flowguard Gold CPVC pipe and fittings. PEX may not be substituted.
2. All buried and underfloor trap primer piping shall be type "K" soft copper tubing. No joints below.
3. All exposed, uninsulated water piping in finished areas shall be chromium plated I.P.S. copper or red brass pipe or tubing and fittings. Valves shall also be chrome plated brass or bronze. Any chrome trim with wrench marks shall be removed and new trim installed.
4. Type of tubing shall be stamped or printed on each length by Manufacturer.
5. Trap primer piping - in place of copper tubing from the trap primer outlet to the floor drain, contractor may use.

2.09 PIPE EXPANSION FITTINGS AND LOOPS

- A. Provide expansion loops on hot water supply (120 degrees and above) and recirculating return lines where shown and on any straight pipe lengths over 100 feet that occur as a result of relocating piping to meet field conditions. Loop shall be 2 feet by 4 feet offset, and located near center of length. Anchors shall be bolted collars held by angular braces in direction of piping near opposite ends of the pipe. Provide guides on each expansion joint.

2.10 STORM WATER, SANITARY WASTE AND VENT PIPING

A. Sump Pump Piping

All waste piping 1" size and smaller, not buried, shall be type "L" hard drawn copper tubing with drainage fittings made up with 95-5 solder. All exposed piping or tubing in finished areas shall be chrome plated copper or brass. All chrome trim with wrench marks shall be removed and new trim installed.

B. Vent Piping, and Underslab Storm water and Sanitary Waste Piping

All piping and fittings shall be PVC Schedule 40 polyvinyl chloride plastic, as per ASTM-A-2665 or latest standard. Solvent as per ASTM-D-2564. Exposed vent piping above roof shall be **black** PVC or CPVC for appearance and solar heat dissipation of frost.

C. Storm water and Sanitary Waste, Second Floor and Above

For sound attenuation, all sanitary waste pipe and fittings, shall be standard weight cast-iron, conforming to Commercial Standards CS188-66. Fittings shall be cast-iron, no-hub ASA Group 022 pipe, complete with neoprene elastomer, corrosion-resistant stainless steel shield and clamping assemblies conforming strictly to ASME Standard C654 and requirements of CISPI Standard 310.

Substitution with PVC piping, or other piping system with inferior sound deadening characteristics, is not allowed. Substitution of piping system with equal or superior sound deadening characteristics can be submitted for review provided it is accompanied by:

1. Manufacturer's literature citing proof of acoustic properties by an independent laboratory testing agency.
2. Shop drawings showing how the new piping assembly, with any sound insulation required, can be fitted into the designated wall or space. Note: any preparation of sketches or engineering time required by a consultant for this, shall be reimbursed by this contractor.
3. Shop drawings showing the fire stopping system used and/or how the piping transitions through fire rated walls.
4. A proposal for sizeable credit. Note: proposal must also detail the cost of any related changes required by other trades, such as adding insulation or fattening of walls, to accommodate the proposed change. Any related charges that arise after the change order is approved, shall be paid by this contractor, at no additional cost to the owner.

2.11 PIPE SLEEVES AND ESCUTCHEONS

A. Sleeves

1. Contractor shall set sleeves for all piping penetrating walls and floors. Sleeves through masonry shall be steel pipe sleeves two sizes larger than pipe. Piping passing through walls other than masonry shall be provided with # 24 gauge galvanized steel tubes with wired or hemmed edges.
2. Sleeves set in concrete floors shall finish flush with underside, but extend minimum of 1 inch above finish floor. Weld clips to sleeves for support in concrete pre-cast planks of a size that will be covered by concrete topping. Sleeves set in partitions shall finish flush with each side.
3. Space between sleeves and pipes shall be sealed to make smoke and water tight with 3M Brand Fire Barrier Caulk CP25 or Putty 303.

4. Masonry sleeves shall be Schedule 40 steel pipe.
5. This Contractor has the option to use the Pro-set system on lieu of the above.

B. Exterior Sleeves

Where piping passes through exterior walls, provide and install a complete pipe sleeve/hydrostatic wall closure system.

1. Wall sleeve shall be schedule 40 steel pipe, two pipe sizes larger than carrier pipe. Sleeve shall be the same length as the thickness of the wall served.
2. The hydrostatic closure device shall consist of identical interlocking links of solid synthetic rubber compounded to resist ozone, water, chemicals and extreme temperature variations. Each link shall be connected by corrosion resistant bolts and nuts to form a belt that is to fit snugly around the pipe. Under each bolt and nut there shall be a metal pressure plate so that when each nut is tightened the rubber links will expand between the pipe and sleeve to form a continuous, air tight and water tight seal.
3. Units to be Link-Seal system Model LS wall seal by Thunderline Corp. or reviewed equal.

C. Escutcheons

Where piping passes through finish walls, floors, ceilings and partitions, provide and set two piece nickel plated steel floor and ceiling plates.

2.12 PLUMBING FIXTURES

A. CD-1 Clothes Dryers, Stacked - gas connection.

Provide two (2) flex gas connectors and gas cocks. Appliance by G.C.

B. CW-1 Clothes Washer Supply and Drain Unit.

Guy Gray WB-200 recessed supply and drain unit for automatic washers, ½" Watts Duo-cloz valve, 2" drain, white enameled steel. Or approved equal. Appliance by G.C.

C. DW-1 Dishwasher, Under Counter

Appliance by G.C. Install with all required accessories.

D. LV-1 Lavatory, Countertop

1. AMERICAN STANDARD 476.028 Aqualyn Countertop Lavatory, oval, vitreous china, self rimming, front overflow, faucet ledge, holes on 4" centers, color "white". Or reviewed equal. Counter by G.C.
2. Moen model 8414, commercial brass, single handle lavatory faucet, 4" centers, ceramic control components, aerator, pop-up drain assembly, chrome, meets ADA. Change out aerator with Moen 0.5 GPM to 1 GPM model. Or reviewed equal.

3. McGuire chrome 17 ga. P-trap. Pair of chrome plated angle supplies, wheel stops, wrought (not bell) escutcheons. Or reviewed equal.
- E. LV-2 Lavatory, Countertop – Adaptable
1. AMERICAN STANDARD 476.028 Aqualyn Countertop Lavatory, oval, vitreous china, self rimming, front overflow, faucet ledge, holes on 4” centers, color “white”. Or reviewed equal. Counter by G.C.
 2. SYMMONS Symmetrix S-20-2-FR single handle lavatory faucet, 4” centers, ceramic control components, aerator, pop-up drain assembly, chrome, meets ADA, 0.5 GPM flow restrictor. Or reviewed equal.
 3. McGuire Prowrap insulated P-trap and supply covers, chrome plated angle supplies, wheel stops, wrought (not bell) escutcheons. Or reviewed equal.
 4. Installation note: as the sink cabinet will be designed to have the front removable, care must be taken not to install any piping in such a manner that would cause an obstruction to this or to full wheelchair access.
- F. LV-3 Lavatory, Wall Mounted - ADA
1. AMERICAN STANDARD 955.000 Murro Universal Design wall hung lavatory, for concealed arm support, 4” center holes, vitreous china, rear overflow, self draining deck, color “white”. 0059.020 shroud/Knee Contact Guard, vitreous china. Or reviewed equal.
 2. SYMMONS Symmetrix S-20-2-FR single handle lavatory faucet, 4” centers, ceramic control components, aerator, pop-up drain assembly, chrome, meets ADA, 0.5 GPM flow restrictor. Or reviewed equal.
 3. McGuire chrome plated, 17 Ga P-trap, chrome plated angle supplies, wheel stops, wrought escutcheons. Or reviewed equal. Must fit inside shroud/knee guard.
- G. MB-1 Mop Basin
1. The mop basin shall be Fiat MSB-2424, molded stone or reviewed equal. The molding shall be done in matched metal dies under heat and pressure resulting in a one-piece homogeneous product. Size of unit shall be 24”x24”x10” high.
- The drain body shall be cast brass, chrome plated, complete with cast brass lock nut and gaskets. A combination dome strainer and lint basket made from #302, 16 gauge stainless steel attached with tamper proof screws shall be included. The drain body shall provide for a lead caulked joint to be 3” I.P.S.
- Provide the following accessories:
- a. Stainless steel wall guard, MSG-2424
 - b. Service faucet with vacuum breaker; integral stops and wall brace plate #830-AA.
 - c. 30” Hose with ¾” coupling at one end; Plate #832-AA.

- d. Mop Hanger, stainless steel, 24" long with (3) holders, Plate #889-CC.
- e. Silicone sealant #833-AA.
- f. Vinyl bumper guard #-77-AA.

H. SH-1 Shower, Roll-in, Right Hand – ADA

- 1. Enclosure shall be Comfort Designs prepackaged model 64371, gel-coated fiberglass, right hand unit, open top, 1/2" threshold at finished floor, outside dimensions 63" x 38-1/2" x 80-3/4", 1/2" tri-cell honeycomb wall construction, textured floor, molded soap ledges, smooth tile pattern, color white, 3 year warranty. Accessories: Factory mounted 1-1/4" comfort care white grab bars, 500 lb. capacity HDP plastic fold-up seat (on left hand side), no-caulk brass drain with stainless steel strainer, stainless steel curtain rod, 1" white self adhesive collapsible dam, heavy duty weighted shower curtain. Suggest optional "Easy base". Or reviewed equal.
- 2. Symmons 4000-X Temptrol single lever blade handle pressure balanced valve with integral service stops. 4403 Carrington trim, chrome. Euro-Flow H321-V-30-2.0 hand held shower with 5' metal hose with integral vacuum breaker, 30" bar, 2 GPM flow rate restrictor. Or reviewed equal. Mount bar centered on right hand wall with bottom of bar at approximately 48". Center valve 10"-12" from front of unit and 42"-44" height". Install hose wall connection centered on bar at opposite side from valve.
- 3. Provide heavy duty chrome brass roller ball curtain rings available from www.clawfootsupply.com. Or reviewed equal.

I. SH-2 Shower, Roll-in, Left Hand – ADA

- 1. Enclosure shall be Comfort Designs prepackaged model 64371, gel-coated fiberglass, left hand unit, open top, 1/2" threshold at finished floor, outside dimensions 63" x 38-1/2" x 80-3/4", 1/2" tri-cell honeycomb wall construction, textured floor, molded soap ledges, smooth tile pattern, color white, 3 year warranty. Accessories: Factory mounted 1-1/4" comfort care white grab bars, 500 lb. capacity HDP plastic fold-up seat (on right hand side), no-caulk brass drain with stainless steel strainer, stainless steel curtain rod, 1" white self adhesive collapsible dam, heavy duty weighted shower curtain. Suggest optional "Easy base". Or reviewed equal.
- 2. Symmons 4000-X Temptrol single lever blade handle pressure balanced valve with integral service stops. 4403 Carrington trim, chrome. Euro-Flow H321-V-30-2.0 hand held shower with 5' metal hose with integral vacuum breaker, 30" bar, 2 GPM flow rate restrictor. Or reviewed equal. Mount bar centered on left hand wall with bottom of bar at approximately 48". Center valve 10"-12" from front of unit and 42"-44" height". Install hose wall connection centered on bar at opposite side from valve.
- 3. Provide heavy duty chrome brass roller ball curtain rings available from www.clawfootsupply.com. Or reviewed equal.

- I. SK-1 Sink, Single Bowl – Adaptable
1. Elkay LRAD-2522-65-4 single bowl stainless steel sink, 21" x 16" x 6-1/2" bowl, 18 gauge, type 302 SS, self-rim, satin finish, sound guard undercoating, 4 hole drilling. LK-35 Standard strainer. Or reviewed equal.
 2. SYMMONS Symmetrix S-23-3 single handle kitchen faucet with hose and spray mounted on escutcheon, 8" centers, ceramic control components, aerator, chrome, meets ADA, or reviewed equal.
 3. McGuire Prowrap insulated 1-1/2" P-trap and supply covers, chrome plated angle supplies, wheel stops, wrought escutcheons. Or reviewed equal.
 4. Installation note: as the sink cabinet will be designed to have the front removable and the counter height adjustable, care must be taken not to install any piping in such a manner that would cause an obstruction to this or to full wheelchair access.
- J. SK-2 Sink, Single Bowl - ADA
1. Elkay LRAD-2522-65-4 single bowl stainless steel sink, 21" x 16" x 6-1/2" bowl, 18 gauge, type 302 SS, self-rim, satin finish, sound guard undercoating, rear drain, 4 hole drilling. LK-35 Standard strainer. Or reviewed equal.
 2. SYMMONS Symmetrix S-23-3 single handle kitchen faucet with hose and spray mounted on escutcheon, 8" centers, ceramic control components, aerator, chrome, meets ADA, or reviewed equal.
 3. McGuire Prowrap insulated 1-1/2" P-trap and supply covers, chrome plated angle supplies, wheel stops, wrought escutcheons. Or reviewed equal.
- K. TS-1 Tub / Shower – Right Hand – ADA Adaptable
1. Enclosure shall be Comfort Designs prepackaged model 6032GTS1, drain on right hand side, gel-coated fiberglass, right hand valve, open top, 18" max height tub at finished floor, outside dimensions 60" x 33" x 77", 1/2" tri-cell honeycomb wall construction, textured floor, molded soap ledges, smooth tile pattern, color white, 3 year warranty. Accessories: Factory installed blocking on areas required for future ADA grab bars, heavy duty shower curtain, stainless steel curtain rod. Or reviewed equal.
 2. Symmons S-4404-X Temptrol single lever blade handle pressure balanced valve with integral service stops, tub filler spout, integral diverter, S-4404 Carrington trim, chrome. Euro-Flow H321-V-30-2.0 hand held shower with 5' metal hose with integral vacuum breaker, 30" bar, 2 GPM flow rate restrictor. Or reviewed equal. Mount bar centered on left hand wall with bottom of bar at approximately 46". Center valve 10"-12" from front of unit and 28" height". Install hose wall connection centered on bar at opposite side from valve. Set adjustable limit stop screw to 110 degrees.
 3. McGuire 1221TL22, height 12 to 14", chrome plated brass commercial bath waste and overflow, trip lever, flat strainer, 17 gauge tubing.

L. TS-2 Tub / Shower – Left Hand – ADA Adaptable

1. Enclosure shall be Comfort Designs prepackaged model 6032GTS1, drain on left hand side, gel-coated fiberglass, left hand valve, open top, 18" max height tub at finished floor, outside dimensions 60" x 33" x 77", ½" tri-cell honeycomb wall construction, textured floor, molded soap ledges, smooth tile pattern, color white, 3 year warranty. Accessories: Factory installed blocking on areas required for future ADA grab bars, heavy duty shower curtain, stainless steel curtain rod. Or reviewed equal.
2. Symmons S-4404-X Temptrol single lever blade handle pressure balanced valve with integral service stops, tub filler spout, integral diverter, S-4404 Carrington trim, chrome. Euro-Flow H321-V-30-2.0 hand held shower with 5' metal hose with integral vacuum breaker, 30" bar, 2 GPM flow rate restrictor. Or reviewed equal. Mount bar centered on left hand wall with bottom of bar at approximately 48". Center valve 10"-12" from front of unit and 42"-44" height". Install hose wall connection centered on bar at opposite side from valve. Set adjustable limit stop screw to 110 degrees.
3. McGuire 1221TL22, height 12 to 14", chrome plated brass commercial bath waste and overflow, trip lever, flat strainer, 17 gauge tubing.

M. WC-1 Water Closet, Floor

1. AMERICAN STANDARD 2018.212 Champion 15-1/4", Elongated Toilet, vitreous china, 1.6 GPF, 3" non-adjustable flapper-free flush valve, siphon jet action, left handed side mounted trip lever, close coupled tank, bolt caps, fully glazed trapway, color "white", 10 year warranty. Or Reviewed equal, if any.
2. AMERICAN STANDARD 5311.012 Laurel elongated molded closed front seat with cover, commercial duty, stainless steel bolts. Or reviewed equal by Church, or Beneke.
3. McGuire chrome water closet supply with wheel handle stop. Or reviewed equal.
4. To minimize invert drop for water closets with cast-iron piping, use a push-on closet flange with a plain end closet bend. Tyler Pipe or reviewed equal.

N. WC-2 Water Closet, Floor – ADA

1. AMERICAN STANDARD 2002.012 Champion Right Height, 16-1/2", Elongated Toilet, vitreous china, 1.6 GPF, 3" non-adjustable flapper-free flush valve, siphon jet action, left handed side mounted trip lever, close coupled tank, bolt caps, fully glazed trapway, color "white", 10 year warranty. Or Reviewed equal, if any.
2. AMERICAN STANDARD 5311.012 Laurel elongated molded closed front seat with cover, commercial duty, stainless steel bolts. Or reviewed equal by Church, or Beneke.
3. McGuire chrome water closet supply with wheel handle stop. Or reviewed equal.

4. To minimize invert drop for water closets with cast-iron piping, use a push-on closet flange with a plain end closet bend. Tyler Pipe or reviewed equal.

O. WC-3 Water Closet, Floor – ADA

Same as WC-2 except order with alternate tank configuration 4260.800 with trip lever located on right side.

2.13 EQUIPMENT OR PLUMBING FIXTURES BY OTHERS

Any equipment and fixtures by other sections will be provided and set in place by those sections. This contractor will connect gas, domestic hot water, waste and vent as required.

A. Hot water storage tank

1. Tank is provided and set in place by Section 15600. Provide and connect all domestic water piping, fittings, valves, and pumps as shown on drawings.
2. Water temperature in storage tank shall be 140° F. Water temperature to most fixtures shall be 120° F. set by thermostatic mixing valve at tank.

B. Boiler

1. By Section 15600. Provide gas connection and water make-up as required.

2.14 PLUMBING SPECIALTIES, DRAINAGE

A. Carriers

1. Wall hung fixtures including water closets, lavatories, lav-decks and drinking fountains shall be supported with adjustable floor mounted carriers to fit building conditions, piping system, and fixtures specified. Each carrier shall be provided with a wall finishing frame. All carriers shall be secured to the floor with tie down lugs.
2. Carriers shall be as manufactured by Watts or reviewed equal by Zurn, Smith, Josam or Wade.

B. Traps

1. Traps of material and design as approved by the State and shall be furnished and installed at all fixtures and appliances. Trap each fixture separately, keeping all trap screws below water line; vent each trap. Make offsets in vent piping with 45-degree angle fittings when possible. Pitch horizontal vents toward waste lines, group vents and take through roof as shown. All traps, at fixtures and appliances shall be provided with accessible clean outs.
2. All traps under sinks and lavatories, and all piping and fittings shall be chrome-plated.

C. Cleanouts

Provide cleanouts for soil and waste where shown on the drawings and as required by code.

1. Floor Cleanouts (FCO)

All floor cleanouts in concrete or tile shall be flush with finish floor.

a. Type "1", Round, recessed for 1/8" tile

Zurn ZN-1400-BP-X-K, nickel bronze rim, bronze plug, anchor flange.

NOTE: Coordinate tile insert with tile installer at time of floor installation. Adjust height of rim to the thickness of the tile to be used so that it will be flush with the finished floor and oriented correctly before the tile installer arrives. Failure to prepare or coordinate properly will result in this contractor paying for the call-back of the tile installer at no additional expense to the Owner.

b. Type "2", Round, for unfinished areas

Zurn Z-1400-BP-K, cast iron top, bronze plug, anchor flange.

c. Type "3", Round, for Carpet with marker

Zurn ZN-1400-CM-BP-K, carpet marker, nickel bronze, bronze plug, anchor flange.

d. Type "4", Cleanout to grade

Zurn Z-1474 Duracoated cast iron. Cleanout plug shall be Zurn Z-1449-BP cleanout ferrule, cast iron with bronze plug. Or reviewed equal.

2. Wall Cleanouts

All wall cleanouts shall be Zurn Z-1445 cleanout tee with threaded plug. Polished nickel bronze cover, Zurn ZANB-1462 or reviewed equal by Watts, Smith, Josam or Wade.

3. Flashing

Flash each above grade floor clean out with Chloraloy® 240 thermoplastic elastomeric sheet membrane for concealed waterproofing, or other approved flashing material, extending 24" beyond perimeter of clean out and lock into clamping collar.

D. Floor Drains (FD)

1. All floor drains above grade shall be complete and each provided with flashing flange, flange device, and 24"x24", Chloraloy® 240 thermoplastic elastomeric sheet membrane for concealed waterproofing, or other approved flashing material, lock into drain clamping collar.

2. Traps for floor drains shall be deep seal traps. Those without trap seal primers shall be topped-off with 12 oz. of mineral oil to retard evaporation. Those in poorly heated areas, such as loading docks and penthouses, shall be filled with an undiluted non-toxic, non-corrosive antifreeze effective to at least -20 deg F.
 - a. Type "1" General. Round

Cast iron body, flashing collar, nickel bronze, 6" adjustable strainer head, inside caulk, trap primer connection. Zurn ZN-415-6B-P or equal by Josam, Wade or Smith.
 - b. Type "2" Indirect Waste w/ recessed grate

Cast iron body, flashing collar, polished bronze, 5" adjustable raised flanged grate, inside caulk, trap primer connection. Zurn ZB-415-5I-P or equal by Josam, Wade or Smith. Install with top of flange flush with floor so grate is recessed.
 - c. Type "2" Boiler Room

Cast iron body, flashing collar, sediment bucket, polished bronze, 7" adjustable deep flanged grate, inside caulk, trap primer connection. Zurn ZB-415-7N-P-Y or equal by Josam, Wade or Smith.

2.15 PLUMBING SPECIALTIES, WATER

A. Trap Primer (TP)

Furnish and install self-adjusting automatic trap primers equal to Model PR-500 as manufactured by Precision Plumbing Products Inc. Provide DU-2 distribution unit where indicated. Or reviewed equal. NOTE: As the trap primer may be on a line larger than 1/2", flow through type trap primers smaller than the pipe size are not acceptable.

B. Hose Bibs (HB)

1. Type "1" Exterior Hose Bib

Zurn Z-1321 exposed Ecolotrol "Anti-Siphon" automatic draining, non-freeze wall hydrant, integral backflow preventer, all bronze interior parts, operating key. Or reviewed equal.

C. Shock Absorbers (SA)

Shock protection shall be provided where shown on drawings and at all quick closing devices. Devices shall be stainless steel shell, welded expansion bellows surrounded by non-toxic mineral oil or gas, pressurized compression chamber charged and factory sealed, all, in-line design, threaded nipple and PDI reviewed. Sized to meet the conditions.

1. Type "1", 'A' P.D.I. units
Zurn Z-1700, #100. Or reviewed equal.
2. Type "2", 'B' P.D.I. units
Zurn Z-1700, #200. Or reviewed equal.

D. Thermometer (T)

Units to be dial type, 4.1/2" with 30° to 180° range; Trerice Universal angle or reviewed equal.

E. Pressure Gauge (P.G.)

Furnish and install pressure gauges with gauge cocks on piping where shown on drawings. The dial range shall be such that the normal pressure shall be approximately mid-way of dial. Gauges shall be Trerice No. 600 or equivalent by Weiss or Nurnburg, 4.1/2" dial size, cast aluminum case, with brass "T" handle cocks and No. 872 bronze pressure snubbers on water units.

F. Vacuum Relief Valve

Watts Model N36 or reviewed equal.

G. Backflow Preventers (BFP)

Provide and install all necessary components to provide protection against potentially hazardous backflow or back siphonage and the contamination of the potable water system at the required GPM demand. Unit shall be UL, USC, ASSE, 1APMD and AWWA approved.

1. Type "1", Entrance

Watts 909M1QT-S reduced pressure zone backflow preventer, 2", quarter turn full port ball valves, strainer, 8 psi fall-off at 85 GPM. Airgap Watts 909-AGF. Or reviewed equal.

2. Type "2" Mechanical Equipment

Watts #9DM2 double check with atmospheric port, or reviewed equal.

H. Mixing Valves (MV)

1. Type "1" Master Mixer

Symmons thermostatic mixing valve Model 5-700, inlet size 1-1/4", outlet size 1.1/2" capacity 43 GPM @ 10 psi differential pressure for exposed piping, solid bi-metal thermostat scale hot to cold, rough bronze, check stops, set at 120°F. Or reviewed equal.

I. Expansion Tank

Watts Model DETA-30. Potable water expansion tank, 15 gallon, 10.5 gallon acceptance, 1" connection, precharged to 40 psi. Or reviewed equal.

J. Relief Valve

Watts #530 calibrated pressure relief valve. Set at 100 PSI. Or reviewed equal.

K. Braided Stainless Steel Water Connectors

EPDM tubing jacketed by type 304 stainless steel braid, stainless ferrule, brass nuts. By Zurn or reviewed equal.

L. Dielectric Unions

Series 3000 as manufactured by Watts or reviewed equal.

M. Meter

Provide a meter that meets the criteria of the local water district and has remote reader.

2.16 SUMP PUMP (SP)

A. Type 1, Elevator Pit

Stancor model SE-50 sump pump with oil minder probe and alarm, ½ hp 115 V, 1 phase, 8 amps, or reviewed equal.

2.17 DOMESTIC HOT WATER CIRCULATOR PUMPS (DCP)

A. Circulators

Provide and install in-line all bronze, corrosion proof, circulating pump on hot water circulating lines with capacity as shown on the drawings. Unit to be provided with internal overload protection.

1. Type 1 – 120 deg System

Circulator to be Taco Mode 008, bronze construction, ¾" union ends, 7 GPM at 10 ft. head, 1/25 HP, 115V/60/1 or reviewed equal.

B. Control – Manual shut-off switch; pump to run continuously.

C. All power wiring and manual power switch with indicator light shall be provided and installed by Division 16.

2.18 ACCESS DOORS AND PANELS

A. Furnish General Contractor with access doors/ panels for all locations where service access is required behind walls, above sheetrock and masonry ceilings, and below floors for

equipment, piping, valves, and specialties furnished under Division 15.

- B. Shall be located in closets, storage rooms and/or other non-public areas whenever possible, in a workmanlike manner, positioned so that junction can be easily reached and the size shall be sufficient for this purpose (minimum 12 inches by 16 inches). When required in corridors, lobbies or other habitable areas, they shall be located as directed by the Architect.
- C. Access panels shall be as manufactured by Inland Steel Products Company "Milcor", Walsh-Hannon-Gladwin, Inc., "Way-Loctor", or reviewed equal. Types shall be as follows:
- D. Units shall have 16-gauge steel frame and 14-gauge steel hinged door panel. Door shall have concealed spring hinges allowing door to be opened to 175° and with cylinder locks.
- E. Units shall be factory primed for field painting by Section 09900.
- F. Install UL-rated 1-1/2 hour Class B access panels where required to comply with applicable Code requirements (i.e. at all vertical chases penetrating floor levels with access doors required for service, etc.).

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that plumbing may be installed in strict accordance with all pertinent codes and regulations and the reviewed Shop Drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.02 COORDINATION WITH OTHER TRADES

A. Before installation, participate in a coordination meeting with the Clerk of the Works, General Contactor, Mechanical/HVAC, Fire Protection and Electrical trades. Establish and resolve areas of conflict and congestion, especially those indicated on the drawings. Priority to be given to HVAC equipment and large ductwork, then gravity piping, then small ductwork, then piping based on descending order of size. Special consideration given to allow access to valves, dampers etc. Mutually develop coordination sketches documenting space allocation and provide copies to all effected trades.

B. Failure to coordinate will result in this contractor removing and relocating his piping at no additional expense to the owner.

3.03 INSTALLATION OF PIPING AND EQUIPMENT

A. General

1. Install all piping promptly, making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
2. Provide uniform pitch of at least ¼ inch per foot for all horizontal waste and soil piping 3" or less. For piping 4" and above, slope at 1/8" minimum per foot
3. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the jobs site.
4. Install pipes to clear all beams and obstructions. Do not cut into or reduce the size of load carrying members without the approval of the Architect.
5. Plumbing vents
 - a. Back vent all plumbing fixtures.
 - b. Pitch all vents at 1/32" per foot minimum toward waste lines for proper

- c. drainage to prevent unintended traps.
- c. Install vent piping with each bend 45 degrees minimum from the horizontal, wherever structural conditions will permit.
- d. Group plumbing vents and take through roof as shown.
- e. Increase vents 3" and smaller one size before going thru roof. Make size transition a minimum of 12" below the surface of flat roofs and 72" (or as structure permits) below sloped roofs.
- f. Terminate 18" to 24" above roof.
- g. If installing in locations other than as shown on the drawings, line up with other plumbing vents for a neat appearance.
- h. Do not install plumbing vents within 10 feet of an operable window or door or within 25 feet of a ventilation air intake.

6. All risers and off-sets shall be substantially supported.

7. Pipe hangers shall be placed on center as follows:

<u>MATERIAL</u>	<u>HORIZONTAL</u>	<u>VERTICAL</u>
Cast-iron	At joints not to exceed 10'	15' or at each story whichever is less, and stacks at the base
Copper 1-1/4" & less	6'	6'
1-1/2"	6'	10'
2" & up	10'	10'
PVC, DWV	4'	4'
Steel	10'	10'

8. Arrange all piping to maintain required grade and pitch to lines to prevent vibration. Expansion loops to anchors shall be provided where shown on drawings.

9. Make all changes in pipe size with reducing fittings.

10. All low points in water piping shall be drained with 1/2" gate valve with hose nipple and metal cap.

11. No piping shall be installed in such a manner to permit back-siphonage or flow of any liquid in water piping under any conditions.

12. No water piping shall be installed outside of building or in an exterior wall unless adequate provisions are made to protect such pipe from freezing.

13. All piping and drain openings left unattended will be capped, plugged or securely covered to prevent accidental entry of foreign matter. Roof drains in use will be provided with domes.

B. Joints and Connections

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside the fittings; use graphite on all clean out plugs. DO NOT use Teflon tape on gas piping.

2. Smoothly ream all cut P.V.C. pipe. Clean and use solvent for fitting connection and

in strict accordance with the manufacturer's recommendations.

3. Make all joints in copper water tube with solder applied in strict accordance with the manufacturer's recommendations.
- C. Coordinate with the General Contractor to depress the finished floor where indicated on drawings. Install floor drains at low points of surface areas to be drained. Adjust grates of drains 1/32" below finished floor, unless otherwise indicated. Finished floor shall be depressed according to the following drainage area radii:
1. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 2. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 3. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3.04 STERILIZATION AND FLUSHING OF PIPES

- A. After preliminary purging of the system, chlorinate the new potable water system in accordance with the current recommendations of the American Water Works Association, and in accordance with all pertinent codes and regulations. Chlorinate only when the building is unoccupied.
- B. Upon completion of the sterilization, thoroughly flush the entire potable water system.
- C. After sterilization and flushing are complete, a sample shall be collected from the end of the longest main, or at any other location selected by the Architect, and a water analysis test provided. The test must prove the water acceptable or additional disinfecting of system performed. A copy of the test report shall be submitted to the Architect.

3.05 CLOSING IN UNINSPECTED WORK

- A. Do not cover up or enclose work until it has been properly and completely inspected and approved.
- B. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect and at no additional cost to the Owner.

3.06 TESTING OF PIPING

Tests shall be applied to the plumbing installation as required by codes and where as directed by the Architect, and in all cases before work is covered by earth fill or pipe covering.

- A. Sanitary piping shall be tested when all underground work is complete (before covering) and again, after all piping is installed, but before it is further closed in. Sanitary systems shall be securely stopped, except at the highest point, and the entire system filled with water to the point of overflow for 24 hours. All leaks shall be repaired. Cracked pipes and fitting shall

be removed and replaced. No doping of soil pipe or fittings will be allowed. Plan testing around expected weather and temperature conditions or provide protection so that pipes do not freeze.

- B. New domestic water piping shall be filled and subjected to a hydrostatic pressure test of 150 psi for 8 hours with no leaks. If leaks are detected they shall be repaired and the test repeated until work is tight. NOTE: Testing with compressed air only is NOT ACCEPTABLE.
- C. Testing of Fuel Gas piping shall conform to NFPA 54. Testing of natural gas piping shall also conform to the requirements of the gas supplier.

3.07 CLEANING

- A. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the this installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item, being careful to avoid all damage to finished surfaces. Additional attention may be required to thoroughly clean any used, re-used or owner provided fixtures.
- B. Clean out all strainers and aerators and adjust or replace washers, cartridges, etc

3.08 INSTRUCTIONS

On completion of the job, this Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The time of instruction shall be arranged with the Owner.

3.09 RECYCLING

Discarded materials, both new and removed, shall be recycled whenever practical through metal salvage dealers (piping, etc.), paper salvage (cardboard shipping containers, etc.), wood products, etc. The Plumbing Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

3.10 HAZARDOUS MATERIALS

Mercury or any other material deemed by the Federal Environmental Protection Agency or the State Department of Environmental Protection to be hazardous shall not be used in any components of the plumbing systems.

END OF SECTION 15400



**SECTION 15600
MECHANICAL**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

1.02 ALTERNATES

There are alternates that apply to this section of the project. See Part 4, "ALTERNATES".

1.03 INTENT

It is the intent of the drawings and specifications to provide for the installation of heating and ventilating systems which are safe, quiet, and economical in operation and complete in all respects. The heating system will provide a uniform temperature of 70 degrees F. in all living spaces as may be noted on the drawings, when the outside temperature is -2 degrees F. All materials and equipment necessary to accomplish the intent shall be furnished and installed by the heating (mechanical) contractor.

1.04 DEFINITIONS

ATC Automatic Temperature Control
EC Electrical Contractor (Division 16)
GC General Contractor
HC Heating (mechanical) Contractor
PC Plumbing Contractor

1.05 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation and perform all operations required to install complete heating and ventilating systems in the buildings, in accordance with these specifications and applicable drawings.
2. All temperatures are expressed in degrees Fahrenheit.
3. Work to be performed shall include, but is not limited to, the following:
 - a. Provide and install forced hot water heating system in building areas indicated on drawings.
 - b. Provide and install exhaust systems in building areas indicated on drawings.
 - c. Pipe, valve and fittings
 - d. Hot water specialties
 - e. Circulating pumps and boiler work
 - f. Radiation
 - g. Unit heaters and cabinet unit heaters

- h. Insulation
- i. Fans
- j. Sheetmetal
- k. Temperature control
- l. Tests and balance

- 4. Specifications and accompanying drawings do not indicate every detail of pipe, valves, fittings, hangers, ductwork and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.
- 5. Before submitting proposal, Mechanical Contractor shall be familiar with all conditions. Failure to do so does not relieve Mechanical Contractor of responsibility regarding satisfactory installation of the system.
- 6. Mechanical contractor shall be responsible for rigging to hoist his own (and his sub-contractors') materials and equipment into place.
- 7. Mechanical contractor and his sub-contractors shall be responsible for start-up of all equipment provided under this section.

B. Related Work Described Elsewhere

- 1. Excavation and backfill
- 2. Cutting and patching
- 3. Firestopping between building construction and pipe sleeves and between building construction and ductwork, Section 07900.
- 4. Electrical conduit and wiring, except as noted below
- 5. Roofing, curbs, curb openings and framing of openings.
- 6. Setting of sleeves in masonry work (sleeves provided by Mechanical Contractor)
- 7. Door louvers
- 8. Finish painting, Section 09900
- 9. All finish work

C. Commissioning

- 1. A commissioning agent has been retained by and works directly for the Owner. The commissioning agent's responsibility shall include ensuring the mechanical systems function as designed. A full scope of the agent's duties may be provided on request.
- 2. This contractor shall provide documentation on mechanical equipment that may be requested by the commissioning agent with notification provided to the Architect of such.
- 3. Should the commissioning agent requested changes or alterations to the mechanical systems, said changes or alterations must be authorized by the Architect or Engineer of record prior to work. See part 1.19, "CHANGE ORDERS".
- 4. The scope of the mechanical contractor's responsibility regarding commissioning shall include (but not be limited) to:
 - a. Attend commissioning meetings.

- b. Coordinate factory start up of the ATC and boiler systems to include the commissioning agent. Coordination shall include as a minimum 5 working days notice of factory start up tests.
- c. Coordinate and provide at least 5 working days notice of testing and balancing contractor being on site to allow the commissioning agent to observe the process.
- d. Complete check lists on boilers, pumps and controls.
- e. Demonstrate all sequences of operation of all mechanical equipment.

D. Mechanical Electrical Work

- 1. Provide and erect all motors, temperature controls, limit switches as specified.
- 2. Power supply to switches, fused switches, outlets, motor starters, to line terminals of equipment, and all related wiring and fuses to properly connect and operate all electrical equipment specified shall be furnished and installed under Division 16, "ELECTRICAL" (Division 16). Division 16 shall not mount electrical equipment to indoor mechanical equipment without the consent of Division 15. Division 16 shall not drill wiring holes in equipment casings but shall make use of factory wiring knockouts when present. Coordinate all wiring between Mechanical and Electrical to provide a complete and operating system.
- 3. All power wiring provided under this section shall be in accordance with the latest rules and regulations of the National Fire Underwriters, National Electric code, National Fuel Gas Code, and Local Codes Division 16. Install all wiring under the supervision of the Division 16. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section.
- 4. Automatic Temperature Control (ATC) Systems

Electric wiring for ATC systems shall be furnished and installed by ATC Contractor under supervision of Division 16. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section. Low voltage wiring shall be plenum rated and installed in an organized manner. Conduit for low voltage wiring shall not be required.
- 5. Boilers

Division 16 shall provide a separate circuit breaker for each boiler and wire to line terminals on unit control. Oil burner contractor shall provide all other wiring, including control and safety circuits, low water cut-offs and fusible switches.
- 6. Fans
 - a. Division 16r to wire to unit mounted disconnect switches with overload protection provided with units.
 - b. Division 16 to provide 120 volt power from exhaust fans to motor operated dampers associated with each fan, where provided. Dampers and actuators to be provided by ATC Contractor.

7. Automatic Temperature Control (ATC) Panel

Division 16 shall provide a dedicated 120 volt, 15 amp circuit breaker for each temperature control panel. Wiring from circuit breaker to temperature control panels will be provided and installed by the ATC Contractor. Division 16 shall also provide a duplex convenience receptacle on a separate circuit within 6 feet of panel.

8. Circulating Pumps

Division 16 shall provide and wire a disconnect switch for each pump. Division 16 shall provide and wire magnetic starters for three phase units. Starters to have Hand-Off-Automatic switch and automatic re-start feature in event of power failure.

9. Unit Heaters

- a. Cabinet Type: Division 16 shall wire to disconnect switch provided with unit.
- b. Propeller type: Division 16 shall provide and wire service switch with overload protection.

11. All motors 1/3 HP and smaller shall be wired for 120 volt, 1 phase, 60 hz. Motors 1/2 HP and larger shall be wired for 208 volt, 1 phase, 60 hz, unless specifically shown otherwise.

1.06 PERMITS

- A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.
- B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner's maintenance manual.

1.07 CODES, ORDINANCES AND PERMITS

- A. All work performed under this Section of the Specifications shall be done in accordance with applicable National, State and local Codes, Laws and Ordinances. The following abbreviations are used for reference to standards which are to be followed:

AABC	Associated Air Balance Council
ADA	Americans With Disabilities Act
AMCA	Air Movement & Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers

ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
NEC	National Electrical Code
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriter's Laboratories

- B. The latest issue of each Code in effect at the time of bidding shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.08 QUALITY ASSURANCE

A. Qualification of Workpersons

Use sufficient qualified workpersons and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of system throughout.

- B. Work performed shall conform with all Local and State Rules and Regulations, as well as those of the National Fire Protection Association (N.F.P.A.).

- C. Piping design shall conform to ANSI, ASME B31.9 and AWS D10.9 codes.

- D. Expansion tank shall conform to ASME Section VIII Code.

- E. Air separator shall conform to ASME Boiler and Pressure Vessel Code.

- F. Welding standards shall conform to ANSI Boiler Code, Section IX, B31.1

1.09 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. **All materials and equipment of the same classification shall be the product of the same manufacturer**, unless specified otherwise.

- A. Any proposal for substitution of Mechanical equipment, materials or vendors shall be made in writing PRIOR TO OPENING OF BIDS, see Division 1. Submit full details for consideration and obtain written approval of the Architect. The phrase "or approved equal" shall be defined to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "approved equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.

- B. Approval by Architect for such substitution shall not relieve Mechanical Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work
- C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.
- D. Materials and equipment determined as an “approved equal” and/or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. Manufacturer, model, etc.) specified.
- E. Any additional cost(s) resulting from the substitution of equipment, regardless of acceptance by the Architect or Engineer, shall be paid by this Contractor. Additional costs may include, but not be limited to, electrical and/or structural alterations from the contract documents. Contractor shall be solely responsible to verify that substitutes will fit within the designated spaces provide while permitting adequate clearances for servicing of equipment as required by the manufacturers. Contractor shall, upon request from the Architect or Engineer of record, provide such verification of ample space and clearances in the form of drawings or any other manner requested.
- F. All materials not specified otherwise shall be manufactured within the United States and supplied locally (within the State of Maine) when available. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.

1.10 PLANS AND SPECIFICATIONS

Mechanical Contractor shall provide his sub-contractors with a copy of the ENTIRE portion of Part 1 of this specification, portions of this specification and copies of drawings which pertain to the equipment to be supplied at no cost to the sub-contractor. Provide ATC Contractor with entire set of Electrical plans and specifications. Provide Testing and Balancing sub-contractor with copies of shop drawings indicating coil gpm's, fan air volumes, etc. Failure to do so may result in the Architect providing the required materials at the Contractor's expense.

1.11 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD (.dwg and .dxf) files will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD 2006 and may be provided in either the 2000 or 2004 file formats. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files.

All contract documents are copyrighted material. No portion of materials may be reproduced or duplicated except as indicated in the release form. Where release forms are not required (Adobe based files), materials may be printed for use by the intended recipient only and may not be reproduced or copied in any other manner or for any purpose other than for use pertaining to the construction of this project unless written permission is obtained.

1.12 SHOP DRAWINGS & SUBMITTALS

- A. As soon as possible after award of Contract (but not longer than 21 calendar days), before any material or equipment is purchased, Mechanical Contractor shall submit to the Architect shop drawings for approval (see Division 1 for required quantities). If shop drawings are not submitted within the allotted time frame all substitutions included in the late shop drawings will be invalid and the equipment specified must be provided. Any costs resulting from delays in the project schedule due to failure to submit shop drawings related to this section in a timely manner shall be the responsibility of the Mechanical Contractor. Shop drawings shall be properly identified and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data, fan curves, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.
- B. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with requirements of the drawings and specifications. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.
- C. All related items shall be submitted as a package. Partial submission shall not be reviewed until the package is complete, as itemized in paragraph "H" below.
- D. Should any materials or products be purchased and/or installed without prior review and comment the contractor shall be required to remove or replace those products and/or materials if directed by the Architect at his the contractor's expense. If the materials are not removed (or replaced) or if the project is delayed as a result the Architect reserves the right to order the withholding of payment until the situation is resolved in a manner satisfactory to the Architect.
- E. Mechanical shop drawings shall be separate from Plumbing shop drawings. All submittals shall have a clear area on the front no less than 4inches x 3inches to be reserved exclusively for the Engineers' shop drawing stamp or they will be refused for re-submittal.
- F. Submittals must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.
- G. Review must be obtained on the following items:
 - 1. Ductwork and Accessories
 - a. Registers and grilles

- b. Duct access doors
 - c. Volume control dampers (manual and automatic)
 - d. Duct sealant
 - e. Fire dampers and sleeves
 - f. Turning vanes
 - g. Flexible duct
 - h. Kitchen range hoods and accessories
 - i. Backdraft dampers
 - j. Louvers and brick vents - provide color chips (photocopies not acceptable)
– provide samples if substituting
 - k. Filters
 - l. Vents from gas heating appliances
 - m. Exterior vent hoods from dryers, range hoods and exhaust fans where applicable.
2. Mechanical Equipment (sound data must be provided with all interior motorized equipment).
- a. Full warrantee information must be included with all submittals.
 - b. Fans and accessories - provide full fan curves and computer selection printouts.
 - c. Cabinet unit heaters - provide color chips (photocopies not acceptable)
 - d. Horizontal unit heaters
 - e. Pumps and accessories - provide full pump curves and computer selection printouts.
 - f. Boilers and accessories, confirmation of start-up and State Inspection
 - g. Domestic hot water storage heaters and accessories
 - h. Equipment identification tags
3. Piping and Accessories
- a. Pipe, valves, unions and flanges
 - b. Manual balancing valves with read-out gauge and pressure tappings. Provide a schedule clearly indicating every valve, its location, GPM, size and pressure drop.
 - c. Automatic Balancing valves
 - d. Air vents (automatic and manual)
 - e. Air separator
 - f. Relief valves
 - g. Expansion tank and accessories
 - h. Pipe hangers and insulated pipe supports
 - i. Pressure gauges and thermometers
 - j. Triple duty valves
 - k. Pressure reducing valves
 - l. Pipe flexible connectors
 - m. Pipe and valve markers
 - n. Backflow preventer
 - o. Flow control valves
 - p. Underground piping system
 - q. PEX tubing, fasteners, connectors, hangers and accessories

4. Terminal Units
 - a. Finned radiation
5. Insulation
 - a. Pipe
 - b. Duct
 - c. Pipe fittings
 - d. Air separator
6. Automatic Temperature Control (ATC) System

1.13 PRODUCT HANDLING

A. Protection

Use all means necessary to protect heating and ventilating materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.14 AS-BUILT DRAWINGS

Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of all blueprints furnished for this job. On this special set of blueprints, record *completely and accurately* all differences between the work as actually installed and the design as shown on the drawings. These record prints must be kept up to date by recording all changes within one week of the time that the changes are authorized. At the completion of the work, this set of drawings shall be delivered to the Architect for the Owner electronically in the form of CAD drawings. If a complete record of changes is not made and electronic CAD drawings not provided by the Mechanical Contractor, a record shall be made by the Engineers, and *the cost of the record shall be paid by the Mechanical Contractor*. Copies of the mechanical CAD drawings may be made available electronically to the Mechanical Contractor if desired. Drawings shall be dated accordingly and clearly identified as "AS-BUILT". Contact the Architect directly or the Engineer via e-mail at mechsyst@maine.rr.com. Specify required CAD format when requesting the files. CAD drawings were generated using AutoCAD 2006 and utilize both paper space and model space with external references to various other drawings. Files will be compressed and will require "WinZip" (<http://www.winzip.com>) for extraction. A release form will be provided which must be signed and returned to the Engineer prior to transfer of files.

1.15 MAINTENANCE MANUAL

- A. On completion of this portion of the work, and as a condition of its acceptance, submit for approval two copies of a manual describing the system. Mechanical equipment manuals shall be separate from plumbing manuals. All manuals shall be original copies, not photocopies or they will be refused for re-submittal. Prepare manuals in durable 3-ring binders approximately 8½ inches by 11 inches in size with at least the following:
1. Identification on the front cover and spine stating general nature of the manual.
 2. Neatly typewritten index.
 3. Complete instructions regarding operation and maintenance of all equipment involved.
 4. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name, address and telephone number of nearest vendor of parts.
 5. Copy of all guarantees and warranties issued.
 6. Where contents of manuals including manufacturer's catalog pages, clearly indicate the precise item included in this installation and delete, or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.
- B. In addition to above, provide two (2) separate offset style binders properly identified, each containing a copy of all reviewed shop drawings and catalog cuts. (NOTE: May be incorporated in Maintenance Manuals, if binders are of adequate size.)

1.16 OBJECTIONABLE NOISE AND VIBRATION

Mechanical equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping or ducts, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Mechanical Contractor at no extra cost to the Owner.

1.17 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.

1.18 MINOR DEVIATIONS AND DISCREPANCIES

- A. The drawings are intended to indicate only diagrammatically the extent, general character and approximate locations of mechanical work. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, plumbing and electrical drawings so that work under this section is properly installed and coordinated with other Sections.
- B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on the mechanical drawings, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.
- C. Questions to the Architect or Engineers are encouraged, but any answers or advice is non-binding. Therefore, inquires about such items should be made at least 4 days prior to when bids are due to allow time for a clarifying addendum to be issued.
- D. Any conflicts arising from duplication of equipment specified in different portions of the specifications shall be brought to the attention of the Architect prior to submitting bids. Failure to do so does not relieve the Contractor from responsibility of providing said materials and equipment and a credit will be taken for the duplicated item(s).

1.19 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by the Architect or Engineer of record.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.20 COORDINATION

- A. Contractor shall be responsible to coordinate his work with that of other trades to adjust to field conditions prior to commencing work. If a reasonable solution cannot be achieved without compromising the integrity of the intended design or would result in additional cost the Architect must be notified immediately prior to commencement of work. Failure to do so does not relieve the Contractor from providing and installing the systems to the satisfaction of the Architect at no additional cost.
- B. Contractor shall be responsible to review job conditions and identify conflicts and/or obstructions to ductwork and piping prior to fabrication. If conflicts and/or obstructions are noted the Architect must be notified immediately prior to commencement of work. The cost of any fabrication work performed without confirmation and notification of conflicts and/or obstructions shall be the responsibility of the contractor.

1.21 WORKPLACE SAFETY

Mechanical contractor shall be responsible for the safety of his workpeople.

PART 2 - PRODUCTS

2.01 PIPING

A. General

Provide and erect in accordance with best practice of trade all hot water supply, hot water return, drain and vent piping shown on the plans and as required to complete intended installation. Contractor shall make offsets as shown or required to place all piping in proper position to avoid other work, and to allow application of insulation and finish painting.

B. Pipe Materials:

- | | | |
|----|---|--|
| 1. | Heating hot water, 2½ inches and larger. | Schedule 40 standard weight black steel, ASTM 12 |
| 2. | Heating hot water mains, 2 inches and smaller, cold water, drains from relief valves and automatic vents. | Type "L" hard drawn copper tubing with sweat fittings. |
| 3. | Heating water runouts to radiation, above grade, 180°F. maximum. | PEX crosslinked flexible tubing, ASTM F876 and F877. |

C. Pipe Fittings:

- | | | |
|----|--------------------------|--|
| 1. | Screwed | ASTM 125# cast iron screwed, ASTM A126, ASA B16.1 |
| 2. | Welded | Standard weight butt weld carbon steel, ASTM A234, ANSI B16.9 from A106 Gr. B. seamless Tube |
| 3. | Unions | 250 malleable iron, brass to iron seats |
| 4. | Flanges | 150# forged steel slip-on ASTM A234 |
| 5. | Sweat | Cast bronze or wrought copper made up with 95-5 solder |
| 6. | Connections to equipment | 2 inches and smaller – unions, 2 ½ inches and larger – flanged. |

- D. All heating hot water mains 2½ inches and larger shall have welded connections using standard factory-fabricated tees, elbows, reducers, and caps. Branch outlets in welded sizes shall be made with tees for full size or one size reduction and with either "Weldolets" and "Threadolets" or factory shaped nipples for all other sizes. All welds shall be made by welders certified by the State of Maine and shall be capable of welding in any position "in the field". All welds shall conform with the rules set forth in the Standard Manual on Pipe Welding of the Heating, Piping and Air Conditioning Contractors national Association. All slip on fittings shall be back welded. Fire extinguishing equipment shall be kept within 25 feet of welding areas at all times. Contractor shall take additional measures when welding close to wood structures to protect the wood from igniting.
- E. All metallic piping 2 inches in size and smaller shall be type "L" hard drawn copper tube with sweat fittings.
- F. The Mechanical Contractor may, at his option, use schedule 40 standard weight black steel, ASTM 12, with threaded fittings for piping 2 inches and smaller in lieu of copper. The option of steel or copper MUST be stipulated in the bid and thereafter no deviation will be acceptable. If steel is to be used, the piping system shall be 100% steel with no mixture from copper to steel.
- G. The Mechanical Contractor may also, at his option, use an IPS Grooved Piping System in lieu of welded, flanged and threaded connectors for steel piping 2½ inches in size and larger. If this system is to be utilized contractor must state so very clearly in his bid and the system shall be 100% grooved. System shall employ grooved mechanical pipe couplings, fittings, valves and other grooved components. All grooved components shall be of one manufacturer, and conform to local code approval and/or as listed by ANSI-B-31.1, B-31.3, B-31.9, ASME, UL/ULC, FM, IAPMO or BOCA. Grooved end product manufacturer to be ISO-9001 certified. Grooved couplings shall meet the requirements of ASTM F-1476. System shall be by Victaulic or approved equal.
1. Pipe shall be Schedule 40 standard weight black steel, ASTM 12 - Roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends to be grooved in accordance with Victaulic current listed standards conforming to ANSI/AWWA C-606.
 2. Mechanical couplings shall be manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade "E" EPDM. There shall be two type of couplings utilized:
 - a. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13. Victaulic Style 07 (Zero-Flex®).

- b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three Couplings shall be placed in close proximity to the vibration source. Victaulic Style 75 or 77.
3. Flange Adapters: For use with grooved end pipe and fittings, for mating to ANSI Class 125 / 150 flanges. Victaulic Style 741.
4. Grooved End Fittings: Fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12.
5. Hole-Cut Branch Outlets: Branch reductions on 2 inch through 8 inch header piping. Bolted branch outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183. Victaulic Style 920 / 920N.
6. Grooved End Valves
 - a. Butterfly Valves are not permissible.
 - b. Ball valves in 2½ size shall be lever operated, 1,000 psi CWP suitable for bidirectional and dead-end service at full rated pressure. Body shall be grooved end black enamel coated ductile iron conforming to ASTM A536. Ball shall be chrome plated carbon steel with chrome plated carbon steel stem. Victaulic 726.
 - c. Check valves in 2½ inch size shall be spring assisted, PPS coated ductile iron body, ASTM A-536, Grade 65-45-12, aluminum bronze non-slam tilting disc, stainless steel spring and shaft, EPDM rubber seat, 300 psi (2065 kPa). Victaulic Series 716.
7. Grooved End Specialties

Dielectric waterways: 1 inch through 8 inch sizes, grooved, plain end, or threaded end, ASTM A-53 carbon steel or ASTM A-536 ductile iron body, zinc electroplated, with LTHS high temperature stabilized polyolefin polymer liner. Victaulic Style 47.
8. Assembly
 - a. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove.
 - b. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.
 - c. See the latest copy of Victaulic's Field Assembly and Installation Instruction Pocket Handbook (I-100).
 - d. All grooved components (couplings, fittings, valves, gaskets, and specialties) shall be of one manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

- e. Manufacturer shall provide on-site training for contractor's field personnel by a factory-trained representative in the proper use of grooving tools, application of groove, and product installation. Manufacturer's authorized representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products.

2.02 VALVES

A. General

- 1. Valves shall be provided as shown and as required to make the installation and its apparatus complete in operation, locate to permit easy operation, replacement and repair. All pressures specified are steam working pressure.
- 2. All valves must be so constructed that they may be repacked under pressure while open.
- 3. Globe valves shall be installed in all lines where regulation is required.
- 4. Check valves shall be installed in all lines where flow may reverse from intended direction.
- 5. Except for above or as otherwise noted on drawings, ball valves shall be installed in all supply and return lines and on all drain lines.
- 6. All valves to comply with federal specifications and be so listed.
- 7. Butterfly valves shall not be used.

B. Types and Manufacturers

All valves shall be of one manufacturer and by one of the manufacturers listed. The following list is provided as a means of identifying the quality and type required.

- 1. Gate Valves 2 inches in size and smaller shall have bronze bodies, rising stem, solid wedge, union bonnet, rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1169	1151
Stockham	B-124	B-120
NIBCO	S-134	T-134
Hammond	IB648	IB629

2. Globe Valves 2 inches in size and smaller shall have bronze bodies, union bonnet, renewable composition disc for service intended, rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1590-T	590-T
Stockham	B-24-T	B-22-T
NIBCO	S-235-Y	T-235-Y
Hammond	IB423	IB413T

3. Globe Valves (non-Victaulic) 2½ inches in size and larger shall have iron bodies, union trim, OS&Y, bolted bonnet, solid disc, gland packed, flanged ends. Rated for 125# WSP, 200# WOG:

	<u>Flanged Ends</u>
Milwaukee	F-2981
Stockham	G-512
NIBCO	F-718-B
Hammond	IR116

4. Plug type Globe valves 2 inches in size and smaller shall have bronze bodies, union bonnet, stainless steel plug type disc and seat. Rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	591-A	
NIBCO	T-256-AP	

5. Ball valves 1¼ inches in size and smaller shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blow-out proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "full port". Rated for 400# WOG and 350°F:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	BA-350S	BA-300S
Apollo	82-200	82-100
Watts	B-6081	B-6080
NIBCO	-----	-----
Hammond	8614	8604

6. Ball valves 1½ and 2 inches in size shall have bronze bodies, two piece, standard port, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blow-out proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Rated for 400# Bar non-shock cold working pressure.

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Apollo	70-200	70-300
Watts	B-6000-SS	B-6001-SS
NIBCO	S-580-66	T-580-66
Hammond	8513	8503

7. Ball valves (non-Victaulic) 2½ inches in size and larger shall have carbon steel bodies, Type 316 stainless steel stems, Type 351 stainless steel balls (vented), glass filled Teflon seats and seals and blow-out proof stems. Shall be equipped with suitable packing for service intended. Rated for 150# WOG and 350°F:

Flanged Ends

Apollo	88-140
Watts	CF-1500-150-02-T316
NIBCO	F-510-CS-R-66-FS

8. Ball valves for grooved piping systems – see 2.01, G, 6, “Grooved end valves:.
9. Check Valves 2 inches in size and smaller shall be horizontal swing type with bronze body, Teflon disc. Rated for 125# WSP, 200# WOG:

Soldered Ends

Screwed Ends

Milwaukee	1509-T	509-T
Stockham	B-310-T	B-320-T
NIBCO	S-413-Y	T-413-Y
Hammond	IB945	IB904

10. Check valves (non-Victaulic) 2½ inches in size and larger shall be horizontal swing type with iron body, bronze trim and flanged ends. Rated for 125# WSP, 200# WOG:

Flanged Ends

Milwaukee	F-2974
Stockham	G-931
NIBCO	F-918-B
Hammond	IR1124

2.03 INTERIOR HANGERS AND SUPPORTS

A. General

1. All interior hangers and supports shall be specially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.
2. Piping specified shall not be supported from piping of other trades.
3. Hangers shall be steel, adjustable clevis type; plain for steel pipe and copper plated for copper tubing. Carpenter & Paterson, Inc., Fig. 100 (Fig. 100 CT copper plated) or approved equal. Hangers on hot water and drain piping shall be sized for the piping only (not including insulation). Hangers on cold water piping, and where specifically indicated on drawings, shall be sized to include the insulation and include thermal hanger shields (insulated pipe supports).
4. Thermal hanger shields shall be Carpenter & Paterson, Inc., Fig. 265P or approved equal.

5. Exposed vertical risers 3/4 inch and smaller shall be supported at the mid-point between floor and ceiling with split ring type hangers; copper plated for copper tubing. Carpenter & Paterson, Inc., Fig. 81 (Fig. 81 CT copper plated) or approved equal.
6. Piping suspended from walls, trench walls and partitions shall be supported by steel support bracket. Carpenter & Paterson, Inc., Fig. 69 or approved equal.
7. All steel hangers shall be factory painted.
8. Supports for PEX tubing shall be designed specifically for PEX material, provided and approved by the tubing manufacturer.

B. Hanger Rods

1. Hanger rods shall be galvanized all thread rod. Rod size shall be as follows:

<u>Pipe Size</u>	<u>Rod Size</u>
1/2" to 2"	3/8"
2 1/2" to 3"	1/2"

2. Provide toggle bolts for fastening to concrete blocks and compound anchor shields for bolts for fastening to poured concrete.
3. Provide lag points with rod couplings or side beam connectors with drive screws for fastening to wood.
4. All nuts for hanger rod to be stainless steel.

C. Supports

Provide and install angle iron supports for pipe hangers as required. Angle iron supports shall be adequate size for span and piping or equipment load.

2.04 PIPE SLEEVES AND ESCUTCHEONS

A. Sleeves

1. Mechanical Contractor shall set sleeves for all piping penetrating walls and floors. Sleeves through masonry shall be steel pipe sleeves two sizes larger than the pipe. Pipe passing through walls other than masonry shall be provided with #24 gauge galvanized steel tubes with wired or hemmed edges.
2. Sleeves set in concrete floor shall finish flush with the underside, but extend a minimum of 1 inch above the finish floor. Sleeves set in partitions shall finish flush with each side.
3. Spaces between sleeves and pipes within building shall be sealed fire and smoke tight. Material shall be 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant, or approved equal. Sealant material shall be U.L. listed.

C. PEX tubing must be labeled (on the tubing) as follows:

1. The manufacturer's name or trademark
2. The standard to which it conforms (ASTM F876, F877, or both)
3. Tube size and CTS
4. Material designation code (PEX0006)
5. Pressure/temperature rating(s)
6. SDR9

The marking interval shall be not more than five feet.

2.08 HOT WATER SPECIALTIES

A. Manual (Adjustable) Balancing Valves

1. Return mains and elsewhere as indicated shall be provided with a balancing valve equipped with readout valves to facilitate the connecting of a differential pressure meter where indicated (locate on return lines at each duct coil). Each readout valve shall be fitted with an integral EP check valve designed to minimize system fluid loss during the monitoring process. Each balancing valve shall have an indexing pointer and calibrated name plate to indicate the degree of closure of the precision machine orifice. Each balancing valve is to be constructed with internal O-ring seals to prevent leakage around the rotating element.
2. Valves shall be sized with an operating pressure differential range of 1.50 psig (minimum) to 2.00 psig (maximum).
3. Provide a schedule clearly indicating every valve, its location, GPM, size and pressure drop.
4. Each balancing valve shall be Taco Circuit Setter with a working pressure of 175 psig and a maximum operating temperature of 250°F. Units by Bell & Gossett or Tour and Anderson will be considered.

B. Automatic (Preset) Balancing Valves

1. All finned radiation, convectors, cabinet unit heaters, unit heaters, unit ventilators and elsewhere as indicated, shall be provided on the return line from each unit with a balancing type valve equipped with readout taps to facilitate the connecting of a differential pressure meter. Valve body shall include a handle ball valve, Y-strainer, flow control cartridge assembly, two (2) pressure/temperature plugs, inlet union and outlet union. Valve bodies shall be line size.
2. Design
 - a. The GPM for the automatic flow control valves shall be factory set and shall automatically limit the rate of flow to within 5% of the specified amount.

- b. For ½ inch to 2 inch sizes the flow cartridge shall be removable from the Y body housing without the use of special tools to provide access for regulator changeout, inspection and cleaning without breaking the main piping (Access shall be similar to that provided for removal of a Y-strainer screen).
- c. True operating ranges of 2 - 32 psid or 5 - 60 psid are required. The design flow should be achieved at the minimum psi differential. A 50% safety factor applied to the lower operating range is not acceptable.
- d. Each valve shall have two PIT ports.
- e. All automatic flow control devices shall be supplied by a single source and certified flow tests, witnessed by a professional engineer, shall be available.
- f. Provide factory product warranty of not less than five (5) years and free first year cartridge exchange.

3. Construction

- a. Internal wear surfaces of the valve cartridge shall be electroless nickel or stainless steel.
- b. Internal flow cartridge body shall have machined threads so the spring free height may be compensated for without the use of fixed shims. A crimped sheet metal design is not acceptable.
- c. Internal flow cartridge shall be permanently marked with the GPM and spring range.
- d. For ½ inch through 2 inch pipe sizes: An assembly shall consist of a brass Y-type body, integral brass body ball valve and 'O' ring type union. Flow Design "AutoFlow" Model AC or approved equal.
- e. For 2½ inch pipe sizes and larger: Ductile iron body suitable for mounting wafer style between standard 150# or 300# flanges. The long flange bolts and nuts shall be provided with each control valve. Flow Design "AutoFlow" Model WS or approved equal.
- f. All valves shall be factory leak tested at 100 psi air under water.

4. Minimum ratings

½ inch through 2 inch pipe size: 400 PSIG at 250DF

5. Flow Verification

- a. Where indicated on the plans, the differential pressure across the Automatic Flow Control Valve shall be measured for flow verification and to determine the amount of system over heading or under pumping.
- b. Flow shall be verified by measuring the differential pressure across the coil served or the wide open temperature control valve and calculating the flow using the coil or valve Cv.

6. Test Kit

A differential pressure test kit shall be supplied to verify flow and measure overheading. The kit shall consist of a 42 inch diaphragm gauge equipped with ten foot hoses and P/T adapters all housed in a vinyl case. Calibration shall be 0-35 PSID for 2-32 PSI spring range or 0 - 65 PSID for 5-60 PSI range.

7. Installation

- a. Install automatic flow control valves on the return lines of equipment as indicated on the plans. Balancing valve on supply side is not acceptable.
- b. The standard ports and handles shall clear 1 inch thick insulation. Handle and port extensions are required for over 1 inch thick insulation.
- c. Install, on the supply side of coils, a Y strainer with a brass blowdown valve with $\frac{3}{4}$ inch hose end connection with cap and chain.

C. Radiator Valves

All radiation loops shall be provided with ball valves on both supply and return ends for 125 psig at 250°F. as specified under valves.

D. Drains

Each downfeed convector, cabinet unit heater, unit heater, coil and unit ventilator shall be provided with a drain valve between the shut-off valves and heating equipment at the lowest point in the piping. All low points in piping mains shall be provided with drain valves. Drain valves shall be ball valves as specified under VALVES with hose connections and metal caps. Drain finned radiation with easily accessible drain couplings or drain elbows.

E. Air Vents

1. Air vents shall be installed at the equipment, all high points in the piping as indicated on the plans or as may be required.
2. Automatic air vents shall be Taco 409 brass vent. Units by Anderson, Armstrong (No. 1-AV) or Sarco will also be considered. Pet cocks shall be installed with each unit and the drains from the vents shall be run as indicated on the plans. An air chamber shall be installed at each air vent and shall be line size for all piping up to 2 inches in size; 2 inch for larger piping. Do not use on glycol systems, use manual vents only.
3. Manual air vents shall consist of air chamber with a Dole No. 14A Coin Valve with copper tube extension. Install valve in accessible location.
4. By-pass type vents shall be installed where shown and as detailed on the drawings. By-pass valves shall be plug-type globe as specified under VALVES.

F. Expansion Tank

Furnish and install vertical pressurized replaceable bladder type water expansion tank pre-charged to pressure indicated on drawings. Tank shall be constructed of steel for 125 psi working pressure in accordance with ASME Code, and have the necessary tappings for water connections and charging valve. Tank shall be furnished with ASME stamp and certification papers. A copy of ASME certification shall be provided with equipment submittal.

1. Tank shall be installed with a manual shut-off valve between the tank and the system and a union between the tank and the valve.

2. Tank shall be Taco CAX series. Units by Bell & Gossett or Wood will be considered. Capacities shall be as shown on drawings and are minimums.

G. Backflow Preventer

Backflow preventer shall be furnished under division 15400, "PLUMBING".

H. Water Pressure Reducing Valve

Furnish and install a pressure reducing valve with brass body construction and built-in strainer in the cold water piping connected to hot water heating system as shown on the drawings. The valve shall be adjustable and be No. 335, as manufactured by Taco. Units by Bell & Gossett and Watts will be considered. Provide pressure relief valve with operating pressure 100% over system pressure, but not exceeding 100 psi.

I. Flow Control Valve

Furnish and install flow control (flo-check) valves with line size cast iron body and threaded ends for pumps P-X and P-X. Working parts shall be easily removable for inspection and cleaning without removing valve body from the pipeline. Taco Model "Flo-Chek" or approved equal by Bell & Gossett.

J. Air Separator

Furnish and install Taco AC25F in-line air separator. The unit shall be flanged and contain a removable strainer and blow down. Unit to be constructed in accordance with A.S.M.E. boiler and pressure vessel code and stamped 125 psig design pressure. Equal equipment by Bell & Gossett will be considered.

K. Flow Metering Station

1. Provide and install a flow metering station in the combined discharge of pumps P-X & P-X as indicated on drawings.
2. Unit shall be designed to thread into a weld-o-let pipe tap.
3. Unit shall include a type 304 stainless steel tube, brass block and vales and all required mounting hardware. Maximum working pressure shall be 200 psig at a maximum temperature of 250°F.
4. Unit shall be designed for the specific pipe size into which it is to be installed.
5. Unit shall be Taco Standard Metering Station 7026 or approved equal.

L. Pressure Gauges

Furnish and install pressure gauges with gauge cocks on piping where shown on drawings. Tubing to pressure gauges shall be of sufficient length to extend beyond pipe insulation and still leave enough space to easily operate the gauge cock. The dial range shall be such that the normal pressure shall be approximately midway of the dial. Gauges shall be Weiss Series 4CTS with 4½ inch dial size, stainless steel or cast aluminum case, with brass "T" handle cocks and bronze pressure snubbers. Units by Ashcroft, Nurnburg & Trerice will be considered.

Pressure range: Water Systems 0-60 psi

M. Thermometers

Furnish and install where indicated on the drawings and in Part 3 - EXECUTION, dial type thermometers with stainless steel case, 4½ or 5 inch dial size, bimetal, universal angle type. Thermometers shall be Weiss 5VBM series. Units by Ashcroft, Nurnburg & Trerice will be considered. Provide and install thermometer wells on supply and return branch piping to duct reheat coils (when present) and two thermometers in boxes for the Owner's use.

Temperature Range: Heating System... 30°F. - 240°F.

2.09 DOMESTIC HOT WATER STORAGE TANKS AND HEATERS

A. Storage Water Heaters

Furnish and install hot water storage tank and heaters of size and capacity, complete with all accessories as shown on drawings.

B. Tanks

Tanks shall have a storage capacity of 60 gallons, installed in a vertical position and constructed of 316L stainless steel in accordance with the ASME Code for Unfired Pressure Vessels to withstand a working pressure of 150 psi. Tanks shall be provided with a heating element, aquastat control tapping, cold water inlet and drain, hot water outlet and T&P relief valve connection. The heating element in the tank shall consist of a 90/10 cupronickel coil. Storage tank shall be covered with a 2 inch thick closed cell foam insulation. Outer covering shall be heavy duty rigid plastic. The entire unit shall carry a manufacturer's lifetime warranty. All connections shall be standard I.P.S. threads. The tanks shall be the dimension as shown on drawings.

C. Relief Valve

ASME temperature and pressure relief valves shall be provided and installed on the domestic hot water outlet by section 15400, "PLUMBING"

D. Units to be Super-Stor model SS-60 or approved equal.

2.10 CIRCULATING PUMPS

A. Circulating Pumps P-X, P-X and P-X

1. Furnish and install hot water circulating pumps of the type, size and capacity shown on drawings. Pumps shall employ ECM technology, Wilo Stratos or approved equal.
2. Pumps shall be wet rotor, glandless inline circulating pumps and shall include electronic variable speed control to operate at constant/variable differential pressure control without external sensors.
3. Materials and Construction
 - a. Circulating pumps shall be constructed with Cast-Iron bodies with factory applied Cathaphoresic coating.
 - b. Shafts shall be constructed of high quality stainless steel. Motor bearings shall be metal impregnated carbon sleeve bearing type. Impellers will be constructed of a high strength, glass filled polypropylene engineered composite.
4. Pumps shall include the following features:
 - a. Integrated synchronous motors using ECM technology with permanent magnetic rotors, sensorless control electronics and single phase electronic converters.
 - b. Infra-red (IR) interface for wireless communication and an infra-red monitor.
 - c. Integrated overload motor protection.
 - d. Fault contact "FC" terminals shall be included in the terminal box and are to be potentially free, normally closed contacts that open on the event of a failure.
 - e. Interface (IF) modules shall be included and installed in the terminal box. Modules shall permit BMS communication via LONworks, 0 – 10 volt DC control of speed and head setpoint, external minimum speed, external off, dual pump communication and pump operation status.
 - f. Internal programming to regulate pump on/off operation based on outdoor temperature.
 - g. Internal programming to regulate pump speed in response to changes in system pressure.
 - h. Internal programming to provide lead/lag operation for pumps P-2 and P-3. Provide interface wiring between pumps.
5. Pumps shall have a terminal box with NPT electrical connections and a secure, gasketed cover, Class 2 protection level. Include on the face of the terminal box cover a single adjustment button, front readable graphical pump display, field adjustable for horizontal or vertical positioning of the terminal box. The display shall indicate:
 - a. Operation status
 - b. Control mode

- c. Differential pressure or speed/setpoint
 - d. Fault and warning signals
6. Pumps shall have a coded terminal strip indicating common/neutral/ground within the terminal box for field connections for single phase 230 volt, 60 Hz power.
7. Electrical
- a. Motor shall be a minimum of class H winding insulation as defined by UL 778.
 - b. Voltage variances shall be less than +/- 10% from rated voltage with pump under load conditions. Maximum amperage not to be exceeded is indicated on the pump nameplate. Electrical power to the pump is confirmed when the face of the graphic display is lit.

B. Circulating Pumps P-X and P-X

- 1. Furnish and install hot water circulating pumps of the type, size and capacity shown on drawings. Pumps shall employ ECM technology, Wilo Top S or approved equal.
- 2. Pumps shall be a maintenance free, self venting, system lubricated type specifically designed for quiet operation with a horizontal motor mounted directly to the pump volute.
- 3. Pump volute shall be constructed of cast iron, rated at 145 PSI working pressure. Temperature range for shall be from 14° to 230°F, based on maximum ambient temperatures of 104°F.
- 4. Impeller shall be constructed of engineered composite polypropylene. Shaft shall be made of hardened stainless steel and sleeve bearings made of metal impregnated carbon. Rotor can and rotor cladding shall be constructed of high quality stainless steel. Water lubricated sleeve bearings to be constricted of metal impregnated carbon. Pump shall not incorporate the use of couplings or mechanical seals of any kind.
- 5. The integral motor shall be non-overloading at any point of the curve, include thermal overload protection and rated for continuous duty operating on 120 volt, 1 phase, 60 hertz alternating current.
- 6. Pumps shall be a manually selectable, two speed design regardless of voltage.
- 7. Pumps shall be UL and ULC approved.

2.11 BOILER UNITS

- A. Furnish and install where shown on the drawings, low mass cast iron, direct vent natural gas fired boiler units. Units shall be condensing type with stainless steel burners. Units shall be wired for 120 volts, 1 phase, 60 hertz power, see "Boiler Schedule", sheet M5.
- B. Compliances
 - 1. ASME Compliance: Boilers shall bear ASME "H" stamp and be National-Board listed.
 - 2. FM Compliance: Control devices and control sequences according to requirements of FM.
 - 3. IRI Compliance: Control devices and control sequences according to requirements of IRI.
 - 4. Comply with NFPA 70 for electrical components and installation.
 - 5. CSD-1
 - 6. SCAQMD Rule 1146.2 for low NOx equipment
 - 7. BACT Compliant (Best Available Control Technology)
- C. Submittals
 - 1. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated.
 - 2. Detail equipment assemblies and indicate dimensions, required clearances, and method of field assembly, components, and location and size of each field connection.
 - 3. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
 - 4. Source Quality Control Tests and Inspection Reports: Indicate and interpret test results for compliance with performance requirements before shipping.
 - 5. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
 - 6. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include parts list, maintenance guide, and wiring diagrams for each boiler.
- D. Warranties
 - 1. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Installing contractor shall provide one year of warranty parts and labor.
 - 2. Special Warranty: Submit a written warranty, executed by the contractor for the heat exchanger.
 - 3. Warranty Period: Manufacturer's standard, but not less than 10 years from date of Substantial Completion on the heat exchanger. Warranty shall be non-prorated and not limited to thermal shock. Additional 21 year thermal shock warranty on heat exchanger.

E. Design

Boilers shall be CSA design certified as a condensing boiler. Boilers shall be designed for a minimum of 4:1 continuous turn down with constant CO₂ over the turndown range. Boilers shall operate with natural gas and have a CSA certified input rating as noted on the drawings, and a thermal efficiency rating of 88% at rated input and 99% at minimum input. Boilers shall be symmetrically air-fuel coupled such that changes in combustion air flow or flue flows affect the BTUH input without affecting combustion quality. Boilers will automatically adjust input for altitude and temperature induced changes in air density. Boilers shall use a proven pilot interrupted spark ignition system and shall use a UL approved flame safeguard ignition control system using UV detection flame sensing. The UV detector shall be air cooled to prevent condensate formation and so designed as to prevent misalignment. The design shall provide for silent burner ignition and operation. The boiler shall be down fired counter flow such that formed condensate always moves toward a cooler zone to prevent re-evaporation. An aluminum corrosion resistant condensate drain designed to prevent pooling and accessible condensate trap shall be provided. Boiler shall be able to vent a horizontal distance of 80 equivalent feet.

F. Service Access

Boilers shall be provided with access covers for easily accessing all serviceable components. The boilers shall not be manufactured with large enclosures, which are difficult to remove and reinstall. All accesses must seal completely as not to disrupt the sealed combustion process. All components must be accessible and able to adjust with the removal of a single cover or cabinet component.

G. Indicating Lights

Each boiler shall include a diagnostic control panel with a full text display indicating the condition of all interlocks and the BTUH input percentage. Access to the controls shall be through a completely removable cover leaving diagnostic panel intact and not disrupted.

H. Components

1. Combustion Chamber shall be constructed of cast-iron.
2. Heat Exchanger: Boilers shall be a cast iron sectional unit designed for pressure firing and shall be constructed and tested for 100 P.S.I water working pressure, in accordance with the A.S.M.E. Section IV Rules for the Construction of Heating Boilers. Individual sections will have been subjected to a hydrostatic pressure test of 250 PSIG at the factory before shipment and they shall be marked, stamped or cast with the A.S.M.E. Code symbol. Boilers with less than 250-psi pressure test will not be acceptable for this project. The sections shall be of a down fired counter flow single-pass design. Water ports will be sealed with graphite port connectors. The sections will be fully machined for metal to metal sealing of the gas side surfaces. The design will provide for equal temperature rise through all sections. The heat exchanger shall be designed to prevent fluid boiling. The iron shall have a minimum thickness of 3/8". The heat exchanger design should have no limitations on temperature rise or restrictions to inlet water temperature and a Cv of 100.
3. Stainless steel jackets.

4. Gas burner shall be constructed of stainless steel. The burner flame shall burn horizontally and be of the pre-mix type with a forced draft fan. Burner shall fire to provide equal distribution of heat throughout the entire heat exchanger. The burner shall be easily removed for maintenance without the disruption of any other major component of the boiler. A window view port shall be provided for visual inspection of the boiler during firing. The gas distribution components and burner shall be enclosed with a cast-aluminum housing.
5. The ignition hardware shall consist of insulated ignition electrodes and UV sensing tube permanently arranged to ensure proper ignition electrode and UV alignment.
6. Boilers shall be capable of operating at rated capacity with pressures as low as 2" W.C. at the inlet to the burner pressure regulator.
7. The burner shall be capable of 99% efficiency without exceeding a Nox reading above 12 ppm.

I. Burner and gas train

1. Burner Firing: Full modulation with 4:1 turndown @ Continuous CO2
2. Burner Ignition: Intermittent spark
3. Safety Controls: Energize ignition (14,000 Volts), limit time for establishing flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, and allow gas valve to open.
4. Flue-Gas Collector: Enclosed combustion chamber with integral combustion-air blower and single venting connection.
5. Gas Train: Manual gas valves (2), main gas valve (solenoid), 'B' valve, pilot gas pressure regulator, and automatic pilot gas valve. All components to be factory mounted.
6. Safety Devices: Low gas pressure switches, air-flow switch, and blocked flue detection switch. All safeties to be factory mounted.

J. Boiler Trim

1. Safety-Relief Valve: 40 psi, ASME rated, factory set to protect boiler and piping as per schedule/drawings.
2. Combination water pressure and temperature shipped factory installed. LCD inlet/outlet temperature gauges to be an integral part of the front boiler control panel to allow for consistent easy monitoring of temperatures factory mounted and wired.
3. Low water cut off (with manual reset) shall be factory mounted and wired. Provision for installation of a low water cut off shall be provided.
4. Boilers shall be provided with a Honeywell RM7897C series digital flame safe guard display module standard. The flame safe guard shall be capable of both pre and post purge cycles.
5. Operating Temperature Control: Shall be a digital controller adjustable from 120 to 240 degrees F. Control shall be factory mounted and sense the inlet and outlet temperature of the boiler through resistance sensors.
6. High Limit: Temperature control with manual-reset limits boiler water temperature in series with the operating control. High Limit shall be factory mounted and sense the outlet temperature of the boiler through a dry well
7. Aluminum condensate receiver pan.
8. Low air pressure switch.
9. Blocked Flue Detection Switch

10. Manual Reset Low Water Cut Off (CSD-1 Factory Mounted and wired)
11. Modulation Control
12. Temperature/Pressure Gauge
13. Manual Reset High Limit
14. Air Inlet Filter (Washable)
15. Inlet/Outlet Temperature Display
15. Full Digital Text Display for all Boiler Series of Operation and Failures
17. Variable Frequency Drive and Combustion Air Fan
18. Condensate Drain
19. FM and CSD-1 Compliant Gas Train
20. Diagnostic Keyboard Display for RM7800 series control.

K. Motors

Open drip-proof motors where satisfactorily housed or remotely located during operation. Blower motor shall be externally mounted for ease of service. There shall be no requirement to remove covers or gas train components to remove the blower motor. Blower motor shall not exceed ½ HP and not require more than 5 amps.

L. Controls

1. Each boiler shall maintain set temperature as determined by its own internal controls. Temperature shall be reset according to outdoor temperature. Provide outdoor and boiler temperature sensors with each boiler.
2. A domestic hot water override shall be included to provide 180°F. water whenever pump P-4 or P-5 activates. ATC Contractor shall provide interface between pump controls and override cycle.
3. Controls shall include a “true run time” lead-lag controller to designate one boiler as the lead unit while the other boiler serves as stand-by. The lead boiler shall provide heat and domestic hot water as required by the heating system. Should the lead boiler not be able to meet load demands the stand-by boiler shall become active to supplement the lead boiler.
4. Either boiler shall activate pump P-1 whenever the boiler(s) are active. A flow switch mounted in the boiler shall verify flow before permitting boiler(s) to fire. ATC Contractor shall provide interface between pump control and boilers cycle.
5. Boiler manufacturer shall provide qualified personnel to install any controls and wiring requiring field installation. Installer shall work closely with the ATC Contractor to be sure interlocks between boiler controls and building controls are installed and functioning properly.

M. Units shall be Hydrotherm Model KN-6, shipped in one piece on skids. Units by the following manufacturers will be considered:

1. Aerco KC Series
2. Viessmann Vertomat
3. Lochinvar Intellifin Series (only)
4. Buderus SB Series

N. Testing

Testing all pressure parts of the boilers shall be subjected to hydro-static tests according to ASME Code for low pressure boilers. Field tests shall be limited to maximum working pressure for which each boiler is intended. Contractor shall furnish all equipment, piping, water and labor necessary to perform such tests as may be required by the Boiler Inspector or as directed by Architect. Tests shall be of duration necessary to satisfy Boiler Inspector and Architect.

O. Startup and Commissioning

1. Engage a factory-authorized service representative to assist the Contractor with startup service. Start up to be performed only after complete boiler room operation is field verified to offer a substantial load, and complete system circulation. One-year warranty shall be provided by the manufacturer. One year's service shall be provided by the Contractor. Manufacturer shall also include pricing to provide a factory authorized technician for up to 4 service calls over that one year period.
2. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections. Do not proceed with boiler startup until wiring installation is acceptable to equipment Installer.
3. Complete manufacturer's installation and startup checklist and verify the following:
 - a. Boiler is level on concrete base.
 - b. Flue and chimney are installed without visible damage.
 - c. No damage is visible to boiler jacket, refractory, or combustion chamber.
 - d. Pressure-reducing valves are checked for correct operation and specified relief pressure. Adjust as required.
 - e. Clearances have been provided and piping is flanged for easy removal and servicing.
 - f. Heating circuit pipes have been connected to correct ports.
 - g. Labels are clearly visible.
 - h. Boiler, burner, and flue are clean and free of construction debris.
 - i. Pressure and temperature gages are installed.
 - j. Control installations are completed.
4. Ensure pumps operate properly.
5. Check operation of pressure-reducing valve on gas train, including venting.
6. Check that fluid-level, flow-switch, and high-temperature interlocks are in place.
7. Start pumps and boilers, and adjust burners to maximum operating efficiency.
 - a. Fill out startup checklist and attach copy with Contractor Startup Report.
 - b. Check and record performance of factory-provided boiler protection devices and firing sequences.
 - c. Check and record performance of boiler fluid-level, flow-switch, and high-temperature interlocks.
 - d. Run-in boilers as recommended or required by manufacturer.

8. Perform the following tests for each firing rate for high/low burners and for 100, 66, and 33 percent load for modulating burners. Adjust boiler combustion efficiency at each firing rate. Measure and record the following:
 - a. Gas pressure on manifold.
 - b. Combustion-air temperature at inlet to burner.
 - c. Flue-gas temperature at boiler discharge.
 - d. Flue-gas carbon-dioxide and oxygen concentration.
 - e. Natural flue draft (if applicable).
9. Measure and record temperature rise through each boiler.

P. One Year Service

Each boiler-burner unit shall be provided with free service period of one (1) year after acceptance by Owner. This service will include parts replacement and repair, excluding normal maintenance and adjustment. This service shall be a factory authorized service.

2.12 SMOKE PIPE

- A. Smoke pipe shall meet all requirements of a category IV positive pressure smoke venting systems. Furnish and install as indicated on drawings, a double wall, pre-fabricated vent system complete with all required supports, braces, stiffeners, hangers and weather caps. Sizes indicated on drawings are minimum inside diameters required by the boiler manufacturer. Inner wall shall be AL29-4C stainless steel, no less than 0.024 inches thick. The outer jacket (casing) shall be aluminized steel, no less than 0.024 inches thick. A minimum space of 1 inch shall be provided between the outer and inner walls. System shall be UL-1738 listed and comply with ANSI Z21.47, NFPA 54 and the National Fuel Gas Code. Shop drawings shall carry documentation of such.
- B. Provide fire stopping collar (provided by smoke pipe manufacturer) at each ceiling and floor as the vent rises through the building.
- C. Vent pipe and accessories shall be Corr/Guard Model CG by Metal-Fab, Inc. or approved equal by Metalbestos for systems using natural gas and shall be installed in strict accordance with the manufacturer's instructions and all applicable N.F.P.A., B.O.C.A. and local codes and ordinances.

2.13 FINNED RADIATION

- A. Finned pipe radiation shall consist of ¾ inch copper tube with aluminum fins. Each radiator shall have the finned length and heating capacity indicated on the drawings.
- B. Covers for all types shall be not less than 18 gauge steel, residential style with full back plates and continuous dampers. Back plate (factory painted) shall be securely fastened to the wall studs with screws at 48 inch centers maximum. Elements shall be supported by approved slide cradles and universal brackets spaced a maximum of 48 inches on center. Provide return line hangers where shown on drawings. Covers shall have baked enamel finish in white color.

- C. Unless shown differently on the drawings, the covers shall be a minimum of 1'-6" longer than the finned length. End covers or wall sleeve and wall sleeve supports shall be provided for each end of the cover.
- D. All ratings shown on the drawings are based on 160°F. average water temperature with a 40°F. temperature drop and 2.0 gallons per minute flow rate. The following types are based on Sterling Radiator Co. to establish a standard:
 - 1. Standard finned pipe (FP): Single tier element, 8½ inches high x 2.23/32 inches deep enclosure with return line hangers, ¾ inch copper tube, aluminum fins. Sterling Kom-Pak.
 - 2. FP-A: Single tier element, 9.13/16 inches high x 3.1/4 inches deep enclosure with return line hangers, ¾ inch copper tube, 2¾ x 2 ½ inch aluminum fins, 60 per linear foot. Sterling Senior.
 - 3. FP-B: Extruded 6063T5 clear anodized aluminum enclosure for use in high moisture applications. Single tier element, 6.7/16 inches high x 2.15/32 inches deep enclosure with return line hanger, ½ inch copper tube, 1.11/16 x 1.32/32 inch aluminum fins, 64 per linear foot. Sterling Kom-Pak.
- E. Provide itemized list of exact amount of finned tube and cover to be provided in each room and output capacities with submittals.
- F. Units by Haydon, Rittling and Vulcan will be considered. However, if capacities cannot be met in the lengths indicated, additional lengths must be provided to meet minimum required output at no additional cost.

2.14 CONVECTORS

- A. Convectors of the size and types listed on the drawings shall be provided and installed. They shall have removable front panels. Backs and end enclosures of the cabinets shall be constructed of not less than 20 gauge steel. Fronts and tops shall be of not less than 18 gauge steel, if less than 48 inches long and 16 gauge if 48 inches or longer. Elements shall consist of round seamless copper tubes, non-ferrous fins securely fastened to the tubing, taps at each end for venting on up-feed units and drains on down-feed units, with ratings as shown on the drawings. Cabinets shall have baked enamel finish in color to be selected by Architect. Provide not less than two (2) color chip cards with submittals (photocopies not acceptable). Ratings shown on the drawings based on 160°F. average water temperature with a 40°F. temperature drop as indicated on the drawings.
- B. The following types are based on Sterling to establish a standard:
 - 1. Fully recessed with front outlet and inlet grilles, four side overlapping front cover; Type FWG-A. Submittals must indicate the actual output after compensating for inlet grilles.
 - 2. Surface mount, wall hung, flat top with front outlet grille and bottom inlet; Type W-A.

3. All units shall be firmly fastened to the walls.

C. Units by Dun-Ham Bush, Rittling, Trane Co. and Vulcan will be considered.

2.15 CABINET UNIT HEATERS

- A. Cabinet unit heaters shall be provided and installed where shown and fastened securely. The units shall be mounted as indicated on the drawings and shall include multi-blade centrifugal fans with quiet operating three (3) speed high efficiency direct drive motor, insulated casing, coils of copper tubes with aluminum fins, tamper proof access door to motor control switch. Capacities indicated on drawings to be based on 180°F. inlet water with a 20°F. drop.
- B. All units shall be provided with 3 speed fan switch and unit mounted disconnect switch with thermal overload protection, all factory installed and wired.
- C. Cabinets shall be 18-gauge steel with exposed corners and edges rounded, easily removed access panels. Finish shall be factory applied baked enamel in color as selected by Architect on visible surfaces of enclosure or cabinet. Provide two (2) color chip cards with submittals (photocopies not acceptable).
- D. Cabinet insulation shall be 2 inch thick dual density bonded glass fiber. Exposed side shall be high density erosion proof material suitable for use in airstreams up to 4500 FPM.
- E. Coils shall be evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 200 psi and 220 degrees F.
- F. Provide two (2) sets of 1 inch *pleated media* throwaway type filters for each unit as specified under paragraph 2.19, "FILTERS". One set to be provided WITH each unit from the manufacturer to be used during construction and the other set installed when project is completed.
- G. Units shall be vertical configuration, floor mounted with hot water supply line aquastat provided by A.T.C. Contractor. Models indicated are Sterling. Equivalent models by American Air Filter, McQuay or Trane will be considered.

Units shall be inverted for bottom front discharge with remote thermostat (by A.T.C.), Model FI.

H. Shut-off valve, balancing valve, drain valve with metal cap and air vent shall be provided on each unit.

2.16 FANS

A. General

1. Fans with capacities and types shown on the drawings shall be provided and installed. All roof curbs, unless otherwise noted, shall be provided by the fan manufacturer and installed by the General Contractor. This Contractor shall furnish the General Contractor with the correct sizes of roof curbs bases for units supplied.

2. Fan selection shall be based on sloping portion of curve with spare capacity of 20% of total CFM and static pressure without increasing motor size. **Provide full fan curves with submittals that shown the entire operating range of the fan - not just the operating point. Fans that are submitted without this data will not be accepted.**
3. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be listed by the Canadian Standards Association Testing Laboratory (CSA). Sones indicated on drawings are maximum allowable.
4. All roof fans shall be provided by this Contractor with a continuous ½ inch thick neoprene rubber curb gasket covering the full thickness of the curb wall.
5. All fans shown with vibration isolators on drawings shall be provided with spring type unless otherwise indicated.
6. Motor operated dampers shall be furnished by ATC Contractor.
7. Wall caps shall be provided where indicated and shall include weather hoods extending to the bottom of the outlet. Units shall be 26 gauge (min) steel, primed for field painting and include a 0.020 inch damper with magnetic closure strips. Turn units over to General Contractor for final painting prior to installation. All units for exhaust fans and range hoods shall be identical in appearance and shall be provided by Aldes Ventilation Corp. (<http://www.americanaldes.com>) 2000 Series or Artis Metals Company (<http://www.artiscaps.com/exhaust.html>). Wall caps provided with fans are not permissible unless they meet these design and construction standards.
8. Roof curbs shall be not less than 13½ inches high, insulated, self-flashing type designed for EPDM roofing systems. Curbs shall include a damper shelf and be structurally designed to adequately support no less than twice the weight of the equipment to be placed on them.

B. Types

1. In order to establish a standard, fan model numbers indicated below are based on Air King and Cook (unless noted otherwise). Equivalent units by Acme and Greenheck ONLY will be considered.
2. Exhaust fans (EF) shall be ceiling mounted, direct driven, centrifugal exhaust fan. Fans shall be Energy Star rated and include a ceiling radiation damper for use in fire rated ceilings. Units shall be not more than 10 inches in height and fit within standard 16 inch joist centers. Air King Model FRAK80.

Fan housings shall constructed of 24 gauge galvanized steel. Motors shall be heavy duty, permanent split capacitor, 4 pole, thermally protected. A field wiring compartment with receptacle shall be standard. Blower wheel shall be centrifugal, one piece polymetric. Grille shall be cold rolled steel, powder coated white. Duct collar shall be 4 inch diameter, metal, with backdraft damper. Provide a field fabricated 4 inch to 6 inch diameter duct adapter for each fan.

Provide model AKEDT2 switch and turn over to Div 16. for installation. Switch shall turn on both the fan and separate room light (separate) simultaneously. An adjustable delay timer internal to the switch shall permit the fan to continue operation for an additional 20, 40 or 60 minutes when the switch is turned off.

Fire damper assembly shall include a non-asbestos ceramic blanket and a replaceable 165°F. fusible link. Ceiling radiation damper shall be ULC classified and rated for a 3 to 4 hour fire resistance, U.L. listed 555C.

3. EF-1 shall be Cook ACE-D Series centrifugal roof exhauster. Fan shall be a spun aluminum, roof mounted, direct driven, downblast centrifugal exhaust ventilator.

Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency.

Wheel shall be balanced in accordance with AMCA Standard 204-96, *Balance Quality and Vibration Levels for Fans*.

Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. A disconnect device/switch shall be factory installed and wired from the fan motor to a junction box. Standard wiring shall comply with National Electric Code and NBFU Standards and the fan shall be listed by Underwriters Laboratories (UL705). Thermal overload protectors shall be standard.

Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

Accessories shall include:

- a. Fully insulated roof curb with damper shelf
- b. Gravity shutter
- c. Hinged base

3. S-1 shall be Cook REBS Series roof curb mounted, downblast propeller supply ventilator. Fan shall be of aluminum construction with aluminum bird screen and direct driven.

Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. A disconnect device/switch shall be factory installed and wired from the fan motor to a junction box. Standard wiring shall comply with National Electric Code and NBFU Standards and the fan shall be listed by Underwriters Laboratories (UL705). Thermal overload protectors shall be standard.

Accessories shall include:

- a. Fully insulated roof curb with damper shelf
- b. Line voltage motorized damper.
- c. Hinged base
- d. Prewired fan speed controller

2.17 RANGE HOODS (RH)

- A. Apartment kitchen range hoods shall be designed for under cabinet mounting, ducted operation, provided with (2) fluorescent lamps, 2 speed fan switch and light switch. Lamps to be provided with the units. Units to be 30 inches wide, baked-on white polyester finish with washable aluminum mesh grease filter.
- B. Units shall be Nutone ESN1030WH or approved equal with rear and top knockouts for 10 x 3¼ inch ductwork with integral shutter. Adapters for transition to round ductwork shall be provided under par. 2.23, "SHEETMETAL". Units shall be configured as shown on plans and labeled as Energy Star compliant.

2.18 SHEETMETAL

- A. General

The work under this section includes all the required sheetmetal and duct work, extensions for grilles, manual dampers, automatic counterbalanced (backdraft) dampers, deflectors, setting of control dampers, grilles, registers, , flexible connections, fire dampers, and louvers, as shown on the drawings or required to make the installation complete in accordance with the intent of the drawings and specifications.

- B. Ducts

1. The size of ducts marked on the drawings will be adhered to as closely as possible. The right is reserved to vary duct sizes to accommodate structural conditions during the progress of the work without additional cost to the Owners. The duct layout is schematic to indicate size and general arrangement only. All ducts shall be arranged

to adjust to "field conditions". The Sheet Metal Contractor shall coordinate his work with Division 16 and other trades.

2. Medium and low pressure ducts shall be constructed of galvanized steel in accordance with the following table of duct sizes OR the latest SMACNA HVAC Duct Construction Standards for Metal and Flexible Duct, whichever is stricter, unless otherwise shown on drawings.

<u>Dimensions of Longest Side</u> (inches)	<u>Minimum Sheet</u> <u>Metal Gauge</u>
Up thru 12	26
13 --> 30	24
31 --> 42	22

3. Methods of fabrication and installation shall be in strict accordance with guidelines set forth in the latest SMACNA Guide and Data Book for Low and Medium Pressure Duct Construction unless otherwise shown on drawings. Cross break all ducts with largest dimension being 18 inches and larger. Beaded ducts are not acceptable except for ductwork less than 18 inches in either direction.
4. All dampers and deflectors shall be a minimum of #22 gauge and stiffened as required. Splitter dampers shall not be acceptable.
5. All joints in ducts shall be made air tight, and all branches and turns shall be made with long radius elbows and fittings. Long radius elbows are defined as having a centerline radius of 12 times the width of the duct. If long radius elbows are not used, elbows 18 inches wide and larger shall be provided with fixed double wall airfoil turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius elbow with a throat radius of not less than duct width. Square elbows less than 18 inches wide shall be provided with single wall turning vanes. Square elbows with outside corners cut at 45° or rounded are not acceptable.
6. All ducts shall be installed with necessary offsets, changes in cross sections, risers, and drops which may be required. They shall be constructed with approved joints and be supported in an approved manner.
7. Round ductwork shall be constructed in accordance with the latest SMACNA HVAC Duct Construction Standards for round and oval duct construction. Ductwork larger than 8 inches in diameter shall employ spiral seams. All turns shall be made with smooth (not segmented), long radius elbows and fittings. All seams shall be type RL-5, grooved seam pipe lock or better. *Lap seams are not permissible*. Gauge thicknesses shall be as outlined in SMACNA for galvanized steel round duct gauge selections for maximum 2 inches w.g. static pressure. Ductwork shall be supported with full wrap-around band and single hanger strap as indicated in Figure 4-4 of the 1985 edition of the SMACNA HVAC Duct Construction Standards handbook.
8. Furnish and install flexible connections where indicated. Connections shall be made from Ventglas neoprene coated glass fabric as furnished by Ventfabrics, Inc., or approved equal.

9. Every precaution shall be taken to keep interior of duct system free from dirt and rubbish and to protect all ducts and equipment during construction. At completion, this Mechanical Contractor shall thoroughly clean all equipment to the satisfaction of the Architect.
10. Spaces between ducts and wall, ceiling or floor construction shall be caulked to make smoke and water tight with 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant or approved equal.
11. Testing, Balancing and Leak Testing... See Part 3, EXECUTION
12. Requirements set forth in applicable codes (see part one) shall supercede SMACNA standards.
13. Wall caps shall be provided for exhaust fans and range hoods where indicated and shall include weather hoods extending to the bottom of the outlet. Units shall be 26 gauge (min) steel, primed for field painting and include a 0.020 inch damper with magnetic closure strips. Turn units over to General Contractor for final painting prior to installation. All units for exhaust fans and range hoods shall be identical in appearance and shall be provided by Aldes Ventilation Corp. (<http://www.americanaldes.com>) 2000 Series or Artis Metals Company (<http://www.artiscaps.com/exhaust.html>). Wall caps provided with fans are not permissible unless they meet these design and construction standards.

C. Grilles and Registers

Grilles and/or registers shall be installed at all air supply, relief, return and exhaust openings as shown. All units to be aluminum, except as noted, and provided with baked enamel finish to match color of grille or register and countersunk screw holes. Mounting screws shall be oval head type with head painted to match finish. Unless stated otherwise, the following list is based on model numbers of Anemostat to establish a standard of quality. Krueger, Price and Titus only will be considered for review. If substituting, certified sound criteria shall be included with submittals (and highlighted) indicating CFM and NC levels of each register and grille.

1. Supply Registers: Double deflection; X2HO with opposed blade damper and ¾ inch front blade spacing; front blades set horizontal.
2. Supply Grilles: Double deflection; X2H, ¾ inch blade spacing; front blades set horizontal.
3. Exhaust and Return Registers: X3HOD with opposed blade damper and ¾ inch, 45° front blade spacing, front blades set horizontal.
4. Exhaust and Return Grilles: X3H with ¾ inch, 45° front blade spacing, front blades set horizontal.

D. Louvers

1. All exterior louvers shall be extruded aluminum construction with interior bird screens and anodized in color to be selected by Architect. Provide not less than 2 color chip cards with submittals for review (photocopies not acceptable). Frames and blades shall have a free area of not less than 47% (combination type) and 55% (stationary type) and no less than 0.081 inches thick. The following list is based on model numbers of Ruskin to establish a standard of quality; approved equal units by American Air Warming and Arrow are acceptable.
2. All louvers shall be stationary blade type. Units to be 6 inches deep with certified rating of zero water penetration at free area velocity of 900 FPM based on tests in accordance with AMCA Standard 500. Units 48 inches and less in width shall be Model ELF6375X. Units greater than 48 inches in width shall have drainable blades, Model ELF6375DX.
3. Frames of all louvers to be box type for mounting in masonry walls. with factory mounting flanges on head and side jambs with extended sill for units mounted in frame walls.
4. Louvers in doors shall be provided as a part of the door by the General Contractor.

E. Roof Exhaust Vents

Roof exhaust vents to be heavy gauge aluminum, curb mounted, removable hood, with inside bird screens. Curbs to be provided with vents. Acme Model LQV or approved equal.

F. Duct Sleeves

Provide aluminum duct sleeves through outside wall at all locations as shown on drawings.

G. Sealing of Ducts

All interior ductwork (except prefabricated grease ducts and welded duct) shall be sealed with low VOC water based duct mastic, either "MP" (Multi-Purpose), Hardcast "Iron-grip 601", Polymer Adhesive "Airseal #11", or United Duct Seal (United McGill Corp.) water base, latex or acrylic type sealant. All transverse joints to be continuously sealed. Note that, except as noted, oil or solvent based sealants are specifically prohibited for use on this project. Duct tape, in any form or material, is also prohibited.

For exterior applications, "Uni-Weather" (United McGill Corp.) neoprene based sealant shall be used. No other sealants may be used.

All seams and joints in shop and field fabricated ductwork shall be sealed by applying one layer of sealant, then immediately spanning the joint with a single layer of 3" wide open weave fiberglass tape. Sufficient additional sealant shall then be applied to completely imbed the cloth.

All sealants shall be UL rated at no more than flame spread of 5 and smoke developed of 0. At contractor's option Hardcast 1602 sealant tape may be used in lap joints and flat seams.

H. Duct Access Doors

Hinged insulated access doors with seals shall be provided in ducts where indicated on drawings, or as required. Units shall be provided at each manual damper, motor operated damper, duct coil (both sides), duct mounted temperature control device and fire damper unless accessible through grilles and as shown on drawings. Units to be Ruskin Model ADH-22 for rectangular duct and Model ADR for round duct or approved equal by Elmdor.

I. Motor Operated Dampers

Motor operated control dampers mounted in ductwork shall be provided by ATC Contractor, but installed by this Contractor. Contractor shall seal dampers to ductwork to provide a completely waterproof and airtight seal between damper frames and ductwork.

J. Manual Dampers

1. See Part 3, EXECUTION for installation notes.
2. Manual dampers with smallest dimension 5 inches or less shall be shop fabricated, single 22 gauge blade, 3/8 inch rod, provided with position indicator and locking quadrant.
3. Manual dampers with smallest dimension larger than 5 inches but smaller than 11 inches shall be single blade steel, 16 gauge construction, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.
4. Manual dampers with smallest dimension larger than 11 inches shall be opposed blade steel, 16 gauge construction, linkage concealed in frame, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.
5. Dampers to be installed in aluminum ductwork shall be fabricated of aluminum or isolated from ductwork with rubber grommets between the damper and the duct to prevent oxidation between dissimilar metals.
6. Provide hand quadrants for all manual dampers, Ventline Model 560 or approved equal.

K. Backdraft Dampers

Except where provided with exhaust fans, provide and install automatic counterbalanced backdraft dampers where indicated on the drawings. Unit frames shall be channel type, constructed of 0.090 inch extruded aluminum. Blades shall be 0.025 inch formed aluminum with extruded vinyl edge seals. Unit shall employ aluminum blade linkage concealed in the frame and adjustable zinc plated counterbalance bar on blades (except on top blade). Units shall be capable of being mounted in any position, Ruskin Model CBD2 or approved equal. Contractor shall seal dampers to ductwork to provide a completely waterproof and airtight seal between damper frames and ductwork.

L. Fire Dampers

1. Fire dampers shall be installed to comply with NFPA Code No. 90A and shall bear a U.L. label. Provide fire rated access door at each fire damper not accessible through grille.
2. All fire dampers to be provided by damper manufacturer with integral sleeves (where required) and mounting angles. Sleeves provided "in-field" are not acceptable. Models indicated are Ruskin to establish a standard:
 - a. Wall and floor types; Model IBDT, style "B".
 - b. Wall type behind grilles; Model IBD20, Style G
 - c. Ceiling type above registers and grilles, Model CFD2W.
 - d. Ceiling type in range hood ducts, Model CFDR3W.
3. Provide factory mounted fusible links designed to melt at 165°F. and close the damper.
4. Installation shall be in accordance with damper manufacturer's instructions.

2.19 FILTERS

- A. All cabinet unit heaters with filter banks shall be provided with a minimum of three (3) sets of filters with pleated media. One set to be used during construction (and replaced by the Mechanical Contractor during construction if required as determined by the Clerk of the Works and/or the Mechanical Engineer). Second set to be installed a minimum of one (1) day and a maximum of three (3) days prior to testing and balancing and/or final inspection. The third set shall be turned over to the Owner in their original unopened shipping boxes for their future use.
- B. Filters shall be Farr 30/30, Air Guard DP-40 or approved equal; 1 inch thick.

2.20 EQUIPMENT IDENTIFICATION

Tag each fan (except kitchen range hoods and toilet exhaust fans), circulating pump, boiler, unit ventilator, unit heater, cabinet unit heater, compressor/condenser unit and switch with rectangular engraved nameplates with white letters on black, Brady Corp., Seton Name Plate Corp. or approved equals. Nameplates shall be mechanically fastened to equipment (adhesives are not acceptable). Embossed labels are not acceptable.

Boiler nameplates shall be 4 inches by 1½ inches, Setonply Style No. M1774. On all other units nameplates shall be 2½ inches by ¾ inch, Setonply Style No. M1771.

Identify all heating hot water supply and return mains with "Set Mark" full snap-around pipe markers by Seton Name Plate Corporation or approved equal by Brady Corp. Markers shall include both identification and direction of flow. Use yellow background with black letters. Markers shall be no less than 10 feet apart except in mechanical room where they shall be not less than 20 feet apart. Identification shall read "Heating Water Supply" or "Heating Water Return" as applicable. Domestic hot and cold water piping shall be labeled differently from heating water piping.

Tag all valves (if not tagged by valve manufacturer) with 1½ inch round brass tags and #6 bead chains, Seton #M4506. Tag shall be consecutively numbered. Provide valve charts identifying valve number, valve identification and service. Mount charts in Mechanical Room in 8½ inch x 10 inch and 8½ inch x 11 inch self-closing aluminum frame with plastic windows. Identify ducts and fire dampers with ventmark HVAC markers.

2.21 INSULATION AND CONDENSATE PROTECTION

A. General

1. Insulation shall be provided for all new metallic hot water supply and return piping, outside air intakes, exhaust ducts, relief ducts and other insulation where shown on drawings.
2. Insulation systems shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

B. Hot Water Supply & Return Piping

1. All new metallic hot water supply and return piping, exposed, above ceilings, within walls, pipe chases or pipe enclosures, shall be insulated with heavy density fiberglass pipe insulation with 450°F. temperature rating and factory applied ASJ jacket. Longitudinal jacket flaps to be secured with flare type stainless steel staples. Cut insulation to include pipe hangers.

Insulation thickness for hot water shall be as follows:

<u>Pipe Size</u>	<u>Insulation Thickness</u>
½" - 8"	1½"

Insulation thickness for hot water run-outs off mains and in partitions shall be as follows:

<u>Pipe Size</u>	<u>Insulation Thickness</u>
½" - 1"	1"

2. All fittings shall be wrapped with fiberglass insulation and covered with a one piece PVC insulated fitting cover secured with flare type stainless steel staples.
3. The ends of insulation on exposed pipes at valves, flanges, unions, etc., shall be finished neat with covering to match jacket and secured with mastic.
4. All valves 2½ inches and larger shall be wrapped with fiberglass insulation, covered and finished neat with covering material to match ASJ jacket on pipe insulation and secured with mastic.
5. Valves less than 2½ inches in size, flanges and unions shall not be insulated. Exception: All valves for cold water application shall be insulated.

C. Duct and Equipment Insulation

1. Insulate the following ducts with 3 inches thick fiberglass duct wrap with factory applied vapor barrier facing:
 - a. Ductwork from EF-1 (Elevator Machine Room) to the exterior wall.
 - b. Intake plenum behind louver for SF-1 and boiler combustion air in Mechanical Room.
 - c. Exhaust ducts connected to apartment range hoods from exterior walls to 72" inside building.
 - d. Ducts connected to all indoor exhaust fans from exterior walls to 72" inside building.
2. Material to carry U. L. label. All laps to be sealed and held in place with adhesive and flare staples. All lap joints to be folded under before stapling so no raw insulation will be showing. On the bottom of ducts 24 inches or wider, mechanical fasteners shall be provided approximately 12 inches O.C.

D. Air Separator

Air Separator shall be insulated with 2 inch thick heavy density fiberglass insulation with ASJ jacket. Insulation to be securely fastened. Finish cover insulation with 14 ounce re-wettable canvas. Note: Manufacturer's identification plates shall remain exposed with insulation material tapered down to plate and finished as specified above.

E. Condensate Protection

Solder or weld bottom and sides of ducts connected to outdoors to prevent water leaks from rain and snow. Seal duct wrap and liner to minimize condensation.

F. Installation

All insulation work shall be executed by skilled insulation workmen regularly employed in the trade.

2.22 AUTOMATIC TEMPERATURE CONTROL (ATC)

A. General

1. Furnish and install a complete system of electric/electronic temperature controls.
2. The control systems shall be provided and installed by trained control mechanics regularly employed in installation and calibration of ATC equipment by the manufacturer or manufacturer's franchised dealer of temperature control equipment.

NOTE: Control installation is not acceptable by wholesalers, contractors or by any firm whose principal business is not directly involved with the manufacture and installation of ATC systems.

Approved manufacturers and vendors are as follows (listed alphabetically):

- a. T.A.C.
Maine Controls
400 Presumpscot Street
Portland, Maine 04103
(207) 774-0220
 - b. Honeywell, Inc.
501 County Road
Westbrook, Maine 04092
(207) 775-3501
 - c. I.B. Controls
3 Pope Rd.
Windham, Me. 04062
(207) 893-0080
 - d. Johnson Controls
39 Salem Street
P.O. Box 840
Lynnfield, MA 01940
1-800-288-1028, ext. 4478
3. Shop drawings of entire control system shall be submitted for approval before work is started. ATC Contractor is required to attend a meeting with the Engineer, Mechanical Contractor and Commissioning Agent along with a preliminary copy of the ATC shop drawings for the purpose of coordination.
 4. Provide ATC technician to test the complete ATC systems sequences for specified cycles of operation with the Testing and Balancing Contractor.
 5. ATC Contractor must, at the end of the warranty period, furnish the Owner with all access codes and passwords assigned to the ATC control systems. ATC Contractor shall also instruct the Owner in the use and operation of the entire control system, including any software all control software that may be utilized (including a backup copy of the final software package to the Owner on CD), see paragraph F, "Instruction and Adjustment".

B. Scope

Control system shall consist of all area thermostats, air stream thermostats, valves, dampers, damper operators, relays, transformers, labor, 7 day program clocks and other accessory equipment, and a complete system of wiring to fulfill intent of ATC specification. Control shall be provided for, but not limited to the following:

1. Direct radiation
2. Fans operated by automatic temperature control system
3. Cabinet and horizontal unit heaters
4. Control of circulating Pumps.
5. Control of domestic hot water

C. Incidental Work by Others

1. The following incidental work shall be furnished by the designated contractor under the supervision of the Control Contractor.
 - a. Mechanical Contractor shall:
 - (1) Install automatic valves and separable wells that are specified to be supplied by the Control Contractor.
 - (2) Furnish and install all necessary valved pressure taps, water, drain and overflow connections and piping.
 - b. Sheet Metal Contractor shall:
 - (1) Install all automatic dampers.
 - (2) Provide necessary blank-off plates required to install dampers that are smaller than duct size.
 - (3) Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
 - (4) Provide access doors or other approved means of access through ducts for service to control equipment.
 - c. The General Contractor shall:
 - (1) Provide all necessary cutting, patching and painting.
 - (2) Provide access doors or other approved means of access through ceilings and walls for service to control equipment.
 - d. Division 16 shall:
 - (1) Provide wiring as described in Fan Schedule on sheet M-X.
 - (2) Wire power to all motor operated dampers.

D. Electric Wiring

1. All low voltage and data wiring for installation of temperature controls shall be by ATC Contractor, except as noted. Power wiring for equipment shall be by Division 16, "ELECTRICAL". See Part 1, Paragraph 1.05, sub-paragraph C, "MECHANICAL ELECTRICAL WORK" for specific requirements.
2. ATC Contractor shall be responsible for coordinating installation of his wiring conduits with Division 16, "ELECTRICAL".

E. Submittal Brochure

1. The following shall be submitted for approval:
 - a. Control drawings with detailed wiring diagrams, including bill of material and description of operation for all systems.
 - b. Panel layouts and name plate lists for all local and central panels.

- c. Valve and damper schedules showing size, configuration, capacity and location of all equipment.
- d. Product data for all control system components.

F. Instruction and Adjustment

Upon completion of the project, the ATC Contractor shall:

- 1. Adjust for use by Owner, all thermostats, controllers, valves, damper operators, and relays provided under this section.
- 2. Furnish two (2) instruction manuals covering function and operation of control systems for use of the Owner's operating personnel. A competent technician shall be provided for instruction purposes.
- 3. Provide training in the setting, use and care of the ATC systems. Training shall commence after the Owner has taken possession of the building and shall not exceed three (3) hours. Cost of additional training shall be negotiated between the Owner and ATC Contractor.

G. Guarantee

Control system shall be guaranteed to be free from original defects in both material and workmanship for a period of not less than one (1) year of normal use and service. This guarantee shall become effective starting the date Architect agrees Owner has begun to receive beneficial use of the system.

H. Hazardous Materials

Mercury, or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the ATC system.

I. Control Panels

- 1. Provide and install surface mounted control panel with dust tight gasketed, hinged door with enamel finish in Mechanical Room where indicated on the drawings. All switches, relays and equipment necessary for system operation shall be provided in control panel including the following:
 - a. Separate thermometers indicating outdoor air and re-set water temperature (on face of panel).
 - b. Pump selector switches (on face of panel) where applicable.
 - c. Install engraved plastic identifying tags for each switch on unit.
- 2. All electric wiring within the panel shall be factory wired to terminal strips.

J. Thermostats

1. General

All thermostats shall be mounted at 48 inches above finish floor to top.

2. Apartments and common areas.

- a. Direct Radiation: Thermostats shall be low voltage, digital, single temperature, with large backlit L.E.D. temperature display.
- b. Thermostats shall not contain mercury or any other toxic material.
- c. Honeywell T8775A1005 for heating only or approved equal.
- d. Provide clear, tamperproof covers in corridors and common areas

3. Public areas– same as apartments and common areas but with clear, tamperproof cover.

4. Fan thermostats

Heavy duty, line voltage, all metal type. Reverse acting (cooling).

5. Cabinet unit heaters

- a. These thermostats shall be of the single temperature type intended for use in visible areas.
- b. Heavy duty with concealed adjustment and heavy duty clear plastic tamper proof covers.

K. Automatic Control Valves

All automatic control valves for direct radiation shall be two position. Valves shall be quiet in operation and fail safe in the normally open position in the event of control power failure. All control valves shall be line size and guaranteed to meet the heating loads as specified. All control valves shall be suitable for the pressure conditions and shall close against the differential pressure involved. Valve operators shall be low voltage. Body pressure rating and connection type (screwed or sweat) shall conform to pipe schedule in this specification.

L. Miscellaneous Devices

Provide all the necessary relays, transformers, valves, positioners, switches, etc. to make a complete and operable system.

M. Dampers

- 1. Control dampers shall have 16 gauge galvanized frames not less than 2 inches in width with airfoil blades not less than 14 gauge galvanized steel, and shall be adequately braced to form a rigid assembly. No dampers shall have blades more than 6 inches wide. Dampers shall be painted with one coat of lacquer. Dampers shall be two position or proportioning as required by specific application, opposed blade type with linkage concealed within the frame. Oilite bronze bearings shall be

provided at the ends of damper blades. ALL DAMPERS SHALL BE MOUNTED WITH BLADES ORIENTED HORIZONTALLY.

2. Damper operators shall be provided with bracket arrangement for location outside of air stream wherever possible. All damper motors shall be sufficient size to operate dampers, including slow opening and fast closing.
3. Dampers shall be provided with flexible metal edge and jamb seals and neoprene blade edge seals for tight closure. Leakage shall be certified to be no more than 2.0 CFM per square foot at 1 inch w.g. on units 24 inches wide and larger, 3.0 CFM per square foot at 1 inch w.g. on units less than 24 inches wide.
4. Control dampers furnished by the Automatic Temperature Control Contractor shall include motor operated dampers installed in supply fan 1 and 2 ducts. Dampers at all combination wall louvers shall be furnished by manufacturer of louver equipment involved.
5. Dampers shall be Ruskin Model CD60 or approved equal by Air Balance or Arrow.

N. Description of Operation – *(STILL A "WORK IN PROGRESS")*

1. System shall be hot water with water supplied from the boilers at a maximum of 180°F, with 40°F drop through the heating system.
2. Reset Water Control

A control sequence and hardware to maintain the water temperature to the system by modulating (resetting) boiler output temperature shall be provided within each boiler's own controls. ATC Contractor shall adjust the reset schedule to provide 180°F water @ 20°F outdoors to 130°F water @ 65°F outdoors (and higher). As the outside temperature falls, the supply water temperature shall be decreased. On a rise in outdoor air temperature, the temperature of the water shall be decreased.

Additional control shall be provided to give priority to domestic hot water. Whenever pumps P-4 or P-5 activate, the reset water controller shall increase boiler output temperature to 180°F water for as long as required.

Coordinate with boiler manufacturer's literature for required control components and sequences not provided with boilers.

3. Boiler Controls
 - a. A true run time lead-lag control is specified to be supplied with the boiler controls.
 - b. ATC Contractor shall provide interlock wiring between boiler controls and pump P-1.
 - c. ATC Contractor shall provide interlock wiring between boiler controls and pumps P-4 and P-5 for domestic hot water override control.
 - d. Coordinate with boiler manufacturer for required control components (if any) and sequences not provided with boilers.
 - f. Boiler manufacturer is required to provide qualified personnel to install

boiler related controls and wiring requiring field installation. Installer is required to work closely with the ATC Contractor to be sure interlocks between boiler controls and building controls are installed and functioning properly. See par. 2.11, "BOILERS".

4. Control of Circulating pumps

- a. Boiler Blend Pump (P-1): When either boiler's internal aquastat calls for heat the pump shall be activated and a flow switch (provided by boiler manufacturer) shall verify flow before permitting burners to ignite. Coordinate with boiler manufacturer's literature for required control components and sequences not provided with boilers.
- b. Heating Pumps (P-2 and P-3): Pumps shall be provided from the factory with lead/lag controls and outdoor air controls. Provide and install communication wiring between each pump's controller. Work with commissioning agent to program pumps for lead/lag operation and pump on/off operation based on outdoor air temperature. Active pump shall run continuously when outdoor temperature is below 62°F. and off above 65°F. (adjustable).
- c. Domestic Hot Water Pumps (P-4 and P-5): Each domestic hot water storage heater is provided with it's own pump to supply boiler water to the heat exchanger coil. Each pump shall be controlled by an immersion aquastat (adjustable setpoints) to be provided and installed into the tank by the ATC Contractor. Pumps shall have a high limit (off) of 140 deg. F. and a low limit (on) of 120 deg. F. Interlock each pump with boiler domestic hot water over-ride controls.

5. Provide and install a bypass between the supply and return mains in the mechanical room to relieve pressure in the supply main as zone valves close. The valve operating mechanism shall be spring loaded, self-contained with adjustable setting.

6. Occupied-Unoccupied Control

There shall be no automatic occupied to unoccupied control.

7. Control Panel

Provide a control panel where indicated in Mechanical Room. The panel shall contain temperature indicators showing outdoor air temperature, boiler discharge temperature and supply (reset) water temperature. Panel shall also contain controls for pumps as previously outlined. All relays and accessories to accomplish the specified sequence of control shall also be contained in the panel.

8. Direct radiation

All direct radiation shall be controlled by single temperature thermostats and two position, line size zone valves. When a thermostat calls for heat the zone valve opens.

9. Cabinet Unit Heaters

Units to be supplied with remote thermostats and aquastats on hot water supply to each unit furnished and installed by ATC Contractor. When thermostat calls for heat the fan shall start provided the supply water temperature is not less than 130°F.

10. Fans shall operate as indicated on "FAN SCHEDULE" on sheet M___. Provide 120 volt motor operated dampers to open when fans cycle (where indicated); wiring by Division 16 unless noted otherwise.

- a. Fans tagged "EF" to operate from switches provided with the fans and installed by Division 16. All fans shall be switched individually with the room lights. A 7 day timing controller by Div. 16, shall permit all fans to operate simultaneously for a set time interval.

Exception: See Par. "b" below for fan in Elevator Machine room.

- b. Exhaust Fan 1, EF in Elevator Machine Room and Supply Fan 1 x shall operate from heavy duty, 120 volt reverse acting cooling thermostats.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all work is complete to the point where this installation may properly commence.
2. Verify that Mechanical systems may be installed in strict accordance with all pertinent codes and regulations and the approved shop drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify Architect.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION OF PIPING AND EQUIPMENT

A. General

1. All piping shall be installed within building insulation.
2. Size and general arrangements as well as methods of connecting all piping, valves, and equipment shall be as indicated, or to meet requirements for complete installation.
3. All vertical pumps shall be supported independently of the piping system.
4. All piping shall be erected to provide for easy and noiseless passage of hot water under all working conditions. Inverted eccentric reducing fittings shall be used whenever water pipes reduce in size in the direction of flow. Tee fittings with reduction in the main direction of flow (run) are not acceptable.
5. All hot water mains shall be run level or pitch slightly upward so that no air pockets are formed in piping. Mains shall be set at elevations so runouts feeding heating equipment shall have no pockets where air can collect or automatic vents shall be provided.
6. Where preset balancing valves are used, it is critical that there not be two valves installed in series anywhere throughout the piping system.
7. Provide drains with hose threads and metal caps at all low points in the water piping system.
8. In erection of hot water piping care must be taken to make allowance for expansion and contraction; piping shall be anchored as necessary to control expansion.

9. Runouts to hot water radiation shall be size indicated on plans.
10. Install brass fittings at all points of dissimilar piping connections.
11. Install a sufficient number of unions or flanges to facilitate assembly and disassembly of piping and removal of equipment.
12. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
12. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective materials from the job site.
13. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load carrying members without the approval of the Architect.
14. All risers and offsets shall be substantially supported.
15. Make all changes in pipe size with approved reducing fittings.
16. All low points in water piping shall be provided with an accessible plug tee or drain valve.
17. All high points in water piping shall be provided with an accessible automatic vent.
18. Maximum spacing of pipe hangers (for metallic piping) shall be as follows:

<u>Pipe Size</u>	<u>Spacing</u>
½", ¾" & 1"	6'-0"
1¼" & 1½"	8'-0"
2" & 3"	10'-0"

19. Whenever possible valves shall be installed with the operating stems in the upright position, however when conditions dictate it is acceptable to position valves 90° to either side of vertical. Valves shall not be installed with the stems in the downward position.
20. Do not substitute one style of valve indicated on drawings for another unless authorized by the Architect. Example: If a gate valve is shown use ONLY a gate valve or if a ball valve is shown use ONLY a ball valve.
21. Mount in-line air separators 3 inches in size and larger independent of the piping system. Do not obstruct removal area of strainer with pipe hangers, equipment or other piping.

B. Joints and Connections

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all plugs.
2. Make all joints in copper tube (water and drains) with 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations.

C. Fire Safety

Fire extinguishing equipment shall be kept within 25 feet of welding areas at all times. No flammable materials shall be placed within 25 feet of welding areas unless they are physically connected to the building structure. Contractor shall take additional measures when welding close to flammable structures to protect the wood from igniting.

D. Thermometers

1. Install thermometers where indicated on drawings and:
2. Install thermometer wells on supply and return branch piping at all duct hot water heating coils and two (2) thermometers with storage cases for the Owner's use.
3. Install thermometers on hot water piping at each port of reset water valve.

E. PEX tubing

1. Install PEX tubing where indicated on drawings.
2. Tubing shall be supported from building structure only, not from other piping or equipment.
3. Do not support other piping or equipment from PEX tubing.
4. PEX tubing may be threaded through structure with the structure acting as support so long as support is not provided in lengths greater than 32 inches on center. Use protective sleeves or bushings where tubing passes through metal studs. Tubing shall not have sags or low points that would prevent thorough drainage of the system.
5. Support devices shall be a product of the PEX manufacturer. Support devices shall be screwed, not nailed, into wood. Do not attach to the underside of floor decks. It is acceptable to support PEX tubing to the side of steel bar joists with "zip" strip draw bands at 32 inch centers (maximum).

3.03 PIPING TEST AND ADJUST

- A. During the installation, all hot water supply and return piping shall be tested with water to a pressure of not more than 125 psi and held for a period of not less than four (4) hours. Isolate cast iron boilers and any other piping or devices not designed for this pressure. Do not use compressed air on PEX tubing systems. Any leaks shall be repaired and another test applied to the piping. All piping shall be tested before it is insulated or otherwise concealed. Contractor shall be required to certify in writing that piping has been tested and conforms to these requirements.
- B. Before operating the water system, all of the new piping shall be flushed out to remove oil and foreign materials. This shall be accomplished by circulating a solution of heavy duty detergent by use of Mechanical Contractor supplied pump.
- C. After the installation is complete and ready for operation, the system shall be tested under normal operating conditions in the presence of the Architect and demonstrated that the system functions as designed.
- D. It shall be demonstrated that all parts of heating system have a free and noiseless circulation of steam and water and that all parts are tight. It shall also be demonstrated that all units are functioning properly and that control system operates correctly.
- E. Should any defects in operation develop during the test periods, the Mechanical Contractor will proceed to correct defects immediately. Additional tests will be conducted after correction.

3.04 INSTALLATION OF DUCTWORK AND EQUIPMENT

- A. General
 - 1. Size and general arrangements as well as methods of connecting all registers, grilles, duct coils and equipment shall be as indicated, or to meet requirements for complete installation.
 - 2. Construction standards and sheet metal gauges shall be as outlined in the latest edition of the SMACNA HVAC Duct Construction Standards handbook for metal and flexible ducts unless specifically indicated otherwise.
 - 3. See paragraph 2.18, "Sheetmetal", sub-paragraph F., "Sealing of Ducts" for duct sealing.
 - 4. Manual Dampers
 - a. Manual dampers may be shop-fabricated on units 5 inches in height and less. All dampers larger than 5 inches MUST be pre-fabricated as previously outlined in this specification.
 - b. All manual dampers located within 10 feet of a fan outlet shall have the blades oriented perpendicular to the fan shaft.
 - c. Provide duct access door as large as possible up to 12 inches x 12 inches at EACH manual damper larger than 5 inches.

B. Protection and Cleaning

1. All open ends of ductwork which is to be unattended for 4 hours or more shall be temporarily protected with plastic sheeting and duct tape (or similar method) to reduce the collection of construction dust and debris.
2. All openings in mechanical equipment (unit ventilators, cabinet unit heaters, fans, etc.) shall be covered with cardboard and thoroughly sealed to duct and contaminants with painters tape during the construction period unless work is actually being performed on the equipment.
3. Prior to testing and balancing and at the end of the construction, clean the interiors of all supply and return air ductwork before changing filters in air handling equipment. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

3.04 TESTING, ADJUSTING AND BALANCING (TAB)

A. General

1. TAB contractor shall be a subcontractor to the Mechanical Subcontractor.
2. TAB contractor shall perform functional performance test of all Division 15 equipment and entire ATC system for specified operation and control sequences.
3. The mechanical contractor shall startup all Division 15 equipment as required by the equipment specifications. Mechanical contractor shall verify that systems are complete and operable before TAB commencing work. Ensure the following conditions:
 - a. Systems are started and operating in a safe and normal condition.
 - b. Temperature control systems are installed complete and operable.
 - c. Proper thermal overload protection is in place for electrical equipment.
 - d. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - e. Duct systems are clean of debris.
 - f. Fans are rotating correctly.
 - g. Fire and volume dampers are in place and open.
 - h. Air coil fins are cleaned and combed.
 - i. Access doors are closed and duct end caps are in place.
 - j. Air outlets are installed and connected.
 - k. Duct system leakage is minimized.
 - l. Hydronic systems are flushed, filled, and vented.
 - m. Pumps are rotating correctly.
 - n. Mechanical equipment is thoroughly clean and free of debris.
4. TAB Contractor shall submit field reports to General Contractor and Architect. Report defects and deficiencies noted during performance of services which prevent system testing and balance.

5. TAB contractor shall submit all verification and functional performance checklists/results, signed by indicated personnel, organized by system and sub-system.
6. TAB contractor shall submit other reports described below.

B. Work Included

1. Test, adjust and balance all air and water systems, including components to conform to air and water flow rates shown on drawings.
2. Test complete automatic temperature control sequences for specified operations described under AUTOMATIC TEMPERATURE CONTROLS.
3. Complete and submit balance report in spreadsheet format. Report shall be submitted with information noted on one side of sheet only (i.e., backside of sheet shall be blank.).
4. Testing of air and water systems will be done by the same agency.
5. Mechanical Contractor SHALL PROVIDE copies of shop drawings indicating coil gpm's, air handling unit air volumes, etc. to the Testing and Balancing contractor at no cost to the contractor.
6. The Balancing Contractor shall carry an allowance of \$250. which may be used, if directed by the Architect, to change motor drives and belts as job conditions require. The allowance or unused portion shall be returned to the Owner upon acceptance of the system.
7. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

C. Quality of Compliance

1. Qualification: TAB Contractor must be independent test and balancing agency.
2. AABC Compliance: Comply with AABC Manual MN-1 "AABC National Standards" as applicable to mechanical and hydronic distribution systems and/or Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
3. Industry Standards: Comply with ASHRAE recommendations for measurements, instruments and testing and balancing.
4. Coordination: Work together with Automatic Temperature Control Contractor to adjust set points of various devices to balance system(s) and test ATC sequences of operation. Temperature Control Contractor shall be responsible for balancing return air, exhaust (relief) air and outdoor air dampers on Air Handling Units in order to achieve proper mixed air temperatures.

5. ASHRAE Guideline 1-1996, "The HVAC Commissioning Process".

D. Execution of TAB Work

1. TAB Contractor shall visit job site and determine that control devices, test devices and valves are correctly installed and ready for balancing.
2. Examine each air and hydronic distribution system to see that it is free from obstructions. Determine that all dampers, registers and valves are in a set or full open position; that moving equipment is lubricated, and that required filters are clean and functioning. Request that Installing Contractor perform any adjustments necessary for proper functioning of the system.
3. TAB Contractor shall use test instruments that have been calibrated within a time period recommended by the manufacturer, and have been checked for accuracy prior to start of testing, adjusting and balancing activity.
4. Verify that all equipment performs as specified. Adjust variable type drives, volume dampers, control dampers, balancing valves and control valves as required by TAB work.
5. Test pressure profile of systems by traverse as required.
6. Adjust each register and damper to handle and properly distribute design airflow within 5% of specified quantities. Mark all setpoints.
7. Adjust front and rear discharge louvers on each supply register to distribute air in an even pattern or as indicated on plans.
8. Set all adjustable balancing valves so that each is furnished with design fluid flow within 5% of the specified quantities. Mark all set points.
9. Take readings at pre-set balancing valves and record flow readings.
10. Adjust air discharge patterns of all supply air diffusers, registers and grilles for optimal air diffusion.
11. Document results of all testing on approved TAB report formats and submit 3 copies for approval and record within 15 days of completion of TAB work. Include a warranty period of 90 days, during which time the Architect/Engineer may request a re-check or re-adjustment of any part of the work. Reports shall be compiled on a spreadsheet such as Excel, Quattro-Pro, Lotus, etc. and shall clearly indicate the following *minimum* information:
 - a. Air (Rated and Actual)
 - 1) System/unit name
 - 2) HP, BHP, voltage, amperage and fan rpm
 - 3) Static pressures; suction, discharge and total
 - 4) Total system flow rate

- 5) Individual terminal flow rates (Terminal readings must show location, make, model and size of register, grille or diffuser).
- 6) Filter status report

b. Water

- 1) Pump full flow and no-flow suction and discharge pressures.
- 2) Rated and actual amperage, voltage and total discharge head (TDH).
- 3) Calibrated balancing device readings will indicate location, size, setting, differential pressure and rated and actual gpm.

Reports to have a minimum of color or must be compatible with monochrome printers. Reports must be submitted to the Architect electronically in addition to hard copies.

E. Drawings

Drawings in CAD format may be made available to the TAB Contractor after the contract for this work is awarded. Contact the Engineer via telephone or at mechsyst@maine.rr.com and request the drawings, indicating CAD format required and a return e-mail address. Files will be compressed and will require WinZip to extract them (available at <http://www.winzip.com>).

F. Acceptable TAB Contractors (listed alphabetically)

1. Central Air Balance
2. Maine Air Balance
3. Tab-Tech International
4. Tekon-Technical Consultants
5. Yankee Balancing

3.05 CLOSING IN UNINSPECTED WORK

A. General

Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance

Should any work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required. After it has been inspected completely and approved, make all repairs and replacements with materials necessary for approval by the Architect and at no additional cost to the Owner.

If it is not practical to uncover the uninspected work it may, at the Architect's discretion, be considered inadequate and credit given to the Owner for the work as if it were not done in satisfactory accordance with the terms of the contract documents.

3.06 TEMPORARY HEATING

- A. Mechanical Contractor shall install the new heating system and related equipment as soon as those portions of the building are ready and the work can be performed.
- B. Mechanical Contractor will be required to permanently connect as many units as possible for temporary heat.
- C. At the conclusion of the temporary heating period, the complete system shall be thoroughly cleaned.
- D. General Contractor will be required to assume full responsibility for the care and operation of the new equipment during its temporary use and to return the equipment to the Mechanical Contractor in perfect order, normal wear and tear excepted.
- E. Water, fuel and electric power required to operate the heating system for temporary heat shall be provided by the General Contractor.

3.07 CLEANING

Prior to acceptance of the buildings, thoroughly clean all exposed portions of the heating and ventilating installation, including the removal all labels and all traces of foreign substance. Prior to testing and balancing vacuum and clean inside of all convectors, finned radiators (spackle droppings), unit ventilators, heat recovery units, fans and cabinet unit heaters. Clean the interiors of ductwork (where accessible) as outlined in 3.03, "INSTALLATION OF DUCTWORK AND EQUIPMENT"; paragraph "B", "Protection and Cleaning".

3.08 INSTRUCTIONS

On completion of the job, the Mechanical Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. (Temperature control system instruction shall be in addition to this instruction period). The time of instruction shall be arranged with the Owner.

3.09 RECYCLING

Discarded materials shall be recycled whenever practical through metal salvage dealers (ductwork, piping, etc.), paper salvage (cardboard shipping containers, etc.), wood & plastic products, etc. The Mechanical Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, refrigerants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

3.10 HAZARDOUS MATERIALS

Mercury, asbestos or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the mechanical systems.

PART 4 - ALTERNATES

4.01 GENERAL DESCRIPTION

- A. Alternate #1 is an add alternate to provide and install solar preheating of domestic hot water. See section 15400, 'PLUMBING'.
- B. Alternate #2 is an add alternate pertaining to the ATC system.

4.02 ALTERNATE #2

- A. Provide an install a Direct Digital Control (DDC) system to limit the temperature range of all thermostats connected to finned radiation and convectors.
- B. System shall be networked and include a Master Controller with a password protected, web based solution to permit the Owner to access the system via the internet and adjust the maximum and minimum temperature set points of the all thermostats at the same time.
- C. Thermostats shall be digital, backlit, heating only with no switches for accessories which do not apply. Thermostats shall provide a fixed space temperature limit of 75 degrees on the high side and 66 degrees on the low side (adjustable via the web based software). Thermostats shall not have the ability to show any other set points settings outside these ranges. The back lit display shall indicate the existing temperature in the space. The controller attached to the thermostats shall open the heating valve on a call for heat within the fixed temperature setting. There shall not be a need for a master panel. The fixed set point limits shall be programmed into the controller(s) only.

END OF SECTION 15600

**SECTION 15710
FIRE SPRINKLERS & STANDPIPES**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

1.03 DEFINITIONS

- A. Reviewed equal: Shall mean that the Engineer, not the contractor, shall make final determination whether materials are an equal to that which is specified.
- B. Equal: Shall mean essentially the same as that product specified, but a model of a different manufacturer.
- C. Concealed: Shall mean in walls, in chases, above ceilings, within enclosed cabinets, otherwise enclosed.
- D. Exposed: Shall mean in finished spaces, in closets, under counters, behind and/or under equipment and/or otherwise visible.
- E. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- F. Others: Shall mean provided by sections other than this section. If not purposely assumed by another section, shall be provided by the General Contractor.
- G. Materials: Shall mean any product used in the construction, including but not limited to: fixtures, equipment, piping and supplies.
- H. Piping: Shall mean pipe, fittings, hangers and valves.
- I. Provide: Shall mean the furnishing and installing of materials.
- J. Substitution: Shall mean materials of significantly different physical, structural or electrical requirements, performance, dimensions, function, maintenance, quality or cost, than that specified.

1.04 DESCRIPTION OF WORK

A. Work Included

Provide all design services, construction documents, labor, transportation, equipment, permits, materials, tools, inspections, incidentals, tests and perform all operations in connection with the installation of a complete new Hydraulically Designed Wet Pipe Sprinkler System in all areas of the buildings, with Wet Standpipe Systems in the stairwells. Comply with requirements of all Authorities Having Jurisdiction. Include aesthetic considerations into the design. Coordinate with interfacing trades. Submit equipment and components for review. Prepare Shop and Record Drawings and Owner's Manuals. Assure quality of workmanship. Provide guarantees and warranties.

1. Automatic Sprinkler System shall meet the standards of the most recent edition of the National Fire Protection Association's (NFPA) NFPA 13R Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.
2. A Dry Automatic Sprinkler System meeting the requirements of NFPA 13 Installation of Sprinkler Systems shall be provided for the parking area beneath the building.
2. A Manual Wet Class 1 Standpipe system shall be provided in the stairwells and shall meet the requirements of the National Fire Protection Association's (NFPA) NFPA 14 Standard for the Installation of Standpipe, Private Hydrant and Hose Systems.

1.05 SUBMITTALS

A. Shop Drawings:

1. Within 30 working days after the General Contractor has received a fully executed contract, prepare and submit Plans / Shop Drawings in accordance with the requirements of NFPA and obtain the Engineer's approval and Owner's Insurance Underwriter approval before proceeding with the fabrication and work.
2. Drawings shall include, but not be limited to:
 - a. Name of Owner and Occupant
 - b. Name and address of Contractor.
 - c. Physical Location
 - d. Plan view of system
 - e. Full height cross section or schematic diagram including ceiling construction and spray obstructions.
 - f. Locations of all partitions, with fire partitions noted.
 - g. Occupancy class for each area and minimum density of water application.
 - h. Locations of concealed spaces
 - i. Plan showing location and size of city water main, where private main attaches, all valves, distance and elevation between main and riser.

- j. Recent hydrant test showing both static and residual pressures, and date and time taken. List any significant known daily or seasonal pressure fluctuations and the cause.
 - k. Make, model and nominal K factor of sprinkler heads.
 - l. Control valves, check valves, drain pipes and test connections.
 - m. Fire department connections
 - n. Details showing riser piping configurations.
 - o. Pipe sizes.
 - p. Switches and supervisory devices.
 - q. Interface with Fire Control Panel.
3. To obtain an electronic copy of the building plan and sections, contact the Engineer. Specify required CAD format when requesting the files.
4. Procedure
- a.. As soon as possible after award of Contract, before any material or equipment is purchased, this Contractor shall submit to the Engineer no less than ten (10) copies for approval. Shop drawings shall be properly identified and shall describe in detail the material and equipment shall be provided, including all dimensional data, performance data, curves, computer selection print-outs, etc.
 - b. Corrections or comments made on the submittals do not relieve the contractor from compliance with requirements of the specification. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.
 - c. All related items shall be submitted as a package.
4. Submit data on the following items:
- a. Piping, fittings and couplings.
 - b. Alarm check valves and trim.
 - c. Backflow preventer.
 - d. Valves and supervisory devices.
 - e. Sprinkler heads and escutcheon plates.
 - f. Supports, hangers and accessories.
 - g. Fire Department Connections.
 - h. Any other significant item valued over \$100.00
5. Submit to the Owner's Insurance Underwriter sufficient copies for approval to allow one copy to be incorporated into each Owner's Manual in addition to the required As-Built Plans

1.06 HYDRAULIC DESIGN DATA

- A. Building Occupancy:
 - 1. Apartments and parking.
- B. Water Density and Square Foot Requirements: Provide per NFPA.
- C. Codes and Requirements:
 - 1. Comply with the standards of most recent edition of the National Fire Protection Association.
 - 2. Comply with the BOCA International Building Code, all Maine State laws as well as local codes and ordinances.
 - 3. Comply with the requirements of the State Fire Marshals Office, Local Fire Chief, Owners Insurance Underwriter, Local Water District and other Authorities Having Jurisdiction

1.07 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner.

1.08 MAINTENANCE MANUAL

On completion of this portion of the work, and as a condition of its acceptance, submit for review two copies of a manual describing the system. Prepare manuals in durable 3-ring binders approximately 8.1/2" by 11" in size with at least the following:

- A. Project name on the spine and front cover, and identification on the front cover stating the project name, general nature of the manual, and name, address and telephone number of the General and Sprinkler Contractors.
- B. Neatly typewritten index.
- C. Complete instructions regarding operation and maintenance of all equipment involved.
- D. Complete nomenclature of all frequently replaceable parts and supplies, their part numbers, and name, address and telephone number of the vendor.
- E. Copy of all guarantees and warranties issued, and dates of expiration.
- F. Shop drawings and equipment/fixtures manufacturer's catalog pages.

PART 2 – PRODUCTS

All products shall be new and must be either Factory Mutual (FM) or Underwriters' Laboratory (U.L.) listed or both.

2.01 MANUFACTURERS

- A. Equipment: Grinnell, Standard, Viking, Central Sprinkler Corp., Reliable, or equal.
- B. Heads: Viking, or equal.
- C. Flow Switch and Supervisory Device: Potter Electric Signal Company or equal.
- D. Backflow preventer: Ames or equal.

2.02 MATERIALS

A. Piping:

- 1. Outside Building, Underground: Is the responsibility of the General Contractor and shall comply with NFPA.
- 2. Inside building: Shall be schedule 40 black steel, standard weight welded, threaded or Victaulic fittings for sizes 2-1/2" and under. Install flanged fitting and flanges at valves and where required. Threadable light wall pipe (schedule 10) shall be permitted only for sizes 3" and over.
- 3. Where permitted by code and based on the construction the contractor may substitute CPVC sprinkler system piping in lieu of the above for the sprinkler system. Install according to manufacturer's requirements and restrictions. Piping and fittings, shall be Harvel Blazemaster CPVC fire sprinkler piping or approved equal. Piping shall be installed only by a factory trained and certified installer. Where piping is exposed or where manufacturers requirements cannot be met, piping shall be the same as above.

B. Sprinkler Heads:

- 1. Temperature Classification:
 - a. Finished area shall be ordinary temperature rating.
 - b. Boiler Room shall be Intermediate temperature rating 175° F to 225° .
- 2. All shall be Quick Response type head.
- 3. All heads shall be glass bulb type .
- 4. Type:
 - a. Generally shall be white, concealed pendant.
 - b. Concealed spaces shall be the type best suited for the configuration of the individual space.
 - c. Any minor unheated spaces shall be dry type.

5. Provide and install a spare head case per NFPA requirements. The case shall contain not less than 12 heads total, no less than two of each style of heads and one wrench for each style of head. Locate case in the sprinkler room near the check valve assemblies.
- C. Provide sprinkler guards on any exposed heads.
- D. Hangers: Provide per NFPA. Provide seismic protection unless specifically exempt by the Authority Having Jurisdiction. Hang from building structure, not piping of other trades.
- E. Sleeves:
1. Pipes Through Floors: Form with Schedule 40 (galvanized) steel pipe and extend 1" above surrounding floor.
 2. Pipes Through Interior Fire-rated or Sound-rated Partitions: Form with steel pipe or 16 gauge galvanized steel.
 3. Pipes through Exterior Building Walls, Concrete Walls or Footing: Form with Schedule 40 (galvanized) steel pipe.
 4. Size: The minimum sleeve diameter shall be either 2 pipe sizes or 2" in diameter larger than the outside diameter of the pipe.
 5. Fire caulk all penetrations through floors and fire rated partitions.
- F. Valves:
1. Riser Control Valve: OS&Y cast iron construction.
 2. Sectionalizing Valves: OS&Y cast iron body.
 3. Drain and Test Valves: Bronze body, gate type or ball type, capable of being padlocked in either open or closed position.
- G. Provide all miscellaneous items required for a complete system, such as: paint, signs, valve tags, pipe markers, chains and locks, relief valves, and water additives.

2.03 COMPONENTS

- A. Fire Department Connection (Verify with local Fire Department). 4" Fire Department connection with, caps with chains and wall plate with "Auto Sprinkler" and "Manual Wet Standpipe". Thread Pattern shall match that of the local Fire Department equipment; also 4" UL listed check valve with automatic ball drip piped to drain. Bronze finish.
- B. Flow Switch for Wet Systems: Model # VSR-F vane type water flow alarm switch with an adjustable retard setting from 10 seconds to 90 seconds having two sets of DPDT contacts for reporting to the building fire alarm system.

- C. Electric Supervisory Switch: All valves shall have a Model # OSYSU-2 electric supervisory device with 2 sets of DPDT contacts to report to the building fire alarm system.
- D. Backflow preventer: Double check, testable, replaceable seats.
- E. Provide all shut-off valves with tamper switches. Lock or chain open valves with break-away padlocks.
- F. Water pressure gauge: Provide one before the valve on each inspectors test connection. Range applicable to fire protection application.

PART 3 – EXECUTION

3.01 PREBID EXAMINATION AND INVESTIGATION

- A. Visit the site and become acquainted with the conditions.
- B. Study all Drawings and Specifications for all related and interfacing trades. No claim will be recognized for extra compensation due to failure to become familiarized with the conditions and extent of the proposed work as indicated within.
- C. Ascertain all Authorities Having Jurisdiction, and consult where needed.

3.02 OBTAINING DRAWINGS AND SPECIFICATIONS

- A. Obtain a FULL set of drawings and specifications as soon as is practical.

3.03 SPECIFIC INSTALLATION REQUIREMENTS

- A. All piping in finished areas shall be run concealed wherever possible.
- B. For aesthetic reasons, locate sprinkler heads neatly and symmetrically, relative to the walls, ceiling grid, diffusers and light fixtures. Center heads in tiles in suspended ceilings.
- C. All piping shall be run as high as practicable. Pitch piping slightly to allow the system to be drained.
- D. System drains shall be valved and piped to discharge. No valve shall be provided ahead of the electric alarm devices.
- F. All sprinkler work shall avoid proposed locations of, and installation clearances for, lighting, ducts, piping, framing and equipment.

3.04 COORDINATION

- A. Coordinate work with that of other trades. Coordinate early for locations of mains. Ductwork, mechanical equipment, electrical panels and large gravity piping will be given priority over sprinkler piping, unless all effected parties agree otherwise
- B. Contact Electrical Contractor and assure that all requirements for power and fire alarm system have been met.

3.05 TESTS

The entire installation shall be tested with water in accordance with all NFPA requirements, all requirements of the local Fire Department and local Water District; and the Owner's Insurance Underwriter; this includes the testing of all alarms. All tests shall be witnessed by the Owner's representative and local Fire Chief's representative. Submit copies of all test certificates, properly signed, to the Engineer.

END OF SECTION 15710

SECTION 16010 GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish all materials, labor, tools, transportation, incidentals, and appurtenances to complete in every detail and leave in working order all items of work called for herein or shown on the accompanying drawings, including work related to:
 - 1. Electrical service entrances.
 - 2. Electrical distribution including new circuit breaker load centers, and associated feeders.
 - 3. Electrical branch circuits, including wiring and devices.
 - 4. Interior lighting including luminaires, lamps, wiring and controls.
 - 5. Exterior lighting including luminaires, lamps, wiring and controls.
 - 6. Fire alarm system including initiating/notification devices, bldg. control panels connection to municipal fire alarm system, and all associated wiring.
 - 7. Cable TV system, including service entrances, outlets and wiring.
 - 8. Telephone system including service entrances, outlets and wiring.
 - 9. Door entry communications system.
 - 10. Surveillance system including wiring for owner-furnished cameras.
- B. Include any minor items of work necessary to provide a complete and fully operative electrical system.
- C. The Contractor for this work is referred to Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work that is a part of this Contract as contained in Division 1. The following General Provisions amplify and supplement these Sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 1 supersede and must be satisfied by the Contractor.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSI/NFPA 72 - National Fire Code.
- C. ANSI/NFPA 101 - Life Safety Code.
- D. OSHA 1910 - Occupational Safety and Health Act.
- E. ADA - Americans with Disabilities Act.

1.3 GENERAL REQUIREMENTS

- A. Contractor shall read the entire specifications covering other branches of work. He is responsible for coordination of his work with work performed by other trades.

- B. Consult all Contract drawings which may affect the location of any equipment or apparatus furnished under this work and make minor adjustments in location as necessary to secure coordination.
- C. System layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be arbitrarily changed. The equipment layout is to fit into the building as constructed and to coordinate with equipment included under other Divisions of work.
- D. Contractor shall contact the Owner's Representative immediately if he notices any discrepancies or omissions in either the drawings or the specifications, or if there are any questions regarding the meaning or intent thereof.
- E. Submit all changes, other than minor adjustments, to the Architect for approval before proceeding with the work.

1.4 SUBMITTALS

- A. Submit under provisions of the following and Division 1.
- B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
- C. Mark dimensions and values in units to match those specified.
- D. Contractor shall check all shop drawings for dimensional correctness, interferences and conformance to specifications and plans. Stamp drawings "approved" and indicate when stipulated check has been made before forwarding them. Identify submittal data by project name and equipment identification number.

1.5 REGULATORY REQUIREMENTS

- A. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances, included but not limited to latest approved editions of the following:
 - 1. State Building Codes.
 - 2. Specific Construction Safety Requirements, State Industrial Commission.
 - 3. National Electrical Code - NFPA 70.
 - 4. National Fire Code - NFPA 72.
 - 5. Life Safety Code - NFPA 101.
 - 6. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
 - 7. ADA - Handicap Accessibility Requirements.
 - 8. State Elevator Code.
- B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes, and ordinances, and they are thereby included in these specifications. All work shall comply with the 2008 edition of NFPA 70, The National Electrical Code. It shall be the Contractor's responsibility to assure that electrical work is in full compliance with the *NEC*.

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- C. Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim will be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.
- D. Obtain and pay for all necessary permits. Request inspections from authority having jurisdiction.

1.6 ELECTRICAL MOTORS

- A. In general, motors will be furnished and installed under other Divisions of work as a factory-installed item. Unless they are factory installed on equipment units supplied under other Divisions, all safety switches and motor starters shall be furnished and installed by the Electrical Contractor. Coordinate prior to submission of bid.
- B. Electrical Contractor shall obtain all wiring diagrams necessary to connect and control equipment requiring electrical energy.

1.7 RECORD DRAWINGS

- A. Record any changes in location of concealed boxes, underground utility service runs, and similar construction on a set of prints and deliver them to the Owner's Representative upon completion of the work.
- B. Record location and depth of exterior work carefully for future reference.

1.8 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Instruct the Owner's representative in all matters pertaining to the proper operation and maintenance of electrical equipment furnished under this contract.
- B. Submit three (3) sets of instructions in hard-bound three-ring notebooks, including installation, maintenance and operating instructions, pamphlets or brochures and warranties obtained from each manufacturer of principal items of equipment.

1.9 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.10 FIRESTOPPING

- A. Firestopping around electrical cable, conduit and/or boxes and firestopping within boxes shall be provided under Division 16 to maintain fire ratings at walls, floors and ceilings. The Contractor shall coordinate penetrations of rated surfaces with the architectural drawings and specifications to assure that the proper fire rating is achieved.

1.11 TEMPORARY POWER AND LIGHTING

- A. The Contractor shall be responsible for provision of temporary electrical power and lighting as required to facilitate construction work.
 - 1. Temporary electrical power shall be obtained from the serving utility company. The Contractor shall make all necessary arrangements for the connection of a temporary power service.
 - 2. The costs for monthly service charges from the serving utility company included in the General Contractor's bid.
 - 3. The Contractor shall provide temporary electrical power distribution as required to facilitate construction activities including:
 - a. Wire/conduit
 - b. Over-current protection
 - c. Receptacle outlets
 - d. Motor disconnect means
 - e. Grounding
 - 4. The Contractor shall provide temporary lighting as required to facilitate construction activities.
 - 5. All temporary electrical power and lighting shall be completely removed prior to substantial completion of the project.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Furnish new and undeteriorated materials and of a quality not less than what is specified.
- B. Contractor to furnish and install only those brands of equipment mentioned specifically or accepted by the Engineer as equivalent substitutes.

2.2 EQUIPMENT SELECTION AND APPROVAL

- A. The selection of materials and equipment to be furnished shall be governed by the following:
 - 1. Where single trade name, brand of manufacturer or material is listed in the specification, the exact equipment listed shall be used in the bid.
 - 2. Where more than one name is listed, Contractor may select any one of the several brands specified.
 - 3. Where trade name, brand of manufacturer of equipment or material is listed in the specification followed by the word "or approved equal," the Contractor may substitute product of equal quality from another manufacturer for consideration by the Engineer.

PART 3 - EXECUTION

3.1 PROTECTION AND CLEANING

- A. Protect all electrical work and products against damage during construction and pay the cost of repair or replacement of electrical products made necessary by failure to provide suitable safeguards or protection.
- B. After all work has been inspected and approved, thoroughly clean all equipment, provided under this work.
- C. Repair all dents and scratches in factory prime or finish coated on all electrical equipment.

3.2 CUTTING AND PATCHING

- A. Cut and patch as required to install new work. Patching shall match existing surfaces in kind and finish.
- B. Obtain prior approval from the Engineer before cutting any structural members.

END OF SECTION 16010



SECTION 16111 CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Rigid metal conduit and fittings.
- B. Non-metallic conduit and fittings.
- C. Electrical metallic tubing and fittings.
- D. Flexible metal conduit and fittings.
- E. Liquid-tight flexible metal conduit and fittings.

1.2 RELATED WORK

- A. Section 16123 - Wiring and Cable

1.3 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated.
- C. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- D. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- E. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

2.2 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. EMT: ANSI C80.3 galvanized tubing.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB1; steel compression or set-screw type.

2.3 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: Steel.
- B. Fittings and Conduit Bodies: ANI/NEMA FB 1.

2.4 LIQUID-TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: Flexible metal conduit with PVC jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB1.

2.5 PLASTIC CONDUIT AND FITTINGS

- A. Conduit: NEMA TC 2; Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.6 CONDUIT SUPPORTS

- A. Conduit Clamps, Straps, and Supports: Steel or malleable iron.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. Size conduit for conductor type installed $\frac{3}{4}$ -inch minimum size.
- B. Arrange conduit to maintain headroom and present a neat appearance.
- C. Route conduit parallel and perpendicular to walls.
- D. Maintain minimum 6-inch clearance between conduit and heat sources such as flues, steam pipes and heating appliances.
- E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.
- H. Support conduit at spacing not to exceed the spacing allowed per ANSI 70.

3.2 CONDUIT INSTALLATION

- A. Cut conduit square using a saw or a pipecutter; de-burr cut ends.

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- B. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- C. Use conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
- D. Install no more than the equivalent of three 90-degree bends between boxes.
- E. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 1-inch size.
- F. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
- G. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- H. Provide No. 12 AWG insulated conductor or suitable nylon pull rope in empty conduit, except sleeves and nipples.
- I. Install expansion joints where conduit crosses building expansion joints.
- J. Where conduit penetrates fire-rated walls and floors, seal opening around conduit with UL listed foamed silicone elastomer compound.
- K. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum. Provide spacers for multiple runs of buried raceways.
- L. Where conduit(s) pass(es) from refrigerated or cooled atmosphere to warmer areas where condensation of water vapor may occur within raceways, conduit bodies sealed with "duct Seal" type compound shall be provided after conductors are installed.
- M. Flexible metal conduit shall not exceed three (3) feet in length.

3.3 UNDERGROUND CONDUIT INSTALLATION

- A. Install top of conduit minimum 30 inches below finished grade.
- B. Encase primary electrical service conduits in a 3-inch (minimum) concrete envelope.
- C. Slope underground conduit away from building.
- D. Use rigid galvanized steel conduit sweeps for underground elbows in conduit sizes 2 inch and larger.

3.4 CONDUIT INSTALLATION OF SCHEDULE

- A. Underground Installations: Schedule 40 plastic conduit.
- B. Exposed Outdoor Locations: Rigid steel conduit.

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- C. Exposed Interior Locations (with prior approval by Architect): Electrical metallic tubing.
- D. Connections to Motors (exterior locations): Liquid-tight flexible metal conduit.
- E. Connections to Motors (interior locations): Flexible metal conduit.

END OF SECTION 16111

SECTION 16123 BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Building wire and cable.
- B. Metal clad cable.
- C. Non-metallic sheathed cable.
- D. Wiring connectors and connections.

1.2 RELATED SECTIONS

- A. Section 16111 - Conduit.
- B. Section 16130 - Boxes.
- C. Section 16195 - Identification.

1.3 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.6 COORDINATION

- A. Determine required separation between cable and other work.
- B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

- A. Manufacturers:
 - 1. *Southwire.*
 - 2. *General Cable.*
 - 3. *Rome.*
 - 4. Substitutions: Or Approved equal.
- B. Description: Single Conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation Voltage Rating: 600 volts.
- E. Insulation Type: THHN or XHHW.
- F. Insulation Color: Color of all service, feeder, branch, motor control, and signaling circuit conductors shall be green for grounding conductors, and white for neutrals. The color of the ungrounded conductors in different voltage systems shall be as follows:
 - 1. 120/208 volt, 3-phase: Phase A - black
Phase B - red
Phase C - blue

2.2 METAL CLAD CABLE

- A. Manufacturers:
 - 1. *General Cable.*
 - 2. *Phelps Dodge Cable.*
 - 3. *Triangle.*
 - 4. Substitutions: Or Approved equal.
- B. Description: ANSI/NFPA 70, Type MC.
- C. Conductor: Copper only.
- D. Insulation Voltage Rating: 600 volts.
- E. Insulation Temperature Rating: 60 degrees C.
- F. Insulation Material: Thermoplastic.
- G. Armor material: Steel.
- H. Armor Design: Interlocked metal tape.
- I. Jacket: None.

2.3 NONMETALLIC-SHEATHED CABLE

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- A. Manufacturers:
 - 1. *Rome Cable*
 - 2. *General Cable*
 - 3. *Triangle*
 - 4. *Southwire*
 - 5. Substitutions: Or Approved Equal.
- B. Description: ANSI/NFPA 70, Type NMC.
- C. Conductor: Copper only.
- D. Insulation Voltage rating: 600 volts.

2.4 WIRING CONNECTORS

- A. Manufacturers:
 - 1. *3M.*
 - 2. *Ideal.*
 - 3. *Thomas and Betts.*
 - 4. Substitutions: Approved equal.
- B. Description: Compression set or twist-on type with integral molded insulation and internal metallic compression ring or spiral screw-on connecting device.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

- A. Concealed Interior Locations (wood studs): Non-metallic sheathed cable or Type MC cable.
- B. Concealed Interior Locations (metal studs): Type MC cable.
- C. Exposed Exterior Locations (with prior approval by Architect): Building wire in conduit.
- D. Service Entrance: Building wire in conduit.
- E. Panelboard and Loadcenter Feeders: Type MC cable.

- F. Exterior Locations: Building wire in conduit.

3.4 INSTALLATIONS

- A. Install products in accordance with manufacturers' instructions.
- B. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- C. Use stranded conductors for control circuits.
- D. Use conductor not smaller than 12 AWG for interior power and lighting circuits. Use Conductor not smaller than 10 AWG for exterior lighting circuits.
- E. Use conductor not smaller than 16 AWG for control circuits.
- F. Use 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
- G. Pull all conductors into raceway at same time.
- H. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- I. Protect exposed cable from damage.
- J. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure. Do not rest cable on ceiling panels.
- K. Use suitable cable fittings and connectors.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- M. Clean connector surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- O. Use split bolt connectors for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- P. Use solderless pressure connectors with insulating covers for conductor splices and taps, 8 AWG and smaller.
- Q. Use insulated spring wire connectors with plastic caps for conductor splices and taps, 10 AWG and smaller.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provision of Section 16195.

3.6 FIELD QUALITY CONTROL

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- A. Inspect wire and cable for physical damage and proper connection.
- B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- C. Verify continuity of each branch circuit conductor.

END OF SECTION 16123

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SECTION 16130 BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wall and ceiling outlet boxes.
- B. Pull and junction boxes.

1.2 RELATED SECTIONS

- A. Section 16180 - Equipment Wiring Systems.
- B. Section 16141 - Wiring Devices.

1.3 REFERENCES

- A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- C. ANSI/NFPA 70 - National Electrical Code.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Electrical boxes are shown in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include ½ inch male fixture studs where required.
- B. Cast Boxes: NEMA FB 1, Type FS, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- C. Non-Metallic Outlet Boxes: PVC Type FS, UL listed.
- D. Air-Seal Boxes
 - 1. Outlet Boxes in Exterior Walls: Provide air-vapor barrier boxes for all outlets in exterior walls. Boxes shall be as manufactured by *Lessco*, or approved equal.
 - 2. Boxes at Top Floor Ceiling: Provide air-vapor barrier boxes for all outlets in ceilings at the top floor. Boxes shall be as manufactured by *Lessco*, or approved equal.

2.2 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS1, galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- E. Install boxes with suitable firestop material to preserve fire resistance rating of partitions and other elements.
- F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- G. Use flush mounting outlet boxes in finished areas.
- H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated or fire-rated or fire-rated walls. Where 24 inch separation in acoustic-rated or fire-rated walls is not

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physically possible, approval for closer spacing shall be obtained from the Architect prior to rough-in. In such cases, provide UL listed firestop pads for boxes.

- I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- J. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- L. Use adjustable steel channel fasteners for hung ceiling outlet box.
- M. Use gang boxes where more than one device is mounted together. Do not use sectional box.
- N. Use gang box with plaster ring for single device outlets.
- O. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- P. Use either sheet metal or non-metallic outlet boxes with non-metallic sheathed cable. Use sheet metal outlet boxes with Type MC cable.
- Q. Provide UL-listed fire-stop material in boxes that are recessed into fire rated walls. Refer to Architectural Contract Drawing for identification of fire walls.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- B. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closure in unused box opening.

END OF SECTION 16130

SECTION 16141 WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Device plates.

1.2 RELATED SECTIONS

- A. Section 16130 - Boxes.

1.3 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. *Hubbell.*
 - 2. *Leviton.*
 - 3. *Bryant.*
 - 4. *Pass & Seymour*
 - 5. Substitutions: Or Approved Equal.

- B. Switch Types: *Pass & Seymour* model numbers are listed below to establish configuration and type of switch. Equal devices by other manufacturers will be accepted.

- C. SPST Switches:
 - 1. Description: NEMA WD 1, commercial, specification grade, AC only general-use snap switch, back and side wired.
 - 2. Device Body: Ivory plastic with toggle handle.
 - 3. Voltage Rating: 120-277 volts, AC.
 - 4. Current Rating: 20 amperes.
 - 5. Model Number: CS20AC1-I

- D. 3-Way Switches:
 - 1. Description: Identical to SPST switches except 3-way operation.
 - 2. Model Number: CS20AC3-I.

- E. Boiler Cut-Off Switches:
 - 1. Description: DPST switch with red handle.
 - 2. Voltage Rating: 120-277 volts AC.
 - 3. Current Rating: 20 Amperes.
 - 4. Faceplate: Red color, engraved "EMERGENCY."
 - 5. Model Number: PS20AC2-RED

2.2 RECEPTACLES

- A. Manufacturers:
 - 1. *Hubbell.*
 - 2. *Leviton.*
 - 3. *Bryant.*
 - 4. *Pass & Seymour*
 - 5. Substitutions: Or Approved equal.

- B. Receptacle Types: *Pass & Seymour* model numbers are listed below to establish configuration and type of receptacles. Equal devices by other listed manufacturers will be accepted.

- C. General Use:
 - 1. Description: NEMA WD 1; commercial, specification grade, 125-volt grounded duplex receptacle, back and side wired.
 - 2. Device Body: Ivory, nylon face.
 - 3. Configuration: NEMA 5-20.
 - 4. Model number: BR20-I.

- D. Tamper-Resistant:
 - 1. Description: NEMA WD 1; specification-grade, tamper-resistant, 125-volt grounded duplex receptacle, back and side wired.
 - 2. Device Body: Ivory, nylon face.
 - 3. Configuration: NEMA 5-20.
 - 4. Model number: TR63-I

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- E. Standard Ground Fault:
 - 1. Description: UL 498, 544, 943; specification-grade, 125-volt, ground-fault interrupt type duplex receptacle with TEST and RESET, side wired.
 - 2. Device Body: Ivory, Thermoplastic.
 - 3. Configuration: NEMA 5-15R.
 - 4. Model Number: 2095-I.

- F. Tamper-Resistant Ground Fault:
 - 1. Description: UL 498, 544, 943; specification-grade, tamper-resistant, 125-volt, ground-fault interrupt type duplex receptacle with TEST and RESET, side wired.
 - 2. Device Body: Ivory, Thermoplastic.
 - 3. Configuration: NEMA 5-15R.
 - 4. Model Number: 2095-TRI.

- G. Electric Range:
 - 1. Description: 125/250 volt, 50-ampere surface receptacle.
 - 2. Device Body: Black thermoplastic.
 - 3. Configuration: NEMA 14-50R.
 - 4. Model Number: 3854/3854-40.

2.3 WALL PLATES

- A. Manufacturers:
 - 1. *Hubbell.*
 - 2. *Leviton.*
 - 3. *Bryant.*
 - 4. *Pass & Seymour.*
 - 5. Substitutions: Or Approved Equal.

- B. Description: Smooth plastic, ivory.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install receptacles with grounding pole on top.
- E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- F. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- H. For non-dwelling unit locations, provide standard GFIC-type receptacles at all receptacle locations within six (6) feet of a sink, whether indicated as such on the Drawings or not.
- I. For dwelling unit locations, provide tamper-resistant type receptacles at all locations. Provide tamper-resistant GFIC-type receptacles in kitchens (except dishwasher and refrigerator receptacles) and in bathrooms.
- J. Install light switches 48 inches above finished floor. Install standard receptacle outlets 18 inches above finished floor. Install receptacle outlets above counters at heights as indicated on drawings.
- K. For dwelling unit locations, provide receptacle outlets such that no point measured horizontally along the floor line in any wall space is more than six feet from a receptacle outlet. Wall space shall be defined as any space two feet or more in width (including space measured around corners) and unbroken along the floor line by doorways, or similar openings. The Contractor shall confirm that this condition has been met prior to rough-in of receptacle outlets.
- L. For dwelling unit locations, provide wall countertop receptacle outlets such that no point along the countertop line is more than 24 inches measured horizontally from a receptacle outlet. At island countertops, provide receptacle outlets with at least one receptacle installed at each island with a long dimension of 24 inches or greater and a short dimension of 12 inches or greater. The Contractor shall confirm that this condition has been met prior to rough-in of receptacle outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights specified and indicated on Drawings.
- B. Install wall switch 48 inches above finished floor.
- C. Install convenience receptacle 18 inches above floor, or as noted on the Drawings.

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- D. Where multiple heating boilers exist, connect all boilers to a single multi-pole emergency disconnect switch to be installed at the boiler room entrance door.

3.5 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION 16141

SECTION 16180 EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical connections to equipment specified under other Sections, including connections to built-in residential appliances and mechanical HVAC equipment.

1.2 RELATED WORK

- A. Division 11 - Appliances.
- B. Division 13 - Sprinkler System
- C. Division 15 - Mechanical Equipment.
- D. Section 16111 - Conduit.
- E. Section 16120 - Wire and Cable.
- F. Section 16130 - Boxes.
- G. Section 16441 - Disconnect Switches.

1.3 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- A. Provide disconnect switches as specified under Section 16441.

2.2 ELECTRIC WALL HEATER

- A. Manufacturers:
 - 1. *Ouellet* Model OPR0502/OPR-T-AN
 - 2. Substitutions: Or Approved Equal.
- B. Description: Heavy-duty wall mounted electric baseboard heater with integral thermostat.
 - 1. Voltage: 120 VAC.
 - 2. Power: 500 watts.
 - 3. Construction: 18-ga. steel cabinet with 16-ga. steel front.
 - 4. Heating Element: Tubular steel with aluminum fins.
 - 5. Control: Single-pole thermostat.

6. Color: White.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

- A. Review Equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 INSTALLATION

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
- B. Make conduit connections to mechanical equipment using flexible cable or flexible conduit.
- C. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.
- D. Install all controllers, control stations, and control devices such as limit switches, speed switches, and temperature switches that are supplied with equipment items. Connect with conduit and wiring.
- E. Provide a local means of disconnect for all motor loads except where factory supplied controllers are provided which contain disconnecting means.
- F. Reference to specification Section where control connection and wiring provisions are specified.

3.4 MECHANICAL SYSTEMS EQUIPMENT CONNECTIONS

- A. Except where provided as an integral element by the equipment manufacturer, provide a combination type magnetic motor starter for all 208-volt fans and/or pumps. Mount starters locally at equipment item as shown on Drawings. Starters shall be as specified under Section 16481.
- B. Except where provided as an integral element by the equipment manufacturer, provide a SPST manual motor starter switch for all 120-volt motors that are part of mechanical systems equipment items. Mount manual switches locally at motors. Manual switches shall be as specified under Section 16481.

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- C. Where noted on the Drawings that an equipment item is to be connected with a local speed switch, make all necessary connections to the speed switch (furnished under Division 15) and to the equipment motor.
- D. Provide an emergency cut-off boiler switch at all doors to the Boiler Room and interlock switches such that turning off any switch shall shut off all boilers.
- E. Install electric wall heater in Elevator Machine Room in conformance with manufacturer's instructions. Coordinate exact location with elevator equipment installer.
- F. Provide connections to Toiler Room exhaust fans and fan time switches. Local room fan/control light switches will be furnished under Division 15 and installed under Division 16.

END OF SECTION 16180

SECTION 16190 SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Conduit, cable and equipment supports.
- B. Fastening hardware.

1.2 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Support Channel: Galvanized or painted steel.
- B. Hardware: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors and/or beam clamps.
- C. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Use expansion anchors.
 - 2. Steel Structural Elements: Use beam clamps.
 - 3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Use expansion anchors.
 - 6. Sheet Metal: Use sheet metal screws.
 - 7. Wood Elements: Use wood screws.
- D. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- E. Do not use powder-actuated anchors.
- F. Do not drill structural steel members.

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- G. Fabricate supports or trapeze hangers from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. Bridge studs to and bottom with horizontal members to support flush-mounted loadcenters in new stud walls.

END OF SECTION 16190

SECTION 16195 ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates and tape labels.
- B. Panelboard Directories.
- C. Underground marker tape.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.
- B. Underground Warning Tape: 6" wide plastic tape, colored red with suitable legend describing buried electrical lines: Model UT27737 as manufactured by *Emedco*, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.
- D. Install underground warning tapes at all buried lines 6" below finished grade.

3.2 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates to identify all electrical disconnect switches, transformers, motor starters, and panelboard. Letter Height: ¼ inch. Use designations indicated on Single Line Diagram included in the Contract Drawings.

3.3 PANELBOARD AND LOAD CENTER DIRECTORIES

- A. Provide a typed directory of panel circuit load descriptions for all panelboards and load centers. Mount directory to inside of panel cover. Identify circuit loads by load type and room location of load served.

END OF SECTION 16195

SECTION 16421 UTILITY SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide new incoming electrical utility service entrances.
- B. Provide new incoming telephone utility service entrances.
- C. Provide new incoming cable television utility service entrances.

1.2 RELATED SECTIONS

- A. Section 16111 - Conduit.
- B. Section 16123 - Wire and Cable.
- C. Section 16450 - Grounding.
- D. Section 16470 - Panelboards.
- E. Section 16721 - Fire Alarm System.
- F. Section 16742 - Telephone System.
- G. Section 16745 - Cable Television

1.3 ELECTRICAL SYSTEM DESCRIPTION

- A. Electrical Service Description: The existing overhead *CMP* electrical utility line shall be modified, and a new underground electrical secondary service shall be provided as shown on the Contract Drawings. The contractor shall coordinate with the utility company all the work required to complete this project.
- B. Work associated with the new electrical services shall be coordinated with:
Mr. Paul Duperre
Central Maine Power Company
162 Canco Road
Portland, Maine 04103
- C. Arrange with *CMP* to modify the existing overhead utility line on Danforth Street as required. Arrange with *CMP* to provide a new pole mounted service transformer. 208/120 volt, 3-phase secondary service shall be extended underground by the Contractor from the new pole mounted service transformer to a modular meter center on the inside of the building. Secondary service conductors shall be extended from the modular meter center to new single-phase load centers located in each living unit of the building.

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- D. Work by *CMP*: The Contractor shall make all necessary arrangements with *CMP* to provide the following:
 - 1. Modifications to the existing overhead utility line in front of the building.
 - 2. New secondary underground electrical system.
 - 3. Pole mounted service transformer.

- E. Work by Contractor: The Contractor shall provide the following:
 - 1. All conduit and secondary service conductors from the pole mounted service transformer to the meter center at the building.
 - 2. Service meter center at the building.
 - 3. Service grounding.

- F. Work by General Contractor:
 - 1. Excavation and backfill.

1.4 TELEPHONE SYSTEM DESCRIPTION

- A. Telephone Service Description: A new underground telephone service shall be provided as shown on the Contract Drawings. The contractor shall coordinate with the utility company all the work required to complete this project.

- B. Arrange with *FairPoint* to modify the existing overhead utility line in front of the building as required. Also, arrange with *FairPoint* to provide a new underground service from the service terminal pole at Danforth Street to the building. Telephone service cable shall be extended underground to new telephone service termination equipment in the electrical room in the building.

- C. Work associated with new telephone services shall be coordinated with:
FairPoint
6 Davis Farm Road
Portland, Maine 04102

- D. Work by *FairPoint*: The Contractor shall make all necessary arrangements with *FairPoint* to provide the following:
 - 1. Modification of existing overhead telephone service line in front of the building as required.
 - 2. Provide new underground telephone service cables from the service terminal pole.
 - 3. Service entrance connections for individual living units, including wiring termination means, and service cables from exterior connection point on the building.

- E. Work by Contractor: The Contractor shall provide the following:
 - 1. Underground conduits between the service terminal pole and the service termination equipment at the electrical room in the building.

1.5 CABLE TELEVISION SYSTEM DESCRIPTION

- A. Cable Television Service Description: A new underground cable television service shall be provided as shown on the Contract Drawings. The contractor shall coordinate with the utility company all the work required to complete this project.

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- B. Arrange with *Time-Warner* to modify the existing overhead utility line in front of the building as required. Also, arrange with *Time-Warner* to provide a new underground service from the service terminal pole at Danforth Street to the building. Cable TV service cable shall be extended underground to new cable service termination equipment in the electrical room in the building.
- C. Work associated with new telephone services shall be coordinated with:
 - Time-Warner Cable of Maine*
 - 118 Johnson Road
 - Portland, Maine 04102
- D. Work by *Time-Warner*: The Contractor shall make all necessary arrangements with *Time-Warner* to provide the following:
 - 1. Modification of existing overhead cable TV service line pole in front of the building as required.
 - 2. Provide new underground cable TV service cables from the service terminal pole.
 - 3. Service entrance connections for individual living units (on a Contract basis), including wiring termination means, and service cables from exterior connection point on the building.
- E. Work by Contractor: The Contractor shall provide the following:
 - 1. Underground conduits between the service terminal pole and the service termination equipment at the electrical room in the building.

1.6 QUALITY ASSURANCE

- A. Conform to the requirements of ANSI/NFPA 70 - National Electrical Code.
- B. Conform to the requirements of:
 - 1. *Central Maine Power Company.*
 - 2. *FairPoint.*
 - 3. *Time Warner*

1.7 UTILITY SERVICE CHARGE ALLOWANCE

- A. The Contractor shall include under Division 16 an allowance of \$25,000.00 to cover the cost of utility service charges. This allowance will be paid according to actual utility company invoices received.

PART 2 - PRODUCTS

2.1 UTILITY SERVICES MATERIALS

- A. Conduit shall be as specified in Section 16111.
- B. Electrical service conductors shall be as specified in Section 16123.

C. Service grounding shall be as specified in Section 16450.

2.2 MODULAR METER CENTERS

A. Manufacturers:

1. *Square D*
2. *Anchor*
3. *Landis & Gyr*
4. *Milbank*
5. *Murray*

B. UL listed, multi-gang meter center with ringless meter sockets and main circuit breaker service sections as detailed on the Drawings.

C. Meter Centers shall be NEMA Type 3R construction, rated for use on a three-wire 240/120-volt system. Meter sockets shall have a fifth terminal in the 6 o'clock position (if required by *CMP*), and shall include a simple handle lever operated by-pass. Meter sockets shall be rated as indicated on the Drawings. Main devices shall have 100K AIC ratings.

D. All meters shall be supplied with an output branch circuit breaker, in sizes as indicated on the Drawings.

E. Approval: Meter centers shall be approved by the *Central Maine Power Company*.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all service related work in conformance with the standards and requirements of the serving utility.

END OF SECTION 16421

SECTION 16441 ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Disconnect Switches.

1.2 REFERENCES

- A. NEMA KS 1 - Enclosed Switches.
- B. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Include outline drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- A. Acceptable manufacturers:
 - 1. *Square D.*
 - 2. *General Electric.*
 - 3. *Cutler-Hammer.*
 - 4. *Siemens.*
 - 5. Substitutions: Or Approved Equal.
- B. Nonfusible Switch Assemblies: NEMA KS 1; Type HD; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front with switch in ON position. Handle lockable in OFF position.
- C. Enclosures: NEMA KS 1; Type 1. For indoor locations; Type 3R for outdoor locations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches for all motor loads and where indicated on Drawings, except where equipment is factory supplied with an integral means of disconnect.
- B. Install disconnect switches within sight and within 25 feet of equipment item being served. Install switch handle no higher than 60 inches above the working surface.
- C. Provide unfused disconnect switches for general motors.

END OF SECTION 16441



SECTION 16450 SECONDARY GROUNDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Power system grounding.
- B. Electrical equipment and raceway grounding and bonding.

1.2 SYSTEM DESCRIPTION

- A. Provide a service ground at the service entrance.
- B. Connect load center feeder ground conductors to service ground at main service entrance.
- C. Connect branch circuit equipment wires to ground bus at load centers.
- D. Provide a dedicated ground for the telephone service.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Service Ground Conductor: Bare copper, stranded conductor.
- B. Load Center Feeder Ground Conductor: Copper conductor.
- C. Branch Circuit Ground Conductors: Insulated (green) copper conductor.
- D. Ground Rods: 5/8-inch diameter, by 8-feet long, copper clad steel rods with bronze ground clamps.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide service ground system in accordance with Article 250 of NFPA 70. Connect service-grounding equipment to made electrodes as well as to the cold water service entrance pipe.
- B. Provide a separate grounding conductor in load center feeders and in all branch circuits provided under this contract. Terminate each end on a grounding lug, bus, or bushing.

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- C. Provide grounding for service riser pole in accordance with all applicable *Central Maine Power Company* requirements.
- D. Provide grounding for each service transformer at transformer pad in accordance with all applicable *Central Maine Power Company* requirements.

3.2 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 10 ohms.

END OF SECTION 16450

SECTION 16470 PANELBOARDS, LOAD CENTERS AND ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Residential Load Centers.
- B. Panelboards.
- C. Enclosed Circuit Breakers.

1.2 RELATED SECTIONS

- A. Section 16195 – Electrical Identification.

1.3 REFERENCES

- A. NECA (National Electrical Contractors Association) “Standard of Installation.”
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA PB 1 - Panelboards.
- D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards rated 600 Volts or Less.
- E. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment.
- F. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

1.5 SPARE PARTS

- A. Keys: Furnish three sets to Owner.

PART 2 - PRODUCTS

2.1 LOAD CENTERS

- A. Manufacturers:
 - 1. *Square D.*
 - 2. *General Electric.*
 - 3. *Siemens.*
 - 4. Substitutions: Or Approved Equal.

- B. Load Centers: NEMA PB 1; circuit breaker type. UL listed for service entrance duty.
- C. Enclosure: Recessed, NEMA PB 1; Type 1.
- D. Cabinet Size: 3¾ inches deep; 14¼ inches wide.
- E. Provide cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- F. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.
- G. Minimum Integrated Short Circuit Rating: 22,000 amperes RMS symmetrical for 240-volt panelboards.
- H. Molded Case Circuit Breakers: NEMA AB 1; plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles.
- I. Arc-Fault Circuit Breakers: Provide arc-fault circuit breakers for all load center branch circuits supplying outlets in dining rooms, living rooms, bedrooms, hallways, and other similar rooms.

2.2 PANELBOARDS

- A. Acceptable Manufacturers.
 - 1. *Square D.*
 - 2. *Cutler-Hammer.*
 - 3. *General Electric*
 - 4. *Siemens.*
 - 5. Substitutions: None Permitted.
- B. Circuit Breaker Panelboards
 - 1. Panelboards: NEMA PB1; circuit breaker type.
 - 2. Enclosure: NEMA PB 1; Type 1.
 - 3. Branch Circuit Panelboard Cabinet Size: 5 ¾ inches deep; 20 inches wide.
 - 4. Distribution Panelboard Cabinet Size: 8¼ inches deep; 32 inches wide.
 - 5. Provide cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel
 - 6. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.
 - 7. Minimum Integrated Short Circuit Rating: 25,000 AIC for 208 volt panelboards.
 - 8. Molded Case Circuit Breakers: NEMA AB 1; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits.
 - 9. Provide circuit breaker accessory trip units and auxiliary contacts as indicated.

2.3 ENCLOSED CIRCUIT BREAKERS

- A. Manufacturers
 - 1. *Square D*
 - 2. *General Electric*

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3. *Siemens*
 4. Substitutions: Or Approved Equal.
- B. Description: NEMA AB-1 molded-case, thermal magnetic trip circuit breakers with a common handle for all poles. Enclosures shall be surface mount, NEMA Type 1.
1. Elevator Service Circuit Breakers: Provide a shunt-trip operator to be connected to the fire alarm system as detailed on the Drawings. Provide an auxiliary contact for use by elevator control wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install load centers and panelboards plumb and flush with wall finishes, in conformance with NEMA PB 1.1. Install recessed, flush with wall finishes.
- B. Height: 4 feet to top circuit breaker in load centers in residential units; 6 feet to top of panelboards.
- C. Provide filler plates for unused spaces in load centers and panelboards per Specification Section 16195.
- D. Provide typed circuit directory for each branch circuit panelboard and load center per Specification Section 16195.

3.2 FIELD QUALITY CONTROL

- A. Measure state load currents at each new panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 16470

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VOLTS: 120/208 MAIN: MLO PANEL: EPI AMPERS 100 ELECTRICAL ROOM

MOUNT: RECESSED WIRES: 4 LOCATION: ELECTRICAL ROOM

BREAKER	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD			CKT TYPE	CKT VA	DESCRIPTION	BREAKER		
					A	B	C				P	A	
20 1	GARAGE DOOR	500	O	1	1000			O	500	GARAGE DOOR	1	20	
20 1	ELEVATOR CONTROLS	500	O	3		1000		O	500	FIRE ALARM CONTROL PNL	1	20	
20 1	ELEV MACH RM RECEPT	400	R	5			900	O	500	FIRE ALARM BOOSTERS	1	20	
20 1	ELEV PIT RECEPT	400	R	7	900			O	500	2ND FL TELEPHONE EQUIP	1	20	
20 1	GEN BATTERY CHARGER	500	O	9		1000		O	500	4TH FL TELEPHONE EQUIP	1	20	
20 1	GENERATOR HEATER	1000	H	11			1500	S	500	SPARE	1	20	
20 1	SPARE	500	S	13	1000			S	500	SPARE	1	20	
20 1	SPARE	500	S	15		1000		S	500	SPARE	1	20	
20 1	SPARE	500	S	17			1000	S	500	SPARE	1	20	
	BLANK			19	0					BLANK			
	BLANK			21		0				BLANK			
	BLANK			23			0			BLANK			
PHASE TOTALS											2900	3000	3400

CONNECTED VOLT-AMPERES= 9300
 CONNECTED AMPERES= 26
 DEMAND VOLT-AMPERES= 5150
 DEMAND AMPERES= 14

CIRCUIT TYPE CODES
 L LIGHTS
 M MOTORS
 R RECEPTACLES
 H HEAT
 O OTHER
 S SPARE

DEMAND FACTOR
 1.0
 0.5
 0.5
 1.0
 0.5
 0.5

PROJECT: 53 DANFORTH STREET
 PROJ. NO: 08-0011
 DATE: 07/15/08
 STATUS: FOR CONSTRUCTION

Bartlett Design
 LIGHTING & ELECTRICAL ENGINEERING
 942 WASHINGTON STREET BATH, MAINE 04530
 TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/208
 MOUNT: RECESSED
 MAIN: MLO
 WIRES: 4
 AMPS 225
 PHASE: 3
 PANEL: HPI SECTION 1
 LOCATION: ELECTRICAL ROOM

BREAKER	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD			CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER		
					A	B	C					P	A	
20 1	GARAGE LIGHTS	448	L	1	1448			2	R	1000	1ST FL RECEPTACLES	1	20	
20 1	GARAGE LIGHTS	288	L	3		1288		4	R	1000	GARAGE RECEPTACLES	1	20	
20 1	SP-1	864	M	5			1364	6	O	500	MOTOR OPER DAMPERS	1	20	
20 1	2ND FL RECEPTACLES	1200	R	7	2200			8	R	1000	2ND FL RECEPTACLES	1	20	
20 1	3RD FL RECEPTACLES	1000	R	9		1150		10	M	150	DCP-1	1	20	
20 1	3RD FL RECEPTACLES	900	R	11			1400	12	S	500	SPARE	1	20	
20 1	P-4	500	M	13	2156			14	M	1656	P-1	1	20	
20 1	P-5	500	M	15		1218		16	M	718	P-2	2	20	
20 1	P-6	500	M	17			1218	18	M	718	P-2	2	20	
20 1	ATC PANEL	500	O	19	1218			20	M	718	P-3	2	20	
20 1	B-1	960	M	21		1678		22	M	718	P-3	2	20	
20 1	B-2	960	M	23			1660	24	R	700	2ND FL RECEPTACLES	1	20	
100 3	PANEL HPI SECTION 2	11300		25	11800			26	O	500	DOOR HOLDERS	1	20	
100 3	PANEL HPI SECTION 2	10150		27		10650		28	O	500	DOOR ACCESS/INTERCOM	1	20	
100 3	PANEL HPI SECTION 2	10900		29			11592	30	L	692	EXTERIOR LIGHTS	1	20	
20 1	CUH-1/CUH-2/CUH-3/CUH-4	600	H	31	1100			32	O	500	1ST/2ND FL EMERG BY-PASS	1	20	
20 1	ROOFTOP RECEPTACLES	400	R	33		900		34	O	500	3RD FL EMERG BY-PASS	1	20	
20 1	SPARE	500	S	35			1000	36	O	500	4TH FL EMERG BY-PASS	1	20	
20 1	SPARE	500	S	37	1000			38	O	500	5TH FL EMERG BY-PASS	1	20	
20 1	SPARE	500	S	39		1000		40	S	500	SPARE	1	20	
20 1	SPARE	500	S	41			1000	42	S	500	SPARE	1	20	
PHASE TOTALS											20922	17884	19234	

CONNECTED VOLT-AMPERES= 58040
 CONNECTED AMPERES= 161
 DEMAND VOLT-AMPERES= 30284
 DEMAND AMPERES= 84

CIRCUIT TYPE CODES
 L LIGHTS
 M MOTORS
 R RECEPTACLES
 H HEAT
 O OTHER
 S SPARE

DEMAND FACTOR
 1.0
 0.5
 0.5
 1.0
 0.5
 0.5

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PROJECT: 53 DANFORTH STREET
 PROJ. NO: 08-0011
 DATE: 07/15/08
 STATUS: FOR CONSTRUCTION



VOLTS: 120/208 MAIN: MLO PANEL: HPI SECTION 2
MOUNT: RECESSED WIRES: 4 LOCATION: ELECTRICAL ROOM

AMPS 225
PHASE: 3

BREAKER	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD			CKT TYPE	CKT NO.	DESCRIPTION	BREAKER	
					A	B	C				P	A
20	4TH FL RECEPTACLES	1000	R	43	1500			44	M	EF-1	1	20
20	4TH FL RECEPTACLES	1000	R	45	1150			46	M	SF-1	1	20
20	4TH FL RECEPTACLES	900	R	47		1900		48	R	5TH FL RECEPTACLES	1	20
20	SPARE	500	S	49	1800			50	R	5TH FL RECEPTACLES	1	20
20	WASHER	1500	R	51		2500		52	O	DRYER	1	20
20	WASHER	1500	R	53				54	O	DRYER	1	20
20	WASHER	1500	R	55	2500			56	O	DRYER	1	20
20	WASHER	1500	R	57		2500		58	O	DRYER	1	20
20	WASHER	1500	R	59				60	O	DRYER	1	20
20	WASHER	1500	R	61	2500			62	O	DRYER	1	20
20	HANDICAP DOOR OPER	500	O	63		1000		64	H	ELECTRIC HEATER	1	20
20	SPARE	500	S	65			1000	66	S	SPARE	1	20
20	SPARE	500	S	67	1000			68	S	SPARE	1	20
20	SPARE	500	S	69		1000		70	S	SPARE	1	20
20	SPARE	500	S	71			1000	72	S	SPARE	1	20
20	SPARE	500	S	73	1000			74	S	SPARE	1	20
20	SPARE	500	S	75		1000		76	S	SPARE	1	20
20	SPARE	500	S	77			1000	78	S	SPARE	1	20
20	SPARE	500	S	79	1000			80	S	SPARE	1	20
20	SPARE	500	S	81		1000		82	S	SPARE	1	20
20	SPARE	500	S	83			1000	84	S	SPARE	1	20
PHASE TOTALS					11300	10150	10900					

CONNECTED VOLT-AMPERES= 32350
CONNECTED AMPERES= 90
DEMAND VOLT-AMPERES= 16425
DEMAND AMPERES= 46

CIRCUIT TYPE CODES
L LIGHTS DEMAND FACTOR 1.0
M MOTORS 0.5
R RECEPTACLES 0.5
H HEAT 1.0
O OTHER 0.5
S SPARE 0.5

PROJECT: 53 DANFORTH STREET
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SECTION 16481 ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manual motor starters.
- B. Combination magnetic motor starters.

1.2 REFERENCES

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA ICS 1 - Industrial Control Devices, Controllers, and Assemblies.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 1.
- B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 1.
- B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

- A. Acceptable Manufacturers (combination motor starters).
 - 1. *Cerus Industrial*
 - 2. Substitutions: Or approved equal.
- B. Acceptable Manufacturers (manual motor starters).
 - 1. *Square D*
 - 2. *General Electric*
 - 3. *Siemens*
 - 4. Substitutions: None permitted.
- C. Manual Motor Starters

1. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, 1 pole, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, and toggle operator.
2. Enclosure: ANSI/NEMA ICS 6; Type 1 for interior locations, Type 4 for exterior locations.

D. Magnetic Motor Starters

1. Motor Starter shall be enclosed in a Type 1 or Type 4 UL rated enclosure. Type 1 enclosure shall include pre-cut holes for conduits with removable plugs.
2. Motor Starter shall be rated for NEMA class B motors for AC-3 switching and AC-4 switching. Starter shall be sized to equivalent NEMA rating for AC-3 switching.
3. Controls and annunciation shall include Hand- OFF- Auto keypad with 20 mm snap dome actuation. Keypad shall be water tight and liquid tight. LED indication shall include Hand, Off, Auto, Run and Overload. Overload reset shall be available by holding Hand and Off for five seconds.
4. Control inputs shall include: Auto Wet input, Auto Dry input, Permissive Auto input, Damper Status Input and Override Input. Automatic control inputs shall be capable of accepting a transistorized input without the need for interposing relays. Wet control inputs shall accept AC or DC inputs from 10 to 138VAC or DC.
5. Damper control shall be built into the starter to provide 24VAC or 120VAC damper control and monitoring.
6. Override input shall disable the starter from operating in either Hand or Auto mode.
7. Protective Functions-
 - a. Electronic Overload shall provide phase failure and phase loss protection, stall, and class 1 - 30 selectable overload protection. Phase failure protection shall initiate when phase loss is greater than 70% for 3 seconds or phase unbalance is greater than 50% for more than 5 seconds.
 - b. Cycling fault protection shall be integral to the starter. Cycling fault shall be enabled whenever the starter is cycled more than 1000 times in a one hour period. This feature shall be selectable to be disabled. Cycling fault shall cause overload LED to blink rapidly.
8. Motor Starters shall be equipped with an integral Motor Circuit that is UL listed 508. The breaker shall carry a UL 508F rating (up to 100A frame size) which provides for coordinated short circuit rating for use with the motor contactor and provides an interrupting rating for the breaker and contactor combination.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's instructions.

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- B. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
- C. Mount combination type motor starters locally to equipment being served, with top at 60 inches (maximum) above adjacent floor, with not less than 36 inches clearance in front of starter (floor to ceiling).

END OF SECTION 16481

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SECTION 16510 INTERIOR LUMINAIRES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires and accessories.
- B. Ballasts.
- C. Lamps.

1.2 RELATED SECTIONS

- A. Section 16130 – Boxes
- B. Section 16950 – Lighting Control System

1.3 REFERENCES

- A. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.
- B. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- B. Product data: Provide dimensions, ratings and performance data.

1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of each luminaire.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- C. Furnish only products that are listed on the currently published *Energy Star* Residential Light Fixtures Products List.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Furnish products as specified in schedule attached to this Section.

2.2 BALLASTS

A. Electronic T8 fluorescent ballasts

1. Non-dimming ballasts:
 - a) Sylvania QHE/UNV ISN-SC series
 - b) Advance IOP/SC series
 - c) Universal B/TUNVHE series
2. Electronic Ballasts for T8 Lamps: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
 - a) Starting Method: Instant Start
 - b) Ballast Factor: 0.88 (minimum)
 - c) Circuit Type: Parallel
 - d) Lamp Frequency: > 40 kHz
 - e) Lamp CCF: < 1.7
 - f) Starting Temperature: 0 F (-17.8 C)
 - g) Input Frequency: 60 Hz
 - h) Total Harmonic Distortion (THD): <10%
 - i) Power Factor: >98%
 - j) Voltage: Universal 120-277 volts
 - k) Maximum Input Wattage:
 - (1) Single Lamp, T8 (32-watt lamps): 28 Watts
 - (2) Two Lamp T8, (32-watt lamps): 55 Watts

B. Ballasts For Compact Fluorescent Lamps:

1. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
 - a) Starting Method: Programmed Rapid-Start (quad and triple-tube lamps); Instant Start (PL lamps)
 - b) Ballast Factor: 0.96 (minimum)
 - c) Circuit Type: Series (quad and triple-tube lamps); Parallel (PL lamps)
 - d) Lamp Frequency: > 40 kHz
 - e) Lamp CCF: < 1.7
 - f) Starting Temperature: 5 F (-20 C)
 - g) Input Frequency: 60 Hz
 - h) Total Harmonic Distortion (THD): <10%
 - i) Power Factor: >97%
 - j) Voltage: Universal 120-277 volts
 - k) Maximum Input Wattage:
 - (1) Single Quad-Tube Lamp T4, 13-Watt: 16 Watts
 - (2) Single Quad-Tube Lamp T4, 18-Watt: 20 Watts
 - (3) Two Quad-Tube Lamp T4, 18-Watt: 38 Watts
 - (4) Single Quad-Tube Lamp T4, 26-Watt: 28 Watts
 - (5) Two Quad-Tube Lamp T4, 26-Watt: 57 Watts

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(6) Two Lamp Triple-Tube T4 Lamp 42-Watt: 94 Watts

2.3 FLUORESCENT AND COMPACT FLUORESCENT LAMPS

- A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

- B. 32-Watt, T8 Fluorescent Lamps:
 - 1. Base: Medium Bi-Pin
 - 2. Initial Lumens: 3100 (minimum)
 - 3. Mean Lumens: 2945 (minimum)
 - 4. CCT: 3500K
 - 5. CRI: 82 (minimum)
 - 6. Life: 20000 hours (3 hours/start)

- C. 17-Watt, T8 Fluorescent Lamps:
 - 1. Base: Medium Bi-Pin
 - 2. Initial Lumens: 1375 (minimum)
 - 3. Mean Lumens: 1305 (minimum)
 - 4. CCT: 3500K
 - 5. CRI: 85 (minimum)
 - 6. Life: 24000 hours (3 hours/start)

- D. 13-Watt, T4 Quad Tube Lamps:
 - 1. Base: 4-pin, G24Q-1
 - 2. Initial Lumens: 900
 - 3. Mean Lumens: 774
 - 4. CCT: 3000K
 - 5. CRI: 82
 - 6. Life: 12000 hours (3 hours/start)

- E. 18-Watt, T4 Quad Tube Lamps:
 - 1. Base: 4-pin, G24Q-2
 - 2. Initial Lumens: 1200
 - 3. Mean Lumens: 1032
 - 4. CCT: 3000K
 - 5. CRI: 82
 - 6. Life: 12000 hours (3 hours/start)

- F. 26-Watt, T4 Quad Tube Lamps:
 - 1. Base: 4-pin, G24Q-3
 - 2. Initial Lumens: 1710
 - 3. Mean Lumens: 1548
 - 4. CCT: 3000K
 - 5. CRI: 82
 - 6. Life: 12000 hours (3 hours/start)

- G. 42-Watt, T4 Triple Tube Lamps:
 - 1. Base: 4-pin, GX24q-4
 - 2. Initial Lumens: 3200
 - 3. Mean Lumens: 2752

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4. CCT: 3000K
5. CRI: 82
6. Life: 12000 hours (3 hours/start)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate and supporting grids for luminaires.
- B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- E. Install recessed luminaires to permit removal from below.
- F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Install wall mounted luminaires at height as scheduled.
- H. Install accessories furnished with each luminaire.
- I. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- J. Bond products and metal accessories to branch circuit equipment grounding conductor.
- K. Install specified lamps in each luminaire.

3.3 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

- A. Aim and adjust luminaires as directed.
- B. Re-lamp luminaires that have failed lamps at Substantial Completion.

3.5 CLEANING

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- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

END OF SECTION 16510

Project: 53 Danforth
Location: Portland, Maine
Date: July 15, 2008

Bartlett Design
942 Washington Street, Bath, ME
(T) 207-443-5447 (F) 207-443-5560

LIGHTING FIXTURE SCHEDULE

All fixtures are 120 volt, unless specifically noted otherwise.
All fixtures shall be Energy Star rated.



Dimensions: Height = 3 1/4" Diameter = 16"

Type: C1

Description: Surface ceiling mounted luminaire with white acrylic diffuser and decorative metal trim.
Fixture finish shall be brushed nickel. Provide electronic ballast.

Lamps: (2) CF26DD/E/827

Manufacturers: Lithonia # 11752 BN



Dimensions: Height = 3" Diameter = 17"

Type: C2

Description: Surface mounted ceiling light with white acrylic diffuser. Fixture finish shall be white.
Provide electronic ballast.

Lamps: (2) CF18DD/E/827

Manufacturers: Brownlee Lighting # 2320-17-WH-218-ES4



Dimensions: Height = 2 1/4" Length/Width = 12"

Type: C3

Description: Surface ceiling mount square fixture with white finish and white acrylic diffuser. Provide electronic ballast.

Lamps: (1) CF13DD/E/827

Manufacturers: Brownlee Lighting # 2035-12-WH-13-ELB



Dimensions: Height = 3" Diameter = 11 1/4"

Type: C4

Description: Surface mounted ceiling fixture with white acrylic diffuser. Fixture finish shall be white.
Provide electronic ballast.

Lamps: (2) CF18DD/E/827

Manufacturers: Brownlee Lighting # 2045-11-WH-218-ES4



Type: Ceiling Fan

Description: Low-profile surface ceiling mounted fan with straight blades and white finish. Provide three-speed motor.

Lamps: N/A

Manufacturer: *Hunter Fan Company # 20740*



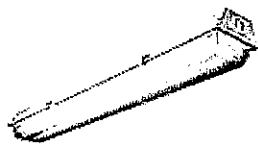
Dimensions: Length = 12.79" Height = 7.01" Projection = 5.82"

Type: E1

Description: Wall mounted emergency light with self contained sealed nickel cadmium battery with ten year rated life. Battery shall be rated to operate fixture lamps for 90 minutes upon loss of normal power. Mount bottom of fixture at 7' - 0" AFF. Fixture housing shall be white.

Lamps: (2) By Manufacturer

Manufacturer: *Lithonia # ELM618 6V-H1206-N*



Dimensions: Height = 5 3/4" Width = 8" Length = 50 1/4"

Type: G1

Description: Linear surface ceiling mounted luminaire with fully gasketed, impact-resistant acrylic diffuser. Luminaire finish shall be white. Luminaire shall be UL listed for damp locations.

Lamps: (1) FO32/830/XP/ECO

Manufacturers: *Columbia Lighting # LU4-132-E120-DL*



Dimensions: Height = 2 3/4" Length = 48" Width = 3 3/4"

Type: J1

Description: Surface ceiling mounted fluorescent strip. Provide electronic non-dimming ballast.

Lamps: (2) FO32/830/XP/ECO

Manufacturers: *Lithonia # C 2 32 120 GESB*



Dimensions: Height = 5 1/2" Length = 50 3/4" Width = 12 1/4"

Type: J2

Description: Surface ceiling mounted fluorescent luminaire with white acrylic diffuser and decorative brushed nickel metal trim. Provide electronic non-dimming ballast.

Lamps: (2) FO32/830/XP/ECO

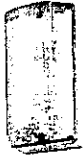
Manufacturers: *Lithonia # 10813BN*

Type: J3

Description: Similar to Type J1 except lamp quantity.

Lamps: (1) FO32/830/XP/ECO

Manufacturers: Lithonia # S 1 32 120 1/2RE



Dimensions: Height = 11" Width = 5 1/4" Projection = 4"

Type: L1

Description: Surface wall mounted luminaire with clear prismatic polycarbonate diffuser. Fixture finish shall be white. Mount in elevator pit 24" above pit floor. Provide electronic ballast.

Lamps: (1) CF13DD/E/827

Manufacturers: Brownlee Lighting # 1005-113-ELB

Type: R1

Description: To be chosen by Architect.

Type: S1 NOT USED



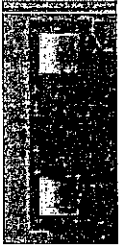
Dimensions: Height = 42" Width = 8"

Type: S2

Description: Exterior bollard with aluminum housing. Luminaire shall have aluminum horizontal louver shielding. Luminaire finish shall be custom color to be selected by Architect. Luminaire shall be UL listed for wet locations. Provide houseside shield.

Lamps: (1) CF42DT/E/IN/835

Manufacturers: Kim Lighting # VRB1-42PL120-CC-P-HS



Dimensions: Height = 21" Width= 6" Projection = 3.5"

Type: S3

Description: Exterior surface wall mounted luminaire with cylindrical white acrylic diffuser and pure copper faceplate and copper rivets. Luminaires shall be installed on wall at height as directed by architect. Luminaire shall be UL listed for wet locations.

Lamps: (1) FT36DL/830

Manufacturers: *Teka Lighting* # AHS-5414



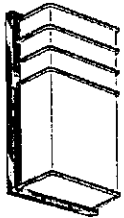
Dimensions: Height = 11.8" Width = 11.8" Projection = 11.8"

Type: S4

Description: Exterior surface wall mounted luminaire with Type IV full cut-off distribution optics. Luminaire shall have tempered glass lens. Luminaire finish shall be black. Luminaire shall be UL listed for wet locations. Install luminaires at heights as indicated on plans.

Lamps: (1) CF42DT/E/IN/835

Manufacturers: *We-ef Lighting* # 622-7032



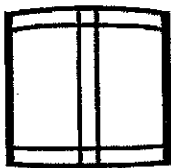
Dimensions: Height = 13.13" Width = 8 1/4" Projection = 4"

Type: S5

Description: Surface wall mounted luminaire with white translucent acrylic diffuser and decorative metal trim bars. Luminaire finish shall be bronze color. Provide electronic ballast. Luminaire shall be UL listed for wet locations.

Lamps: (2) CF26DD/E/835

Manufacturers: *Eclipse Lighting* # ON-L-A-DTT-(2)26-120-EB



Dimensions: Width = 11 1/2" Height= 10 3/4" Projection = 3 3/4"

Type: W1

Description: Surface wall mounted fixture with white acrylic diffuser and nickel tone finish. Provide electronic ballast. Provide separate switching control from each lamp. One lamp shall be controlled by motion sensor and the second lamp shall operate continuously.

Lamps: (2) CF18DD/E/827

Manufacturers: *Brownlee Lighting* # 1375-NT-218-ES3

Type: W2 NOT USED



Dimensions: Height = 6" Length = 27" Projection = 4 1/4"

Type: W3

Description: Linear surface wall mounted fixture with white acrylic diffuser. Fixture finish shall be white. Provide electronic ballast. Install immediately above vanity mirror.

Lamps: (2) FO17/830/XP/ECO

Manufacturers: *Brownlee Lighting# 5057-27-217-ES4*



Dimensions: Length = 11 3/4" Height = 7 5/8" Projection = 4 1/2"

Type: X1

Description: Wall mounted thermoplastic exit sign with red letters and white housing. Fixture shall include LED lamps. Provide directional arrows as indicated on the drawings.

Lamps: By Manufacturer

Manufacturer: *Lithonia # LQM-S-W-1-R-120/277*

SECTION 16535 EMERGENCY LIGHTING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Emergency lighting units.
- B. Exit signs
- C. Lighting by-pass switch devices.

1.2 REFERENCES

- A. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
- B. NEMA WD1 - General Purpose Wiring Devices.

1.3 REGULATORY REQUIREMENTS

- A. Conform to NFPA 101 for installation requirements.

1.4 RELATED SECTIONS

- A. Section 16510 - Lighting Fixture Schedule

1.5 SUBMITTALS

- A. Submit product data under provisions of Division 1 and Section 16010.
- B. Provide product data on emergency lighting units.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of each luminaire.

PART 2 - PRODUCTS

2.1 INCANDESCENT EMERGENCY LIGHTING UNITS

- A. Manufacturers: As specified in the Lighting Fixture Schedule in Section 16510.
- B. Emergency Lighting Unit: Self-contained unit with rechargeable storage batteries, charger, and lamps.
- C. Battery: 6 volt, nickel-cadmium type, with 1.5-hour capacity to supply the connected lamp load.

- D. Charger: Dual-rate charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to fully charged within 12 hours.
- E. Lamps: 12-watt minimum, halogen sealed-beam type.
- F. Indicators: Provide lamps to indicate AC ON and RECHARGING.
- G. Provide switch to transfer unit from normal supply to battery supply.
- H. Unit Voltage: 120 volts, AC.

2.2 EXIT SIGNS

- A. Manufacturers: As specified in the Lighting Fixture Schedule in Section 16510.
- B. Exit Signs: AC-only exit sign with stencil face, white housing and red letters. Exit signs shall be equipped with LED lamp.
- C. Directional Arrows: Exit signs shall include universal, removable directional chevron inserts.
- D. Mounting: Exit Signs shall include universal top, end or back mounting provisions.

2.3 LIGHTING BY-PASS SWITCH DEVICES

- A. Manufacturers:
 - 1. *Bodine* Model GTD-20
 - 2. Substitutions: Or Approved Equal
- B. Description: The device shall be capable of bypassing the local switching means when normal utility power has been lost. The device shall consist of relay switching circuitry, a test switch, a normal power indicator light and an emergency power indicator light contained in one 9" x 6" x 3.5" enclosure; shall sense normal power at 120 VAC, 60 Hz; shall be rated for 120 VAC, 50/60 Hz at up to 20 amps of lighting load; shall draw 280 mA and 3.5 Watts during normal sensing operation; and shall comply with the current NEC. The device shall be UL listed for field installation in indoor or damp locations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install emergency units and exit signs plumb and level.
- B. Aim emergency unit directional lampheads as directed.
- C. Connect power to emergency lighting units to nearest lighting circuit ahead of all switches.

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- D. Install lighting by-pass switch devices in conformance with manufacturer's standards. Install devices in the closest electrical room on each floor.

END OF SECTION 16535

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PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Definition:

1. The purpose of this section is to specify the Division 16 responsibilities and participation in the project commissioning process.
2. Work under this contract shall conform to requirements of Division 1, General Requirements, Conditions of the Contract, and Supplementary Conditions. This specification covers commissioning of mechanical systems that are part of this project.
3. Electrical system installation, start-up, testing, preparation of O&M manuals, and operator training are the responsibility of the Division 16 Contractors, with coordination, observation, verification and commissioning the responsibility of Division 1. The commissioning process does not relieve Division 16 from the obligations to complete all portions of work in a satisfactory and fully operational manner.

1.2 QUALIFICATIONS

- A. The Commissioning Authority will be a Professional Engineer registered in the State of Maine and will be contracted by the Owner under a separate contract. He will be independent of the design or construction team.

1.3 SCOPE OF WORK

A. Commissioning work of Division 16 shall include, but not be limited to:

1. Cooperation with the Commissioning Authority.
2. Providing qualified personnel for participation in commissioning tests.
3. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
4. Providing operation and maintenance manuals, shop drawings, equipment start-up reports, testing and balancing reports and as-built drawings to the Commissioning Authority.

B. The work included in the commissioning process involves a complete and thorough evaluation, verification and documentation of the operation and performance of all components, systems, and sub-systems relating to the following electrical systems:

1. Fire Alarm System as specified in Section 16721.
2. Door Entry Control System as specified in Section 16722.
3. Lighting Control System as specified in Section 16950.

1.4 RESPONSIBILITIES

- A. The Owner will participate in all commissioning functions including attending meetings, scheduling commissioning activities, witnessing commissioning activities and verifying all occupancy schedules and building specific variables.

B. Commissioning Authority:

1. Develop the commissioning requirements and all related testing, verification and quality control sections.
2. Prepare the electrical commissioning program. Include a list of all contractors for commissioning events by name, firm and trade specialty.
3. Execute the electrical commissioning program, through organization of all meetings, tests, demonstrations, training events and performance verifications described in the Contract Documents and approved electrical commissioning program. Organizational responsibilities include preparation of agendas, attendance lists, arrangement for facilities and timely notification to participants for each commissioning event. The Commissioning Authority shall act as chairman at all commissioning events and assure execution of all agenda items. The Commissioning Authority shall prepare minutes of every commissioning event and send copies to all attendees and the Owner within 5 work days of the event.
4. Witness equipment and system start-up and testing. Ensure the results are documented (including a summary of deficiencies), and incorporated in the O&M manuals.
5. Schedule the O&M training sessions. These training sessions are to be attended by the Owner, Commissioning Authority, and Electrical Contractor.
6. Submit detailed verification test procedures and data sheets for review by the Design Professional.
7. Submit detailed functional performance test procedures and data sheets for review and acceptance by the Design Professional.
8. Upon receipt of notification from the Electrical Contractor that the electrical systems have been completed and are operational, the Commissioning Authority shall proceed to verify the operation of systems.
9. Conduct verification tests and document results via detailed checklist data sheets.
10. Conduct functional performance tests. The test data shall be part of the commissioning report.
11. Re-test if performance deficiencies are found, corrected, and additional testing is requested.
12. Prepare the final commissioning report.

C. Electrical Contractor:

1. Include cost to complete all commissioning requirements for electrical systems in the contract price.
2. Make available to the commissioning agent submittal data and O&M data for all equipment included in the project.
3. Ensure cooperation and participation of specialty sub-contractors for fire alarm lighting control and telephone/intercom systems.
4. Attend coordination meetings scheduled by the Commissioning Authority.
5. Assist the Commissioning Authority in all verification and functional performance tests.
6. Prepare preliminary schedule for electrical system orientation and inspections, O&M manual submission, training sessions, system testing, equipment start-up, and task completion for use by the Commissioning Authority. Update schedule as appropriate throughout the construction period.
7. Attend initial training session.
8. Provide written notification to the Commissioning Authority that all electrical work has been completed in accordance with the contract documents, and that the equipment, systems and sub-systems are operating as required.
9. Provide a complete set of as-built records to the Commissioning Authority.

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PART 2 - PRODUCTS

2.1 DOCUMENTATION

- A. The Commissioning Authority will oversee and maintain the development of commissioning documentation. The commissioning documentation will include, but not be limited to, the following:
1. A detailed description of the design intent for the project, listing operating parameters, control sequences, occupancy conditions, etc.
 2. A complete description of how the system is intended to operate.
 3. All system verification checklists, signed by indicated personnel, organized by system and sub-system.
 4. All verification and functional performance test checklists/results, signed by indicated personnel, organized by system and sub-system.

PART 3 - EXECUTION

3.1 EXECUTION

- A. A pre-construction meeting of all commissioning team members will be held. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.
- B. The Contractor shall complete all phases of work so the systems can be started, tested, and acceptance procedures undertaken. This includes the complete installation of all equipment, materials and controls, etc., per the contract documents and related directives, clarifications, and change orders.
- C. A Commissioning Plan will be developed by the Commissioning Authority. The Contractor shall assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If contractor initiated system changes have been made that alter the commissioning process, the Commissioning authority will notify the Owner.
- D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Division 16 Contractor. Start of acceptance procedures before system completion does not relieve the Contractor from completing those systems as per the schedule.
- E. Equipment/System Testing: The Commissioning Authority will verify the operation and testing of all equipment and systems listed in Paragraph 1.03b.
1. Systems Verification Checklist: The Commissioning Authority will prepare a checklist for each system and piece of equipment that the Mechanical Contractor will "sign off" on indicating that the system or equipment is ready to be commissioned.
 2. Systems Functional Performance Checklist: The Commissioning Authority will prepare a checklist for each system and piece of equipment that the Electrical Contractor shall "sign off" on indicating that the system or equipment is functional as specified in all operational modes.

END OF SECTION 16600

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SECTION 16721 FIRE ALARM AND SMOKE DETECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section of the specification includes the furnishing, installation, and connection of a "house" fire alarm system consisting of a microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
- B. This section of the specification also includes furnishing, installation and connection of "local" fire alarm detection/notification means within individual living units. Local fire alarm means shall include, but not be limited to, alarm initiating devices, alarm notification appliances and wiring as shown on the Drawings and specified herein.
- C. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
- D. This section also requires a connection to the City of Portland municipal fire alarm box system for reporting a "house" alarm condition.

1.2 "HOUSE" FIRE ALARM SCOPE

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.
- B. Basic Performance:
 - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on an NFPA Style 7 (Class A) Signaling Line Circuit (SLC).
 - 2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).
 - 3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z).
 - 4. Digitized electronic signals shall employ check digits or multiple polling.
- C. A single ground or open on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
- D. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
- E. Interlock alarm system automatic detectors at the top and bottom of elevator shaft and in the Elevator Machine Room with the elevator power service shunt trip such that an alarm condition at any of these detectors shall automatically disable the elevator electrical service feeder. Provide an interlock between the fire alarm system smoke detectors at the Elevator Lobbies on each floor, and the elevator controller, such that:
 - 1. Alarm activation by either the detector at any upper floor Elevator Lobby, or at the detector in the Elevator Machine Room, shall automatically send the elevator to the First Floor.

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2. An alarm condition activated by the First Floor Elevator Lobby smoke detector shall automatically send the elevator car to the Second Floor.
3. Provide a tamper switch for each sprinkler system valve at all sprinkler lines extended into the elevator shaft.

1.3 BASIC SYSTEM FUNCTIONAL OPERATION

- A. When a fire alarm condition is detected and reported by one of the system initiating devices located in common areas, the following functions shall immediately occur:
 1. The system alarm LED shall flash.
 2. A local piezo electric signal in the control panel shall sound.
 3. A backlit 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
 5. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed and the associated system outputs (alarm Notification appliances and/or relays) shall be activated.
 6. Audible and visual alarm notification appliances throughout the facility (including those in Living Units) shall activate.

1.4 "LOCAL" FIRE ALARM SCOPE

- A. Multiple-station, hard-wired unitary equipment conforming to NFPA 72 shall be provided for all living units and shall be installed in accordance with the project specifications and Drawings.
- B. Basic Performance:
 1. Living Units : Actuation of any automatic fire alarm initiating device causes all Local audible and visual alarms to activate within the given unit.

1.5 SUBMITTALS

- A. General:
 1. Submit shop drawings and product data under provisions of Division 1 and Section 16010.
 2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent equipment (compatible UL Listed) from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
 3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.
- B. Shop Drawings:
 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
 3. Show annunciator layout, configurations, and terminations.

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- C. Manuals:
1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
 2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
 3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.
- D. Software Modifications:
1. Provide the services of a factory-trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
 2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
- E. Certifications: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.6 GUARANTY

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.7 POST CONTRACT MAINTENANCE

- A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

1.8 POST CONTRACT EXPANSIONS

- A. The contractor shall provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

1.9 APPLICABLE STANDARDS AND SPECIFICATIONS

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards.
1. National Fire Protection Association (NFPA) - USA:
 - a. No. 12 CO2 Extinguishing Systems.
 - b. No. 12A & 12B Halon Extinguishing Systems.
 - c. No. 15 Water Spray Systems.

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- d. No. 16 Foam/Water Deluge and Spray Systems.
- e. No. 72-1993 National Fire Alarm Code.
- f. No. 101 Life Safety Code.
- 2. Underwriters Laboratories Inc. (UL) - USA:
 - a. No. 268 Smoke Detectors for Fire Protective Signaling Systems.
 - b. No. 864 Control Units for Fire Protective Signaling Systems.
 - c. No. 268A Smoke Detectors for Duct Applications.
 - d. No. 521 Heat Detectors for Fire Protective
 - e. No. 464 Audible Signaling Appliances.
 - f. No. 38 Manually Actuated Signaling Boxes.
 - g. No. 346 Waterflow Indicators for Fire Protective Signaling Systems.
 - h. No. 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems.
 - i. No. 1971 Visual Notification Appliances.

B. Local and State Building Codes.

C. All requirements of the City of Portland Fire Department.

1.10 APPROVALS

- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
 - 1. UL Underwriters Laboratories Inc.
 - 2. FM Factory Mutual
- B. The fire alarm control panel shall meet UL Standard 864, (Control Units) and UL Standard 1076 (Proprietary Burglar Alarm Systems).
- C. The system shall be listed by the national agencies as suitable for extinguishing release applications.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE

- A. Conduit:
1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements, and shall be as specified in Section 16111.
 2. Where possible, all wiring shall be concealed within partitions or above ceilings. Where exposed wiring is necessary, it shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
 3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
 4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
 5. Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
 6. Conduit shall be 3/4-inch (19.1 mm) minimum.
- B. Wire:
1. All fire alarm system wiring shall be new.
 2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
 3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
 4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
 5. Wiring used for the multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. The system shall support up to 1,000 ft. of untwisted, unshielded wire. The system shall permit use of IDC and NAC wiring in the same conduit with the communication loop.
 6. All field wiring shall be completely supervised.
 7. The Fire Alarm Control panel shall be capable of T-Tapping Class B (NFPA Style 4) Signaling Line Circuits (SLC's). Systems that do not allow or have restrictions in, for example, the amount of T-Taps, length of T-Taps etc., are not acceptable.
 8. Wire for connection to the City's municipal fire alarm system shall be 2/C #16 twisted, shielded pair. Coordinate the purchase of this cable with the City Fire Department prior to purchase.
- C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.
- D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

- E. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 "HOUSE" FIRE ALARM CONTROL PANEL:

- A. The FACP shall be a *Notifier* Model FireWarden-100-2(E), or APPROVED EQUAL and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, printer, annunciators, and other system controlled devices.
- B. System Capacity and General Operation:
 - 1. The control panel shall provide, or be capable of expansion to 198 intelligent/addressable devices.
 - 2. The system shall include Form-C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) programmable Notification Appliance Circuits.
 - 3. The system shall support up to 99 programmable EIA-485 driven relays for an overall system capacity of 301 circuits.
 - 4. The Fire Alarm Control Panel shall include a full-featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
 - 5. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.
 - 6. The FACP shall provide the following features:
 - a. Drift Compensation to extend detector accuracy over life.
 - b. Sensitivity Test, meeting requirements of NFPA 72, Chapter 5.
 - c. Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.
 - d. System Status Reports to display or printer.
 - e. Alarm Verification, with verification counters.
 - f. PAS presignal, meeting NFPA 72 3-8.3 requirements.
 - g. Rapid manual station reporting (under 2 seconds).
 - h. Non-Alarm points for general (non-fire) control.
 - i. Periodic Detector Test, conducted automatically by software.
 - j. Pre-alarm for advanced fire warning.
 - k. Cross Zoning with the capability of: counting two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
 - l. March time and temporal coding options.
 - m. Walk Test, with check for two detectors set to same address.
 - n. UL 1076 Security Monitor Points.
 - o. Control-By-Time for non-fire operations, with holiday schedules.
 - p. Day/Night automatic adjustment of detector sensitivity.
 - q. Device Blink Control for sleeping areas.
 - 7. The FACP shall be capable of coding Notification circuits in March Time (120 PPM), Temporal (NFPA 72 A.2.2.2.2), and California Code.
- C. Central Microprocessor:

1. The Microprocessor shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

D. Display:

1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
3. The display shall provide an 80-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, FIRE ALARM, SYSTEM TROUBLE, ALARM SILENCED, SUPERVISORY, MAINTENANCE/PRE-SIGNAL, DISABLED, BATTERY FAULT, and GROUND FAULT.
4. The Display shall provide a 16-key touch keypad with control capability to command all system functions, entry of alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The Display shall include the following operator functions: ALARM SILENCE, SYSTEM RESET, DRILL, and ACKNOWLEDGE/STEP.

E. Signaling Line Circuit (SLC):

1. The SLC interface shall provide power to and communicate with up to 99 intelligent detectors (Ionization, Photoelectric, or Thermal) and 99 intelligent modules (monitor or control) for a system capacity of 198 devices. This shall be accomplished over a single SLC loop and shall be capable of NFPA 72 Style 4, Style 6, or Style 7 wiring.
2. The loop interface shall receive analog information from all intelligent detectors that shall be processed to determine whether normal, alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet NFPA 72, chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

F. Serial Interfaces:

1. An EIA-232 interface between the Fire Alarm Control Panel and UL Listed Electronic Data Processing (EDP) peripherals shall be provided.

2. The EIA-232 interface shall allow the use of printers, CRT monitors, and PC compatible computers.
 3. The EIA-232 interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset, or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.
 4. An EIA-485 interface shall be available for the serial connection of remote annunciators and LCD displays.
 5. The EIA-485 interface may be used for network connection to a Proprietary Receiving Unit.
- G. Enclosures:
1. The control panel shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
 2. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- H. All interfaces and associated equipment are to be protected so that voltage surges or line transients, consistent with UL standard 864, will not affect them.
- I. Optional plug-in modules shall be provided for by NFPA 72, Chapter 4, Transmitters.
- J. An optional module shall be available which provides 8 Form-C relays rated at 5.0. The relays shall track programmable software zones.
- K. Power Supply:
1. The Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
 2. It shall provide 5.0 amps of usable Notification appliance power, using a switching 24 VDC regulator. A 3.0 amp Notification expansion power supply shall be available for the demanding requirements of UL 1971 and ADA devices, for a total system capacity of 8 amps.
 3. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.
 4. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
 5. It shall be power-limited per 1995 UL864 standards.
 6. It shall provide optional meters to indicate battery voltage and charging current.
- L. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24-volt power supply or used to power Notification Appliances.
1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60-hour standby.
 2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
 3. The FCPS shall include a surface mount backbox.

4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per 1993 NFPA requirements.
 5. The FCPS include power limited circuitry, per 1995 UL standards.
- M. Field Wiring Terminal Blocks: For ease of service all panel I/O wiring terminal blocks shall be a removable, plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.
- N. Operator's Controls:
1. Acknowledge/Step Switch: Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and Trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
 - a. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
 2. Alarm Silence Switch: Activation of the Signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field-programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
 3. System Reset Switch: The system reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
 - a. Holding the system RESET switch shall perform a lamp test function.
 4. Drill (Evacuate) Switch: The drill switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
- O. Field Programming:
1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
 2. All programming may be accomplished through the standard FACP keypad.
 3. All field-defined programs shall be stored in non-volatile memory.
 4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.
 5. Program edit shall not interfere with normal operation and fire protection. If a fire condition is detected during programming operation, the system shall exit programming and perform fire protection functions as programmed.
 6. A special program check function shall be provided to detect common operator errors.
 7. An Auto-Program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
 8. For flexibility, an off-line programming function, with batch upload/download, shall also be available.
- P. Specific System Operations:

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all-analog intelligent smoke detectors in the system from the control panel. Sensitivity range shall be within the allowed UL window.
2. Alarm Verification: Each intelligent addressable smoke detector in the system shall be independently selected and enabled to be alarm verified. The alarm verification delay shall be programmable from 5 to 30 seconds. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any device in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - a. Device status.
 - b. Device types.
 - c. Custom device labels.
 - d. View analog detector values.
 - e. Device zone assignments.
 - f. All program Parameters.
5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing system status.
6. System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer that will be capable of storing up to 650 system alarms/troubles/operator actions. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the History Buffer may be manually reviewed, one event at a time, or printed in its entirety.
 - a. Although the foreground history buffer may be cleared for user convenience, a background, non-erasable buffer shall be maintained which provides the last 650 system events.
 - b. The History Buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
7. Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each intelligent smoke detector and shall analyze the detector responses over a period of time.
 - a. If any intelligent smoke detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field-adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 99 software zones. All addressable devices may be field-programmed to be grouped into software zones for control activation and annunciation purposes.

2.4 "HOUSE" FIRE ALARM COMPONENTS:

- A. Programmable Electronic Sounders:
 - 1. Electronic sounders shall operate on 24 VDC nominal.
 - 2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, Temporal or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
 - 3. Shall be flush or surface mounted as shown on plans.

- B. Strobe Lights:
 - 1. Shall operate on 24 VDC nominal.
 - 2. Shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:
 - a. The maximum pulse duration shall be 2/10ths of one second.
 - b. The strobe intensity shall meet the requirements of UL 1971.
 - c. The flash rate shall meet the requirements of UL 1971.
 - d. The appliance shall be placed 80 in (2,030 mm) above the highest floor level within the space, or 6 in (152 mm) below the ceiling, which ever is the lower.

- C. Audible/Visual Combination Devices:
 - 1. Shall meet the applicable requirements of Section A listed above for audibility.
 - 2. Shall meet the requirements of Section B listed above for visibility.

- D. Addressable Devices – General:
 - 1. Addressable Devices shall provide an address-setting means using rotary decimal switches.
 - 2. Addressable Devices shall use simple to install and maintain decade (numbered 1 to 10) type address switches. Devices that use a binary address setting method, such as a dipswitch, are not an allowable substitute.
 - 3. Detectors shall be intelligent and addressable, and shall connect with two wires to the Fire Alarm Control Panel Signaling Line Circuits.
 - 4. Addressable smoke and thermal detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
 - 5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
 - 6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
 - 7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. An optional base shall be available with a built-in (local) sounder rated at 85 DBA minimum.
 - 8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
- E. Addressable Pull Box (manual station):
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.
- F. Intelligent Ionization Smoke Detector: The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.
- G. Intelligent Thermal Detectors: Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.
- H. Addressable Dry Contact Monitor Module:
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
 2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
 3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
 4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch x 1-1/4 inch x 1/2 inch. This version need not include Style D or an LED.
- I. Two-Wire Detector Monitor Module:
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
 2. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.
 3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- J. Addressable Control Module:
1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized

audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.

2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

K. Isolator Module:

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

L. Waterflow Indicators:

1. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.
2. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30 Å 45 seconds.
3. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve.

M. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. Each Post Indicator Valve (PIV) or main gate valve shall be equipped with a supervisory switch.
3. Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

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4. The mechanism shall be contained in a weatherproof aluminum housing that shall provide a 3/4-inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. Switch housing to be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

N. Remote Annunciators

1. The remote annunciator shall be as manufactured by *Notifier* Model LCD-80/ABF-1B, or approved equal. The annunciator shall include an 80 character LCD display and shall include control switches for system acknowledge, signal silence and system reset period. The annunciator cabinet shall be flush recessed type.

O. House Fire Alarm Control Panel Batteries

1. Shall be 12 volt, Gell-Cell type (two required).
2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

2.5 "LOCAL" FIRE ALARM COMPONENTS

- A. Living Unit Combination Smoke Detector/Horn/Strobe: *Gentex* Model 7109CS. Wall mounted station with integral photoelectric smoke detector, horn and strobe. Unit shall be equipped with status light and test switch.
1. Power: 120 VAC with integral 9 VDC battery.
 2. Contacts: Form C
 3. Horn: 90 dB.
 4. Smoke Sensitivity: 3%.
 5. Strobe: UL1971, 177 cd.

2.6 MUNICIPAL FIRE ALARM MASTER BOXES

- A. Provide municipal fire alarm master transmittal box as directed by the City Fire Department to match the City's standard.
- B. Provide communications cable for fire alarm master box to be run continuously from the master box underground to the riser utility pole at Danforth Street. Provide ten feet of slack cable at the top of the utility riser pole.
1. Description: IMSA Spec 20-2 shielded, 3-twisted-pair, 600 volt, #16 AWG conductor with black polyethylene jacket. Obtain approval from City Fire Department for cable prior to purchasing.

PART 3 - EXECUTION

3.1 INSTALLATION

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- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All wiring shall be concealed in finished areas. Exposed wiring in conduit may be used in areas where concealed wiring is not possible; however, prior approval from the Architect must be obtained for any exposed work prior to installation.
- C. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- D. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- E. Connect the remote annunciator to the main fire alarm control panel with one-pair EIA-485 cable and with two 24 VDC conductors, size #18 AWG.
- F. Verify installation detail with Architect for door holders prior to installation.
- G. Make all necessary connections associated with the City Fire Department municipal master box.

3.2 TEST

- A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.
 - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 - 2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
 - 3. Verify activation of all flow switches.
 - 4. Open initiating device circuits and verify that the trouble signal actuates.
 - 5. Open and short signaling line circuits and verify that the trouble signal actuates.
 - 6. Open and short Notification Appliance Circuits and verify that trouble signal actuates.
 - 7. Ground all circuits and verify response of trouble signals.
 - 8. Check presence and audibility of tone at all alarm notification devices.
 - 9. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.
 - 10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
 - 11. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION

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- A. At the final inspection a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.4 INSTRUCTION

- A. Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The Contractor and/or the Systems Manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION 16721

SECTION 16722 INTERCOM/DOOR CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Combination paging intercom and door control system.

1.2 RELATED SECTIONS

- A. Section 16111 - Conduit.
- B. Section 16123 - Wire and Cable.
- C. Section 16130 - Boxes.

1.3 REGULATORY REQUIREMENTS

- A. System: UL listed.

1.4 SYSTEM DESCRIPTION

- A. Intercom Door Control: An intercom/door access control system shall be provided to facilitate voice paging between the main entrances and individual apartments. In addition, the entrance door lock at the building entry vestibule shall be remotely controlled by local intercom stations in individual apartments.

1.5 SUBMITTALS

- A. Provide wiring diagrams, data sheets, and equipment ratings, layout, dimensions, and finishes.

1.6 PROJECT RECORD DRAWINGS

- A. Include location of system devices.

1.7 OPERATION AND MAINTENANCE DATA

- A. Include operating instructions, and maintenance and repair procedures.

PART 2 - PRODUCTS

2.1 INTERCOM/ DOOR CONTROL COMPONENTS

- A. Manufacturers:
 - 1. *TekTone*.
 - 2. Substitutions: Or Approved Equal.
- B. Master Intercom/Door Control Station:
 - 1. *TekTone* Model # CM492/043/OF192/OH190

2. Mounting: Recessed wall
 3. Station capacity: 43 units
 4. Directory: Model # AM190D.
 5. Communications: Integral speaker and microphone.
 6. Size: 16.5" H x 4" W
- C. System Amplifier:
1. *TekTone* Model # PK543A
 2. Mounting: Surface wall.
 3. Delay Timing: Selectable 10 or 20 seconds.
 4. Size: 5.5" H x 3.125" W x 2" D
 5. Power: 16 VAC, 10 VA
- D. Transformer:
1. *TekTone* Model # SS102A
 2. Primary: 120 VAC
 3. Secondary: 16 VAC
 4. Connection: Hard wired.
- E. Apartment Intercom Station:
1. *TekTone* Model # IR105E
 2. Mounting: Recessed wall.
 3. Communications: Integral speaker and microphone with call button.
 4. Size: 6.875"H x 5" W x 1.25" D.
 5. Speaker: 3.25" diameter with voice frequency response.
- F. Apartment Strobe Unit:
1. *TekTone* Model # LI404B
 2. Mounting: Flush mount.
 3. Size: 6.5" W x 8.5" H.
 4. Strobe: Flashes for 15-20 seconds upon receipt of incoming call signal.
- G. Wiring: As recommended by the manufacturer.
1. Audio: Two-pair 22AWG, twisted, shielded.
 2. Low-Voltage: #18 or #22AWG as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate intercom/door control system with door operators and door hardware being provided under the General Contract. Contractor is responsible for coordination of all interface requirements including proper voltages, conductors and terminations.

3.2 INSTALLATION

- A. Install devices in accordance with manufacturer's instructions.

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- B. Verify exact location of apartment intercom stations and apartment strobe units with Architect prior to rough-in.
- C. Coordinate mounting height for door entry stations with Architect prior to rough-in.
- D. Install system amplifier, transfer relay and power transformer in Electrical Room B09.

3.3 FIELD QUALITY CONTROL

- A. Provide field-testing and adjustment of installed security alarm devices to assure satisfactory operation.

END OF SECTION 16722

SECTION 16742 TELEPHONE SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The Telephone System shall include interior telephone wire, telephone outlets and boxes.

1.2 RELATED WORK

- A. Section 16130 - Boxes.
- B. Section 16421 - Utility Service Entrance.

1.3 REFERENCES

- A. ANSI/NEMA FB 1 - Telephone conduit fittings.

1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record location of telephone outlet boxes.

1.5 WORK BY OWNER

- A. Telephone instruments will be supplied by the Owner.

PART 2 - PRODUCTS

2.1 TELEPHONE BOXES

- A. Outlet Boxes: Sheet metal, galvanized steel, as specified in Section 16130.

2.2 STANDARD TELEPHONE WIRE

- A. Description: Category 5e unshielded twisted 4-pair wiring (UTP), 24 AWG. Category 5e cable shall meet the physical requirements of ANSI/ICEA publication S-80-576 (ref. B1.6). Exterior jacket color shall be green.
- B. Characteristics:
 - 1. Nominal Impedance: $100\text{-}\frac{1}{2} \pm 15\%$ from 1 MHz to 100 MHz)
 - 2. Maximum DC Resistance: $9.38\ \frac{1}{2} / 100\text{ m}$.
 - 3. Mutual Capacitance (max.): 5.25 nF/100m
- C. Manufacturers:
 - 1. AMP.
 - 2. Mohawk.
 - 3. Substitutions: Or Approved Equal.

2.3 TELEPHONE OUTLET JACKS

- A. Manufacturers:
 - 1. *Panduit*
 - 2. *NORDX*
 - 3. *AMP*
 - 4. *Leviton*
 - 5. Substitutions: Approved Equal.

- B. Recessed Wall Type: RJ11, Category 3, 4-pair for modular type (quick connect terminals) suitable for back wiring and mounting in a standard electrical box. Jack shall include a plastic ivory faceplate and mounting lugs. Each telephone outlet faceplate shall also include a video "F" connector as specified under Section 16745.

2.4 TELEPHONE SERVICE WIRING CONNECTION ENCLOSURE

- A. Description: Provide a service enclosure box with lockable hinged front doors to enclose the telephone service wiring termination 110 blocks for the entire facility. Locate the enclosure box on the telephone service board at the second floor telephone room. Size the enclosure box as necessary to accommodate wiring terminations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify that field measurements are as shown on Drawings.
- C. Beginning of installation means installer accepts existing conditions.

3.2 TELEPHONE OUTLETS, WIRING, BOXES AND CONDUIT

- A. Provide telephone outlet boxes and jacks as shown on Drawings. Provide recessed (flush) mounted telephone outlet boxes in all finished areas. Provide surface mounted outlet boxes only in unfinished areas.
- B. Do not install recessed telephone boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated walls.
- C. Secure recessed telephone boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- D. Coordinate mounting heights and locations of outlet boxes mounted above counters, benches, and backsplashes.
- E. Install telephone outlet boxes 18 inches above finished floor.
- F. Conceal telephone wire within partitions or above ceilings. Provide straps as required to properly support cables.

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- G. Do not make splices in telephone wiring. Provide telephone wiring continuous from outlet jacks to 110 telephone termination blocks to be located at the main telephone service board in the electrical room. Make all necessary wiring terminations.
- H. Test all installed telephone wire, outlets and terminations to assure proper operation.

END OF SECTION 17642

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SECTION 16745 CABLE TELEVISION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide new cable TV interior wiring, wiring taps, backboards and outlet jacks.

1.2 RELATED WORK

- A. Section 16111 - Conduit.
- B. Section 16130 - Boxes.
- C. Section 16421 - Utility Service entrance.

1.3 SUBMITTALS

- A. Product Data: Submit physical and operating characteristics of interior cable and outlet jacks.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provision of Division 1.
- B. Accurately record location of cable TV outlets.

1.5 CABLE TELEVISION SERVICE

- A. Cable TV service shall be provided as specified in Section 16421.

PART 2 - PRODUCTS

2.1 INTERIOR CABLE TELEVISION WIRING

- A. Manufacturers:
 - 1. *Belden.*
 - 2. *AT & T.*
 - 3. Substitutions: Or Approved Equal.
- B. Description: Coax cable, 60 degrees C, RG-6 for circuit runs 300 feet and less; coaxial cable, 60 degrees C, RG-11 for circuits longer than 300 feet.

2.2 CABLE TELEVISION OUTLET BOXES

- A. Outlet Boxes: Sheet metal or non-metallic, as specified in Section 16130.

2.3 CABLE TELEVISION JACKS

- A. Recessed Wall Type: "F" style threaded coaxial cable connector suitable for back wiring and mounting in a standard electrical box. Jack shall include a plastic ivory faceplate and mounting lugs. Faceplates shall include a telephone outlet jack as specified under Section 16742.

2.4 CABLE TELEVISION BACKBOARDS

- A. Local Backboards at Service Closets: 3/4" by 30" sq. plywood backboard, painted black. Mount on wall, secured to partition studs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify that field measurements are as shown on Drawings.
- C. Beginning of installation means installer accepts existing conditions.

3.2 CABLE TELEVISION OUTLETS

- A. Provide TV outlet boxes and jacks as shown on Drawings.
- B. Provide recessed (flush) mounted TV outlet boxes in all finished areas.
- C. Do not install recessed TV outlet boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated and fire rated walls.
- D. Secure recessed TV outlet boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- E. Install TV outlet boxes at height indicated on Drawings.
- F. Adjust TV outlet jacks and wall plates to be flush and level.

3.2 CABLE TELEVISION WIRING

- A. Route interior cable concealed in partitions above ceilings. Exposed wiring in conduit may be used where concealed wiring is not possible; however, prior approval from the Architect must be obtained for any exposed work prior to installation.
- B. Do not make splices of television cables.
- C. Support television cables above ceilings using spring metallic clips or cable ties to support cables from structure. Do not rest cables on lay-in ceiling panels.
- D. Provide television cables continuous from outlet jacks to cable taps and service point.

END OF SECTION 16745

SECTION 16910 GENERATOR TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

- A. Provide automatic transfer switches for control of the generator as specified under Section 16915.

1.2 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 1 and Section 16010.
- B. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set and the transfer switch if it is included elsewhere in these specifications.

1.3 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Provide written operating and maintenance instructions as specified in Section 16010. Include product data and operation/maintenance information for all system components.
- B. Provide sufficient training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.
- C. Employ manufacturer's field representative to demonstrate system operation to designated Owner personnel

1.4 FACTORY TESTING

- A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for design prototype tests, and final production tests.
 - 1. Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and pre-production models, which will not be sold, shall have been used for prototype tests.
 - 2. Final Production Tests: Each transfer switch shall be tested under load with all guards in place. Tests shall include:
 - a. The complete transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.

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- b. The complete transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.
- c. The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI C37.90a-2978 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

1.5 WARRANTY & MAINTENANCE

- A. The transfer switch shall be guaranteed against defective material and workmanship in accordance with the manufacturer's published warranty for one year from date of start-up. Optional warranties shall be available upon request.
- B. The transfer switch manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

1.6 COMPLIANCE WITH CODES AND STANDARDS

- A. The ATS shall conform to the requirements of:
 - 1. UL 1008--Standard for Automatic Transfer Switches.
 - 2. NFPA 70--National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700.
 - 3. NFPA 99--Essential Electrical Systems for Health Care Facilities.
 - 4. NFPA 110--Standard for Emergency and Standby Power Systems.
 - 5. IEEE Standard 446--Recommended Practice for Emergency and Standby Power Systems (Orange Book).
 - 6. IEEE Standard 241--Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book).
 - 7. NEMA Standard ICS 2-447 Automatic Transfer Switches.

1.7 ELECTRICAL REQUIREMENTS

- A. Transfer switches not intended for continuous duty or repetitive load transfer switching are not acceptable.
- B. Transfer switches shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load. Switches rated 400 amperes and below shall be suitable for 100% tungsten-filament lamp load. Switches rated above 400 amperes shall be suitable for 30% tungsten-filament load.
- C. The automatic transfer switches shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of overcurrent protection shown on the plans.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES

- A. Acceptable Manufacturers:
 - 1. *Cummins.*
 - 2. *Onan.*
 - 3. *Kohler.*
 - 4. Substitutions: Or Approved Equal.
- B. Transfer switches shall have the following characteristics:
 - 1. Current rating as indicated on Drawings
 - 2. 3-Pole, solid neutral, or 2-Pole solid neutral, as indicated on Drawings
 - 3. 120/208 Volt-60Hz
 - 4. The ATS shall be furnished in a NEMA 1 enclosure.
 - 5. The switch shall be a 600-volt class.
 - 6. The withstand and closing ratings with a current-limiting fuse shall be 200,000 Amps
 - 7. The withstand and closing ratings with any overcurrent protective device shall be 50,000 Amps
- C. All main contacts shall be of silver composition. The main contacts shall be protected by arcing contacts in sizes 400 amperes and above. The main contacts shall be of the blow-on configuration and of segmented construction in ratings 600 amperes and above.
- D. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- E. The contact transfer time shall not exceed one-sixth of a second.
- F. All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.
- G. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- H. The neutral conductor shall be solidly connected as shown on the plans, a neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.
- I. Transfer switches shall be provided with NEMA 1 surface mount enclosures with locking covers.

2.2 TRANSFER SWITCH CONTROL SYSTEM

- A. The control module shall direct the operation of the transfer switch. The module's sensing and logic circuitry must use a solid-state design for maximum reliability and minimum maintenance. The control module shall have a polarized disconnect plug to enable it to be disconnected from the transfer mechanism for routine maintenance.

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- B. All printed circuit boards for the control module must be conformal coated on both sides for environmental protection.
- C. The control module must be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.
- D. The control module shall include lamps to indicate normal or emergency source switch position and normal and emergency source availability. These lamps shall be visible when the enclosure door is closed.
- E. The control module must be upgradable with the following options:
 - 1. Switch position auxiliary contacts.

PART 3 - EXECUTION

- A. INSTALLATION
- B. Install transfer switch in full conformance with manufacturer's requirements and recommendations.
- C. Site Tests: The manufacturer's local representative shall perform an installation check, start-up, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test.

END SECTION 16910

SECTION 16915 - GAS ENGINE DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.1 SCOPE

- A. Provide complete factory assembled natural gas-fired generator set equipment with digital (microprocessor-based) electronic controls.
- B. Provide factory test, startup by a supplier authorized by the manufacturer, and on-site testing of the system.
- C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.2 CODES AND STANDARDS

- A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.
 - 1. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
 - 2. IEEE446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - 3. NFPA70 - National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - 4. NFPA99 - Essential Electrical Systems for Health Care Facilities
 - 5. NFPA110 - Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
- B. The generator set and supplied accessories shall meet the requirements of the following standards:
 - 1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.
 - 2. UL142 - Sub-base Tanks
 - 3. UL1236 - Battery Chargers
 - 4. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.
- C. The control system for the generator set shall comply with the following requirements.
 - 1. CSA C22.2, No. 14 - M91 Industrial Control Equipment.
 - 2. EN50082-2, Electromagnetic Compatibility - Generic Immunity Requirements, Part 2: Industrial.
 - 3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - 4. FCC Part 15, Subpart B.

5. IEC8528 part 4. Control Systems for Generator Sets
6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
7. UL508. The entire control system of the generator set shall be UL508 listed and labeled.
8. UL1236 -Battery Chargers.

D. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURERS

A. Only approved bidders shall supply equipment provided under this contract. Equipment specifications for this project are based on microprocessor-based generator sets manufactured by *Cummins Power Generation*. Equipment by the following other supplier that meets the requirement of this specification is acceptable. Proposals must include a line by line compliance statement based on this specification.

1. *Kohler*
2. Substitutions: None permitted

PART 2 - PRODUCTS

2.1 GENERATOR SET

A. Ratings

1. The generator set shall operate at 1800 rpm and at a voltage of: 208/120 Volts AC, Three phase, 4-wire, 60 hertz.
2. The generator set shall be rated at 85 kW, 106 kVA at 0.8 PF, standby rating, based on site conditions of: Altitude 499 ft. (152 meters), ambient temperatures up to 77 degrees F (25 degrees C)
3. The generator set rating shall be based on emergency/standby service.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
3. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Motor starting capability shall be a minimum of 313 kVA. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.

5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.
3. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.2 ENGINE AND ENGINE EQUIPMENT

- A. The engine shall be natural gas fueled, radiator and fan cooled. Minimum displacement shall be 412.5 cubic inches, with 10 cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Engine accessories and features shall include:
 - B. Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set. For dual fuel systems, changeover from primary to secondary fuel shall be automatic.
 - C. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.
 - D. Skid-mounted radiator and cooling system rated for full load operation in 104 degrees F (40 degrees C) ambient as measured at the generator air inlet, based on 0.5 in H₂O external static head. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture. Rotating parts shall be guarded against accidental contact.
- E. Electric starter(s) capable of three complete cranking cycles without overheating.

- F. Positive displacement, mechanical, full pressure, lubrication oil pump.
- G. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
- H. Replaceable dry element air cleaner with restriction indicator.
- I. Flexible fuel lines.
- J. Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.
- K. Coolant heater
 1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
 2. The coolant heater shall be installed on the engine with high temperature silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
 3. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.
 4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.
- L. Provide vibration isolators, spring/pad type or as recommended by the manufacturer, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.
- M. Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.
- N. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.
- O. Provide a minimum 12 amp battery charger for each generator set battery bank. Generator sets incorporating two battery banks shall be provided with two chargers connected together and operating in parallel, with alarm output(s) connected in parallel. The charger(s) shall include the following capabilities:

1. Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications.
2. The charger shall be compliant with UL991 requirements for vibration resistance.
3. The charger shall comply with the requirements of EN61000-4-5 for voltage surge resistance; EN50082-2 for immunity; EN61000-4-2 for ESD; EN61000-4-3 for radiated immunity; ANSI/IEEE C62.41 category B and IN61000-4-4 for electrically fast transient; EN61000-4-6 for conducted emissions; and FCC Part 15 Class A for radiated emissions.
4. The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24 hours.
5. The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible recharge after normal discharge, an absorption state to return the battery to 100 percent of charge, and a float stage to maintain a fully charge battery and supply battery loads when the generator set is not operating. In addition, the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.
6. The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 amp at rated output current level.
7. The charger shall include the following features:
 - a. two line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;
 - b. LED indicating lamp(s) to indicating normal charging condition (green), equalize charge state (amber), and fault condition (red);
 - c. AC input overcurrent, over voltage, and undervoltage protection;
 - d. DC output overcurrent protection;
 - e. Alarm output relay
 - f. Corrosion resistant aluminum enclosure

2.3 AC GENERATOR

- A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 150 degrees Centigrade.
- B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.
- C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.
- D. The sub-transient reactance of the alternator shall not exceed 15 percent, based on the standby rating of the generator set.

E. The alternator shall be capable of operation with reverse kVAR of 0.15 per unit.

2.4 GENERATOR SET CONTROL

A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

B. The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

C. The generator set mounted control shall include the following features and functions:

1. Control Switches

- a. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
- b. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
- c. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
- d. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

2. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

- a. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
- b. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output. Both analog and digital metering are required.
- c. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
- d. The control system shall log total number of operating hours, total kWh, and total control on hours, as well as total values since reset.

- D. Generator Set Alarm and Status Display. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:
1. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).
 2. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.
 3. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
 4. The control shall include an amber common warning indication lamp.
 5. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:
 - a. low oil pressure (warning)
 - b. low oil pressure (shutdown)
 - c. oil pressure sender failure (warning)
 - d. low coolant temperature (warning)
 - e. high coolant temperature (warning)
 - f. high coolant temperature (shutdown)
 - g. high oil temperature (warning)
 - h. engine temperature sender failure (warning)
 - i. low coolant level (warning)
 - j. fail to crank (shutdown)
 - k. fail to start/overcrank (shutdown)
 - l. overspeed (shutdown)
 - m. low DC voltage (warning)
 - n. high DC voltage (warning)
 - o. weak battery (warning)
 - p. low fuel-daytank (warning)
 - q. high AC voltage (shutdown)
 - r. low AC voltage (shutdown)
 - s. under frequency (shutdown)
 - t. over current (warning)
 - u. over current (shutdown)
 - v. short circuit (shutdown)
 - w. over load (warning)
 - x. emergency stop (shutdown)
 - y. (4) configurable conditions
 6. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

E. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control :
 - a. engine oil pressure (psi or kPA)
 - b. engine coolant temperature (degrees F or C)
 - c. engine oil temperature (degrees F or C)
 - d. engine speed (rpm)
 - e. number of hours of operation (hours)
 - f. number of start attempts
 - g. battery voltage (DC volts)
2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

F. Engine Control Functions.

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

G. Alternator Control Functions:

1. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
2. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage

point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. The protection for this function shall be 3rd party certified to very performance.

3. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. The protection for this function shall be 3rd party certified to very performance.
4. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
5. An line to neutral sensing AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
6. The generator set control shall include a 120VAC-control heater.

H. Other Control Functions

1. The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.
2. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

I. Control Interfaces for Remote Monitoring:

1. The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.
2. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
3. A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
4. The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

2.5 OTHER EQUIPMENT TO BE PROVIDED WITH THE GENERATOR SET

- A. The generator set shall be provided with a mounted main line circuit breaker, sized to carry the rated output current of the generator set. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.
- B. Outdoor Weather-Protective Sound Attenuated Enclosure
1. The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.
 2. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two step electro-coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:
 - a. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
 - b. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
 - c. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
 - d. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
 - e. Salt Spray, per ASTM B117-90, 1000+ hours.
 - f. Humidity, per ASTM D2247-92, 1000+ hours.
 - g. Water Soak, per ASTM D2247-92, 1000+ hours.
 3. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.
 4. Enclosure shall be constructed of minimum 12 gauge steel for framework and aluminum panels. All hardware and hinges shall be stainless steel.
 5. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
 6. The enclosure shall include the following maintenance provisions:
 - a. Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves
 - b. External radiator fill provision.

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7. Provide an external emergency stop switch that is protected from accidental actuation.
 - a. Inlet ducts shall include rain hoods.
8. Maximum Sound levels shall be:
 - a. 63 Hz: 77.6 dB(A)
 - b. 125 Hz: 87.6 dB(A)
 - c. 250 Hz: 88.3 dB(A)
 - d. 500 Hz: 87.3 dB(A)
 - e. 1000 Hz: 85.1 dB(A)
 - f. 2000 Hz: 83.0 dB(A)
 - g. 4000 Hz: 78.8 dB(A)
 - h. 8000 Hz: 74.4 dB(A)
 - i. Overall Sound Power Level: 93.9 dB(A)

PART 3 – OPERATION

3.1 SEQUENCE OF OPERATION

- A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control.
- B. The generator set shall complete a time delay start period as programmed into the control.
- C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:
 1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.
 2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.
 3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.
- D. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.
- E. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.
- F. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.
 1. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

3.2 SUBMITTALS

- A. Within 10 days after award of contract, provide six sets of the following information for review:
1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
 2. A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
 3. Manufacturer's certification of prototype testing.
 4. Manufacturer's published warranty documents.
 5. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
 6. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
 7. Manufacturer's installation instructions.

3.3 FACTORY TESTING

- A. The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.
- B. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.4 INSTALLATION

- A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
- B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- D. Equipment shall be initially started and operated by representatives of the manufacturer.
- E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

3.5 ON-SITE ACCEPTANCE TEST

- A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer,

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with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

- B. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
- C. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.6 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

3.7 SERVICE AND SUPPORT

- A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.
- B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
- C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

3.8 WARRANTY

- A. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 16915



SECTION 16950 LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. This section of the specification includes the furnishing, installation, connection and testing of a complete lighting control system for both interior and exterior lighting. Provide all equipment required to form a complete, operative, and coordinated system as shown on the drawings and specified herein. Components of the Lighting Control System shall include, but are not limited to, the following:
 - 1. Lighting Control Panel.
 - 2. Occupancy Sensors.
 - 3. Daylight Controls.
 - 4. Exterior Photocell.

1.2 RELATED SECTIONS

- A. Section 16010 - Electrical General Requirements.
- B. Section 16111 - Conduit.
- C. Section 16123 – Building Wire and Cable
- D. Section 16130 - Boxes.

1.3 QUALITY ASSURANCE

- A. All system materials shall be UL-listed for their intended duty.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 16010.
- B. Shop Drawings and Product Data:
 - 1. Submit complete and at one time. Provide manufacturer's catalog information showing dimensions, colors, and configurations. Isolated items will not be considered for approval, except by prior authorization.
 - 2. A technical data sheet from the manufacturer should be included with the response for each product proposed. This data sheet shall include the physical specifications as well as the electrical characteristic.
 - 3. The following is required for approval, prior to fabrication and installation:
 - a. Catalog Data Sheets of all manufactured items, including manufacturer and model number.
 - b. Wiring diagrams indicating proposed connections of all equipment and indicating equipment types and model numbers.

1.5 TRAINING

- A. Provide sufficient training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 16010.
- B. Accurately record location of all equipment items.

1.7 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 16010.
- B. Include operating instructions, maintenance and repair procedures.

PART 2 – MATERIALS

2.1 LIGHTING CONTROL PRODUCTS

- A. *Watt Stopper* model numbers are listed below to establish configuration and type of materials. Equal materials by *LCD* or *Leviton* will be accepted.

2.2 LIGHTING CONTROL PANEL

- A. Sequence of Operation:
 - 1. The Lighting Control Panel shall automatically turn on selected exterior lights at a pre-programmed time each day in the evening and turn off same lights at a pre-programmed time each day in the morning. Additionally, the Lighting Control Panel shall automatically control selected exterior lights by photocell such that they will operate from dusk to dawn each day.
- B. Manufacturer:
 - 1. *Watt Stopper*
 - 2. *Lighting Control & Design*
 - 3. *Leviton*
 - 4. Substitutions: None Permitted.
- C. Description: Lighting control panel shall be *Watt Stopper* model LP8S-8-115 and shall provide eight (8) automatic control channels for operating contactors controlling exterior and/or interior lighting. Each channel shall be individually configurable. Each channel shall include an LED light status indicator to provide channel status and a separate

ON/OFF switch for manual channel control. The Control Panel shall consist of the following:

1. Tub: Empty NEMA 1 enclosure that can accept an interior sized to accept up to 8 contactor poles.
2. Cover: Surface with captive screws in a hinged, lockable configuration.
3. Interior: Metal back plate and barrier for separation of high voltage (class 1) and low voltage (class 2) wiring. Intelligence board with eight (8) channels of control provided regardless of interior size. Interiors shall be provided with up to 16 DIN rail mounted contactor poles.
4. Contactors: DIN rail mounted, four-pole, normally closed, electrically held with coil voltage to match panel control power voltage. Contactors shall be compatible with all lighting, ballast, and HID loads and be rated for 20-Amp tungsten up to 277V and rated for 30A ballast and general use up to 600V. Provide 20% spare contactor poles.
5. Auxiliary Power: 350mA at 24VDC and 350mA at 24VAC for operating system devices.
6. Time Clock: The system time clock shall provide time-based control with eight-year time backup, non-volatile memory program storage, automatic daylight savings adjustment, selectable 12/24-hour time formats and selectable date formats. All clock programming shall be accessible from the clock front display/keypad. The time clock shall provide for the following:
 - a. Control of eight control channels with status and manual ON/OFF control of each channel from the front display and keypad.
 - b. Control of eight individual override inputs that can be used to connect external devices such as photocells, switches and daylighting controllers. Each of these inputs shall be capable of being configured to operate as a photocell, as an ON/Auto switch, as a maintained ON/OFF switch, or as a momentary ON/OFF switch.
 - c. Scheduling of any combination of days of the week and/or 3 holiday types with the capacity for temporary and/or repeating schedules that are adjustable from 5 minutes to 10 hours.
 - d. Assignment of 32 perpetual holidays to any one of three holiday day schedules and continuing for 1 to 120 days. Holiday dates shall be specific day/month/year, or perpetual dates including day/month/years or day of the week in a given month every year or self-calculating Easter Sunday.
 - e. Astronomic control capability for calculating sunrise and sunset based on time, latitude, and time zones. All scheduled astronomic/time operations shall be interlocked so loads are not turned on when astronomic off time are earlier than scheduled on times or astronomic on times are later than scheduled off times. Each schedule shall have an independent astronomic offset of ± 120 minutes.

2.3 EXTERIOR PHOTOCCELL

- A. Manufacturer:
 1. *Watt Stopper*
 2. Substitutions: Or Approved Equal.
- B. Photocell shall be *Watt Stopper* model EM-24A2 and shall include a footcandle range of 1-15 and an 8-second time delay. The photocell shall mount on the exterior of a building with its light level window facing the northern sky. The photocell shall provide an ON

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signal when the ambient light level drops below a user-defined dark set point, and an OFF signal when the ambient light level rises above a user-defined light set point.

1. Contacts: One set of normally open, isolated relay contacts that are rated for one Amp at 30 VAC/VDC
2. Set point: adjustable ON/OFF dark set point.

2.4 DAYLIGHTING CONTROLS (Garage)

- A. Sequence of Operation
 1. Photocells shall control lights in the garage selected to automatically turn on/off at a pre-determined daylight level.
- B. Manufacturer:
 1. *Watt Stopper*
 2. Substitutions: Or Approved Equal.
- C. Photocell shall be *Watt Stopper* model number LS-100XA and shall have a footcandle range of 10-200. Photocell shall be provided with *Watt Stopper* power pack for 24 volt control.

2.5 OCCUPANCY SENSORS

- A. Manufacturers:
 1. *Watt Stopper*
 2. *Lighting Control & Design*
 3. *Leviton*
 4. Substitutions: None Permitted.
- B. Occupancy sensors to control lighting shall be as follows:
 1. Lobby 102, Corridor and Stairway Sensors: *WattStopper* Model CX-100-1, or approved equal. Wall mounted, passive infrared motion sensor with linear coverage pattern extending up to 90 feet. Sensor shall have time delay adjustment from 15 seconds to 30 minutes and shall be provided with wall mounting bracket.
 2. Electrical Rooms, Telephone Closets, Elev. Mach. Room 104, Solar 204, Janitor 304, Office 404, Toiler 405, and Laundry 504 Sensors: *WattStopper* Model CI-200-1, or approved equal. Ceiling mounted, passive infrared motion sensor with 360 degree coverage pattern extending up to 24 feet. Sensor shall have time delay adjustment from 15 seconds to 30 minutes and shall be provided with wall mounting bracket.
 3. Garage, Trash/Recycling 103, Bike Storage Room, and Sprinkler Room 106 Sensors: *WattStopper* Model CB-100, or approved equal. Wall mounted, passive-infrared, line-voltage motion sensor rated for outdoor areas. Sensor shall be rated to operate in a temperature range of -40 degrees to 95 degrees F. Enclosure shall be water tight. Coverage shall extend 270 degrees. Motion sensor shall have time delay adjustment from 15 seconds, 5 minutes or 10 minutes, and shall include wall mounting bracket.
- C. Occupancy Sensor Power Packs: Provide a 120 VAC:24 VDC power pack for each motion sensor. Power pack shall be *WattStopper* Model BZ-100, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not install equipment and materials that have not been reviewed by the Architect-Engineer. Equipment and materials that are installed without the Architect-Engineer's review or without complying to comments issued with the review shall be removed from the project when so instructed by the Architect-Engineer. No payment will be made for unapproved or removal if it is ordered removed. The Installer shall be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.
- B. Obtain detailed information on installation requirements from the manufacturers of all equipment to be furnished, installed or provided. At the start of construction check all Contract Documents, including all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.
- C. Equipment and systems shall not be installed without first coordinating the location and installation of equipment and systems with the General Contractor and all other Trades.
- D. Any and all material installed or work performed in violation of above requirements shall be re-adjusted and corrected by the Installer without charge.
- E. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical boxes, conduit and equipment, to determine the exact location of all outlets.
- F. After installation, equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent the entrance of foreign materials.
- G. Install all systems in strict accordance with the manufacturer's instructions.

3.2 WORK

- A. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section shall be replaced, or at the Owner's option, repaired with similar materials, workmanship and quality.
- B. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits in order to determine scope of work.
- C. Clean and touch up all equipment, materials and work sites at the completion of work in each area.

3.3 TERMINATIONS

- A. All conductors of every cable shall be completely terminated at both ends.

3.4 SYSTEM INSTALLATION

- A. Provide all equipment and cabling for a complete installed operating system.
- B. Cabling shall be installed concealed and shall be supported from the building structure.
- C. All cables shall be installed in a neat and workman-like manner. Cables shall be installed parallel and perpendicular to building elements.
- D. Install Lighting Control Panel with top of panel at 60" AFF.

3.5 SYSTEM TESTING

- A. Test Reports: Upon completion and testing of the installed system, test report shall be submitted showing satisfactory system operation, certified by a factory authorized representative.

3.6 ACCEPTANCE DEMONSTRATIONS

- A. Systems installed under this Section shall be demonstrated to the Owner and Architect-Engineer. Demonstrations are in addition to necessary testing and training sessions. Notify all parties at least 7 days prior to the scheduled demonstration. Schedule demonstrations in cooperation with and at times convenient to all parties and so as to not disturb ongoing activities.
- B. Systems shall be tested prior to the demonstrations and each system shall be fully operational and tested prior to arranging the Acceptance Demonstration. Final payments will be withheld until a satisfactory demonstration is provided for all systems indicated or requested.
- C. If the demonstration is not totally complete, performing all functions, features and connections or interfaces with other systems, or if there is a failure during the demonstration, additional demonstrations shall be arranged. Provide and pay for all costs, labor and expenses incurred for all attendees for each additional demonstration required for acceptance and demonstration of complete system operation.
- D. Demonstrations shall be scheduled in ample time to complete all activities prior to final acceptance and Owner occupancy. Demonstrations shall take place at least 30 days prior to the scheduled project completion date and 30 days prior to owner's use and occupancy.
- E. As a minimum, provide demonstrations for systems indicated under "Section Includes" under Part One of the Specifications. Provide demonstrations of additional systems as requested by the Owner, or Architect-Engineer.

3.7 CLEANING UP

- A. Upon completion of all work, and testing, thoroughly inspect all exposed portions of the installation and completely remove all exposed labels, markings, and foreign material.
- B. The interior of all boxes and cabinets shall be left clean; exposed surfaces shall be cleaned and plated surfaces polished.
- C. Repair damage to finish surfaces resulting from work under this Section.

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- D. Remove material and equipment from areas of work and storage areas.
- E. All equipment shall be clean from dirt, dust, and fingerprints prior to final acceptance.

END OF SECTION 16950

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MaineHousing Green Building Standards

**First Edition: August 2005
Revised October 2006**

**Developed by MaineHousing with Integral Contributions from
our Architects, Developers, Contractors and Consultants**

MaineHousing Green Building Standards For Architects, Developers and Contractors

In keeping with its mission to assist Maine people to obtain and maintain decent, safe, affordable housing services, MaineHousing has developed a set of Green Building Standards for designers, developers and contractors who apply for MaineHousing funding. Designing and building in this fashion assures long-term affordability by providing dwellings with low energy use that will insulate owners and occupants from rising fuel prices. The intention is to create healthy, economical and durable buildings that are efficient to operate and maintain.

Green building is the design, construction and operation of buildings that save money and energy, reduce their impact on natural resources and create healthy, comfortable living environments.

The standards are a requirement for all projects that submit applications for funding after May 1, 2005. They are organized into eleven sections, from site to post occupancy. Rehab and renovation projects must conform to the guidelines to the extent that their scope of work includes any specific measure. The emphasis is on energy efficiency, good indoor air quality and, additional site and building features such as native vegetation, that reduce the negative environmental impact of development without adding to the bottom line. MaineHousing's Green Building Standards promote regional products, and support local economies and economic development.

Dale McCormick
Director

MaineHousing History/Process

PREFACE

MaineHousing's *Green Building Standards* were first published and released in August of 2005 thanks to considerable input and dedication of many of our Architect, Developer, Contractor and Consultant partners, including Fore Solutions of Portland, Maine who put the initial *Standards* into their final form. The intent of these standards is to provide a living document – one that may require interpretation from time to time based on specific applications, can and will be amended from time to time, and will continue to grow and be supplemented with new ideas and trends as the world of green building evolves over time.

Since its initial publication, two Amendments have been issued: in March and August of 2006, respectively and in December of 2006 two new standards were developed and approved by the MaineHousing's Board of Directors integral with the 2007 QAP process. This revised document incorporates all amendments issued since the original publication.

Requests for clarification and/or modification of MSHA's *Green Building Standards* shall be submitted to MSHA in writing to the attention of the Construction Services Manger. In making a request, the concerned party shall provide specific standard references, restate the standard in question, and provide a detailed explanation of the proposed request as related to the standard. Any necessary backup information such as hard copy literature, web sites, engineering data, etc. shall also be provided and referenced as an integral part of any requests. MSHA's Construction Services Manager will, in a timely manner, investigate and respond to all requests and, to the extent necessary, shall issue an amendment which documents and implements any proposed clarifications and/or modifications to the standards.

Donald R. McGilvery
Construction Services Manager

MaineHousing Green Building Standards

		Standard	Cost Implications
1 Site			
	R 1	Landscape with at least 75% northern hardy native species that do not require irrigation. This is measured by number of plantings.	No additional cost
	R 2	Preserve existing trees and vegetation, except within 30' of buildings, driveways, solar access, areas cleared for food production and as required for grading for drainage requirements.	No to low additional cost
	R 3	Minimize light pollution to the night sky.	No to low additional cost
2 Building Design			
	R 1	An overall water management plan for the building envelope for prevention of indoor air quality (IAQ) problems from mold.	Costs are dependent on which and how many of these measures differ from standard practice.
3 Energy Efficiency: Building Envelope			
	R 1	The building envelope must be sealed to prevent air leaks.	Additional labor costs and very low additional material costs. Effective training programs for project teams can reduce and contain labor costs.
	R 2	The thermal envelope shall be insulated in a manner that complies with either the requirements of Chapter 4 of the 2004 IECC or the requirements of state law, whichever is more stringent.	Additional cost for labor and materials to meet code requirements. (Note that by using Optimum Value Engineering (OVE) efficiency techniques & sheathing with rigid insulation it should be possible to meet code requirements with no or low additional cost.)

	R 3	Energy efficient windows optimized for solar gain OR advanced framing techniques such as OVE, SIPS, ICF, stress skin panel and others.	Possible additional costs (range low to high) for all recommended thermal improvement strategies except for OVE - OVE should realize both cost savings and thermal efficiency improvement.
	R 4	Spaces between trusses or rafters shall have blocking at the soffit to prevent "windwashing" of the attic insulation.	Low additional cost
	R 5	No pipes or ducts in outside walls.	No additional cost
4 Energy Efficiency: Systems & Appliances			
	R 1	Energy Star labeled systems & appliances	Low cost - Energy Star appliances are currently often specified
	R 2	Bathroom exhaust fans shall be low noise with energy efficient fan motor rated for continuous duty with a minimum rating of 50 cfm.	Low additional cost
	R 3	Water Efficiency: Low flow faucets and showerheads	No additional cost
	R 4	Water Efficiency: Low flow toilets	Additional cost for dual flush, 1.6 GPF toilets are standard.
	R 5	Seal ductwork with duct mastic to prevent air leakage	Very low additional labor and material costs
5 Energy Efficiency: Interior Lighting Fixtures			
	R 1	Lighting lamps and fixtures shall be Energy Star rated.	No additional cost
	R 2	No recessed light fixtures shall be installed in roof/ceiling assemblies.	No additional cost
	R 3	All emergency exit signs shall be LED.	Low or no additional cost
	R 4	Automatic lighting controls to minimize energy use	Minor added cost
6 Inspection/Commissioning			
	R 1	Commissioning required for projects of five units or more with central mechanical systems.	Additional costs contingent upon size and complexity of central mechanical systems.
	R 2	For each project, a representative number of units, as determined by MaineHousing, must be "Blower Door" tested to verify effectiveness of air sealing.	Blower Door tests cost \$150 - \$200 / unit tested
	R 3	A representative sampling of ducted air distribution systems, as determined by MaineHousing, must be tested to verify effectiveness of duct sealing.	Low additional cost

7 Indoor Environmental Quality			
	R 1	Position and size operable windows and glazing systems to take advantage of natural ventilation, cooling and daylighting.	No to low additional cost
	R 2	Use low VOC paint	No additional cost
	R 3	Use low VOC adhesives & sealants	No additional cost
	R 4	If carpet is installed it must meet CRI low emission test standard.	No additional cost
	R 5	No carpet in kitchens, bathrooms or within 3' of entry doors.	No additional cost
8 Materials			
	R 1	Use framing and finish lumber harvested from sustainably managed forests OR local / regional materials OR durable materials.	Additional costs, if any, for verification should be very low. FSC certified wood and most durable products will have higher first costs.
9 Resource Efficiency			
	R 1	Provide space for recycling containers at convenient location(s) for storage of recyclables.	Cost for additional Square Footage required for recycling area
	R 2	Non-mercury thermostats	No additional cost
10 Post Occupancy			
	R 1	Provide tenants with educational materials about green design, building operations, recycling & building maintenance.	Additional cost to purchase or produce, print and distribute educational materials
11 Construction Practices			
	R 1	Construction waste and/or debris recycling to the extent possible	No additional cost

MaineHousing Green Building Standards

SECTION 1 R1 SITE

Standard

Landscape with at least 75% northern hardy native species that do not require irrigation. This is measured by the number of plantings.

Intent

Create natural areas that provide wildlife habitat and promote biodiversity appropriate to the ecosystem.

Requirement

1. Plant with trees, shrubs, perennials, annuals and groundcovers that have one or more of the following attributes:
 - a. Northern, hardy and native to this area
 - b. Edible and/or wildlife enhancing
2. In addition to one of the above - drought tolerant
3. Permanent irrigation system to be permitted by MaineHousing on a case by case basis

Verification

1. Provide MaineHousing with a site plan demonstrating areas of paving, landscaping (with species) and building footprint.
2. Provide a list of all species to be planted
3. Construction Analyst to verify on site

Resources

University of Maine Cooperative Extension Service:

www.umext.maine.edu/onlinepubs/htmpubs/2500.htm

Maine Natural Areas Program Department of Conservation:

www.mainenaturalareas.org/index.php

Rehab/Renovation

The requirements of this standard must be followed where landscaping is included within the scope of the renovation project.

Cost Implication

No additional cost

MaineHousing Green Building Standards

SECTION 1 R2 SITE

Standard

Preserve existing trees and vegetation, except within 30' of buildings, driveways, solar access, areas cleared for food production and as required for grading for drainage requirements.

Intent

Preserve mature trees and vegetation

Requirement

- Use best practices to preserve existing trees and vegetation
1. Inventory existing healthy trees and vegetation on the site
 2. Identify trees and vegetation to be saved
 3. Identify strategies to be used:
 - a. Protective barriers (Must extend to the dripline)
 - b. Relocation
 - c. Other as approved by MaineHousing

Verification

Provide predevelopment and post development site plans highlighting trees and vegetation that were preserved and/or relocated on site.

Resources

None

Rehab/Renovation

The requirements of this standard must be followed in all rehab projects

Cost Implication

No to low additional cost

MaineHousing Green Building Standards

SECTION 1 R3 SITE

Standard

Minimize light pollution to the night sky

Intent

Eliminate light trespass from the building site to reduce the impact on nocturnal environments and the night sky.

Requirement

Design outdoor lighting to provide security without creating light pollution.

1. Do not exceed Illuminating Engineering Society of North America (IESNA) footcandle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments (IESNA RP-33-99).
2. Design interior and exterior lighting so that zero direct beam illumination leaves the project site.
3. Do not use unshielded fixtures (floodlights)

Verification

Manufacturers cut sheets
Site lighting plan

Resources

The IESNA standard is RP-33-99, IESNA Recommended Practice Manual: Lighting for Exterior Environments

IESNA
www.iesna.org
Dark Sky Association
www.darksky.org

Rehab/Renovation

The requirements of this standard must be followed where exterior lighting is included within the scope of the renovation project.

Cost Implication

No to low additional cost

MaineHousing Green Building Standards

SECTION 2 R1 BUILDING DESIGN

Standard

Implement an overall water management plan for the building envelope for prevention of indoor air quality (IAQ) problems from mold

Intent

Create durable and healthy buildings

Requirements

Exterior

Footings & Slab

1. Capillary break over footing with dampproofing, low perm or elastomeric paint
2. Foundation drain at outside perimeter edge of footing
3. Sub-grade (footing) drainage system
4. Gravel bed beneath slab minimum 4" depth, 1/2 " gravel, no fines
5. Minimum six mil polyethylene vapor diffusion retarder between slab and gravel with joints lapped at least one foot.

Surface Drainage

1. Slope final grade away from foundation wall (recommend slope of 5/8" per foot for 10 feet and patios & driveways at 1/4" per foot) not to conflict with Americans with Disabilities Act (ADA) requirements.
2. Downspouts deposit roof water at least 5' from the foundation
3. Provide a 3' graded perimeter of impermeable backfill around the foundation

Basement

1. Damp proofing or moisture barrier assembly system applied to grade
2. Use porous backfill material against foundation walls
3. Provide exterior wall insulation and/or capillary break finish system that drains water to footing drain
4. Capillary break between the foundation and framing

Windows & Doors

1. Sill wrapped with membrane for moisture protection

Roof

1. Overhangs - Minimum of 1 foot

Interior

Appliances

Drainage pans under water heaters and clothes washers when installed on or over finished floors - not required when located within unfinished basements.

MaineHousing Green Building Standards

SECTION 2 R1 BUILDING DESIGN

Verification

1. Construction plans highlighting envelope details for water management
2. Construction Analyst to verify on site

Resources

Building America:

www.eere.energy.gov/buildings/building_america/

Building Science Corporation:

www.buildingscience.com/

Housing and Urban Development (HUD) 'Durability by Design' available at:

www.huduser.org/intercept.asp?loc=/Publications/PDF/durability_by_design_part1.pdf

Rehab/Renovation

The requirements of this standard must be followed to the maximum extent possible where rehab of the building envelope and site work that would permit water management improvements are included within the scope of the renovation project.

Cost Implications

Cost implications are dependent on which and how many of these measures differ from standard practice.

MaineHousing Green Building Standards

SECTION 3 R1

ENERGY EFFICIENCY – BUILDING ENVELOPE

Standard

The building envelope must be sealed to prevent air leaks

Intent

To prevent energy loss through infiltration and cold surfaces on which water vapor can condense.

Requirements

Building can be air sealed using the polyethylene vapor barrier or the airtight drywall approach (ADA).

In addition to sealing poly or drywall:

1. Gaskets or sill seals under mud sills along foundation walls.
2. Seal first floor band joists to the adjoining mud sills and plywood decking using adhesive or caulk. Use construction adhesive or caulking between multiple sill plates.
3. Seal any band joists between upper floors to the adjoining top plates and plywood decking. Use construction adhesive or caulking between multiple top plates.
4. Seal bottom plates of exterior frame walls to the sub-floor with construction adhesive or caulking.
5. Avoid locating bathtubs and shower enclosures on exterior walls. If installed on exterior walls insulate and air seal this area BEFORE shower/tub is installed.
6. Recessed lights must be airsealed and airtight. (Recessed lights may not penetrate the building envelope - see Section 5 R2).
7. Window frames and door jambs must be sealed to their rough openings using low expansion foam, backer rod or caulk but NOT fiberglass.
8. All penetrations through the building envelope must be carefully sealed. Typical penetrations include chimney, duct & plumbing chases and penetrations of pipes and wires through the top plates of top story walls. It is particularly important to seal all possible air paths to the attic.
9. Building areas such as kneewall-floor transitions, dropped soffits, split-level transitions, tuck-under garages and cantilevers must be identified and sealed with a continuous air barrier. Where joist spans or stud bays run between a heated and unheated area all bays must be blocked and sealed at the transition.
10. Attic and crawl space access doors and hatches must be weather-stripped and insulated.
11. Electrical boxes on exterior walls and ceilings should either be airsealed or placed in airtight enclosures (Lessco box or equivalent).

MaineHousing Green Building Standards

SECTION 3 R1 ENERGY EFFICIENCY – BUILDING ENVELOPE

Requirement for Stress Skin Panel, Structural Insulated Panel (SIPs), Insulating Concrete Forms (ICFs)

1. Air seal ceiling systems, wall-ceiling and wall-floor junctions.

Verification

1. Construction plans highlighting envelope airsealing details.
2. Construction Analyst to verify on site.

Resources

For airsealing approaches and details:

Building Science Corporation:

www.buildingscience.com

Building America:

www.eere.energy.gov/buildings/building_america/

Rehab/Renovation

The requirements of this standard must be followed to the maximum extent possible where building envelope improvements are included within the scope of the renovation project.

Cost Implications

Additional labor costs and very low additional material costs. Effective training programs for project teams can reduce and contain labor costs.

MaineHousing Green Building Standards

SECTION 3 R2

ENERGY EFFICIENCY – BUILDING ENVELOPE

Standard

The thermal envelope shall be insulated in a manner that complies with either the requirements of Chapter 4 of the 2004 International Energy Conservation Code (IECC) or the requirements of state law, whichever is more stringent.

Intent

To prevent conductive energy loss and eliminate cold surfaces that can condense water vapor and create rot, mold or mildew.

Requirements

1. Maine (except Aroostook County) Climate Zone 6 requirements - see following page
2. Aroostook County Climate Zone 7 requirements - see following page.

Verification

1. Construction plans and specifications highlighting envelope insulation materials and installation details.
2. Construction Analyst to verify on site.

Resources

International Energy Conservation Code, 2004 Supplement Edition (ISBN 1-58001-230-2).

Rehab/Renovation

The requirements of this standard must be followed to the maximum extent possible where building envelope improvements are included within the scope of the renovation project.

Cost Implications

Additional cost for labor and materials to meet code requirements. (Note that by using Optimum Value Engineering (OVE) efficiency techniques & sheathing with rigid insulation it should be possible to meet code requirements with no or low additional cost.)

MaineHousing Green Building Standards – Referenced Code

SECTION 3 R2 ENERGY EFFICIENCY – BUILDING ENVELOPE

Minimum Requirements of the International Energy Conservation Code, Chapter 4, 2004 Supplemental Edition

Climate Zone 6: Maine except for Aroostook County

Climate Zone 7: Aroostook County

Climate Zone	Fenestration U-Value	Skylight U Factor	Glazed Fenestration SHGC	Ceiling R Value	Wood Frame Wall R Value (2)	Mass Wall R Value	Floor R Value	Basement Wall R Value	Slab R Value & Depth (1)	Crawl Space Wall R Value
6	0.35	0.6	NR	49	21 OR 15+5	15	30	10/13 ⁽³⁾	10, 4ft	10/13 ⁽³⁾
7	0.35	0.6	NR	49	21	19	30	10/13 ⁽³⁾	10, 4ft	10/13 ⁽³⁾

The R Values in the above table are the minimum values for the insulation materials; they are not composite, average, aged, or any other form of factored value.

Long-Term Thermal Resistance (LTTR) values are recognized in the industry as a way of evaluating insulation values over time. LTTR, when tested in accordance with recognized standards (i.e. ASTM C 1303-95) shall be used in evaluating and selecting products for MaineHousing projects.

In summary, the R values listed in the table should be considered as minimums – what could be reasonably expected in a conventionally framed simple structure with standard framing materials and standard spacing, with a reasonable glazed area included in the building envelope. Alternative designs that require additional framing or that include large amounts of glazing erode the thermal envelope performance and must include provisions to meet the minimum R values when compared to a more conventionally framed building.

¹ “Slab R Value & Depth,” the 4ft requirement is clarified as follows:

Traditionally, slabs-on-grade and frost wall foundations have been insulated either with horizontal insulation under the slab edge or vertical insulation on the inside face of the frost walls at a minimum. The “4ft” “Depth” requirement in the Table applies to either of these methods - horizontal or vertical.

Please note also that in addition to the minimum requirements contained in these *Green Building Standards*, MaineHousing has a Construction Standard for Thermal and Moisture Protection (see Construction Services’ *Design and Construction Manual*) that requires a minimum of R5 closed cell rigid insulation beneath the entire floor slab area.

MaineHousing Green Building Standards – Referenced Code

SECTION 3 R2

ENERGY EFFICIENCY – BUILDING ENVELOPE

² The Wood Frame R-Values are further clarified as follows:

Understanding that steel framing is a viable alternative to wood framing, please be advised that Table 402.2.4 of the *International Energy Conservation Code*, 2004 Supplement edition, provides for insulation equivalents to the minimum wood framing requirements for steel stud framing. Please note that due to the thermal “short circuiting” of steel studs continuous insulation over such framing is generally required as an integral part of the equivalency to the wood framing requirements.

³ The first R value applies to continuous insulation, the second to framing cavity insulation; either meets the requirements. When considering the effective R values of plastic foam insulation products, the Long-Term Thermal Resistance (LTTR) value for such products shall be considered the R value for the product.

MaineHousing Green Building Standards

SECTION 3 R3

ENERGY EFFICIENCY – BUILDING ENVELOPE

Standard

Energy efficient windows optimized for solar gain OR advanced framing techniques such as OVE, SIPS, ICF, stress skin panel and others.

Intent

To increase the efficiency of the thermal envelope

Requirements

1. Windows must be National Fenestration Rating Council (NFRC) rated AND have:
 - a. U value of less than .35
 - b. Solar Heat Gain Coefficient (SHGC) of .35 or higher
 - c. Air Leakage Rate (AL) of .30 or less
2. For advanced framing:
 - a. OVE (Optimum Value Engineering) - see below
 - b. ICF (Insulated Concrete Form) system
 - c. SIPS (Structural Insulated Panel) system
 - d. Equivalent system as approved by MaineHousing

Any one of the “advanced framing techniques” (OVE or ICF or SIPS) can be utilized to meet the standard. Further, if for example Optimum Value Framing (OVE) is proposed, it shall be utilized throughout the entire building or project and the more energy efficient windows would then not be required. If, however, Structural Insulated Panel Systems (SIPS) were proposed for a roof system only, with the wall systems designed as conventionally framed, we would expect that energy efficient windows would also be provided in order to meet the intent of the R3 requirement. Therefore, it is important that both the alternative selected be effective and that the extent of the impact be fully understood in determining compliance with the R3 requirements. Providing energy efficient windows **and** advance framing techniques provide the best energy efficiency.

Verification

1. NFRC window labels or manufacturer documentation
OR
2. Construction drawings highlighting framing details
3. Construction Analyst to verify on site

MaineHousing Green Building Standards

SECTION 3 R3

ENERGY EFFICIENCY – BUILDING ENVELOPE

Resources

www.efficientwindows.org

www.efficientwindows.org/factsheets/maine.pdf

www.energystar.gov/index.cfm?c=bop.pt_bop_maine

National Fenestration Rating Council: www.nfrc.org

Residential Windows: A Guide to New Technology and Energy Performance by John Carmody, Stephen Selkowitz, Dariush Arasteh, and Lisa Heschong, WW Norton, ISBN 0-393-73053-0

SIPS:

www.sips.org/

ICF:

www.icfhomes.com/

OVE:

www.buildingscience.com/buildingamerica/targets.htm, then “Advanced Framing” under Recommendations: Green Building Aspects

National Association of Homebuilders 'Simplified Residential Framing Guide', published by NAHBResearchCenter

www.nahbrc.org

Report is Summarized at:

www.nahbrc.org/searchR.asp?selcategory=0&Action=Find&CategoryID=0&TrackID=&Type=&qu=ove&x=29&y=8

Notes

Optimum Value Engineering (OVE) includes but is not limited to:

1. 2x6 @ 24" o.c.
2. Align windows and other openings with framing layout
3. Use of box headers designed for loading conditions
4. Eliminate unnecessary studs such as at corners and T-walls
5. Use drywall clips or an acceptable alternative to eliminate drywall backer studs and ceiling blocking
6. Corner bracing for racking support

Rehab/Renovation

The requirements of this standard must be followed to the maximum extent possible where building envelope improvements are included within the scope of the renovation project.

Cost Implications

Possible additional costs (range low to high) for all recommended thermal improvement strategies except for OVE - OVE should realize both cost savings and thermal efficiency improvement.

MaineHousing Green Building Standards

SECTION 3 R4

ENERGY EFFICIENCY – BUILDING ENVELOPE

Standard

Spaces between trusses or rafters shall have blocking at the soffit to prevent 'windwashing' of the attic insulation*

Intent

To help prevent ice dams and cold interior 'condensing' surfaces

Requirements

*Note that this requirement applies to vented roofs that are insulated with fiberglass, cellulose or other products that do not stop air flow and not to systems that utilize stress skin panels, rigid insulation, SIPS etc.

Block space between trusses or rafters at soffit with durable material sealed in place to prevent the flow of air through or under ceiling insulation.

Verification

1. Construction plans highlighting truss/rafter blocking details
2. Construction Analyst to verify on site

Resources

None

Rehab/Renovation

The requirements of this standard must be followed to the maximum extent possible where building envelope improvements are included within the scope of the renovation project.

Cost Implications

Low additional cost

MaineHousing Green Building Standards

SECTION 3 R5

ENERGY EFFICIENCY – BUILDING ENVELOPE

Standard

No pipes or ducts in outside walls

Intent

Minimize heat loss from ducts and pipes and prevent water damage from frozen pipes

Requirements

No pipes or ducts in outside walls

Verification

1. Construction documents highlighting duct and pipe runs
2. Construction Analyst to verify on site

Resources

None

Rehab/Renovation

The requirements of this standard must be followed to the maximum extent possible where plumbing and/or mechanical and building envelope improvements are included within the scope of the renovation project.

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 4 R1

ENERGY EFFICIENCY – SYSTEMS & APPLIANCES

Standard

Energy Star labeled systems and appliances

Intent

Energy Star systems and appliances are the most fuel efficient and save resources, energy and money.

Requirements

1. Energy Star rated furnaces, boilers utilizing sealed combustion
2. Energy Star refrigerators for all units
3. Energy Star clotheswashers for on-site laundry facilities
4. Where installed - Energy Star dishwashers, freezers
5. Where installed - Energy Star rated heat pumps

Verification

1. Submittals for systems and appliances highlighting Energy Star rating
2. Construction Analyst to verify installation

Resources

Consortium for Energy Efficiency:
www.cee1.org/
Energy Star:
www.energystar.gov/index.cfm?c=home.index

Rehab/Renovation

The requirements of this standard must be followed where building systems and appliance improvements are included within the scope of the renovation project.

Cost Implications

Low cost - Energy Star appliances are currently often specified.

MaineHousing Green Building Standards

SECTION 4 R2

ENERGY EFFICIENCY – SYSTEMS & APPLIANCES

Standard

Bathroom exhaust fans shall meet the requirements of ASHRAE 62.2 - 2003 Ventilation & Acceptable Indoor Air Quality in Low-Rise Residential Buildings.

Intent

To provide systems adequate for spot ventilation that could also provide background whole house ventilation if needed.

Requirements

Fan CFM rating and sone level to be sized according to ASHRAE 62.2 2003 Guidelines regarding the number of bedrooms in the unit and whether or not fans run continuously or intermittently.

Verification

1. Contractor submittals
2. Construction Analyst to verify on site

Resources

1. Standard of quality is Panasonic Whisperfit series
2. **Home Ventilating Institute:**
www.hvi.org/
3. **Maine PUC:**
www.state.me.us/mpuc/doing_business/rules/part9.htm

Notes

Timer controls (such as Airtrak or equivalent) can be installed to cycle the air on a set schedule in order to provide supplemental ventilation and improve air quality - this is an option and is not required by MaineHousing.

Airtrak Controller, Tamarack Technologies: www.tamtech.com

Rehab/Renovation

The requirements of this standard must be followed in all rehab projects.

Cost Implications

Low cost

MaineHousing Green Building Standards

SECTION 4 R3

ENERGY EFFICIENCY – SYSTEMS & APPLIANCES

Standard

Water Efficiency: Low flow faucets and showerheads

Intent

Save money and protect potable water resources

Requirements

1. Faucets: Flow rate of no more than 1 gallon per minute (GPM)
2. Showerheads: Flow rate of no more than 2 gallons per minute (GPM)

Verification

1. Submittals and cut sheets for plumbing fixtures
2. Construction Analyst to verify installation

Resources

H2ouse.org:
www.h2ouse.org/

Rehab/Renovation

The requirements of this standard must be followed where plumbing fixture improvements are included within the scope of the renovation project.

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 4 R4 ENERGY EFFICIENCY – SYSTEMS & APPLIANCES

Standard

Water Efficiency: Low flow toilets and urinals

Intent

Save money and protect potable water resources

Requirements

1. Toilets: Rated at 1.6 gallons per flush (GPF) or less OR dual flush
2. Urinals: Rated at 1.0 GPF or waterless

Verification

1. Submittals and cut sheets for plumbing fixtures
2. Construction Analyst to verify installation

Resources

H2ouse.org:
www.h2ouse.org/

Rehab/Renovation

The requirements of this standard must be followed where toilet and urinal replacements are included within the scope of the renovation project.

Cost Implications

Additional cost for dual flush (though prices are dropping) 1.6 GPF toilets are standard.

MaineHousing Green Building Standards

SECTION 4 R5

ENERGY EFFICIENCY – SYSTEMS & APPLIANCES

Standard

Seal ductwork with duct mastic to prevent air leakage

Intent

Optimize performance and prevent air leakage from ductwork

Requirements

Seal duct connections with water based* duct mastic.

Areas that must be sealed include:

1. Swivel elbows
2. Branch take-offs from trunk ducts
3. Finger jointed connections
4. Folded corners of boots & fittings
5. Filter racks & plenum connections

Verification

1. Provide appropriate language in project specifications
2. Construction Analyst to verify installation

Resources

None

Notes

* Water based duct mastic has low VOC content

Rehab/Renovation

The requirements of this standard must be followed in all rehab projects

Cost Implications

Very low additional labor and material costs

MaineHousing Green Building Standards

SECTION 5 R1 ENERGY EFFICIENCY – INTERIOR LIGHTING FIXTURES

Standard

Lamps and fixtures shall be Energy Star rated

Intent

Optimize the energy efficiency of indoor lighting

Requirements

Specify and install fixtures and lamps that are Energy Star rated

Verification

Contractors submittals highlighting Energy Star rating

Resources

Energy Star:
www.energystar.gov/index.cfm?c=home.index
Efficiency Maine:
www.energymaine.com/

Rehab/Renovation

The requirements of this standard must be followed where interior lighting fixture replacements are included within the scope of the renovation project.

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 5 R2

ENERGY EFFICIENCY – INTERIOR LIGHTING FIXTURES

Standard

No recessed light fixtures shall be installed in roof/ceiling assemblies

Intent

To maintain the thermal integrity of the building envelope

Requirements

No recessed light fixtures shall be installed in roof / ceiling assemblies or in any ceiling that would interrupt the integrity of the building envelope.

Verification

Construction Analyst to verify on site

Resources

None

Rehab/Renovation

The requirements of this standard must be followed by all rehab projects.

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 5 R3

ENERGY EFFICIENCY – INTERIOR LIGHTING FIXTURES

Standard

All emergency exit signs shall be LED

Intent

To save energy and replacement costs

Requirements

All emergency exit signs shall be LED (Light Emitting Diodes)

Verification

1. Contractor submittals
2. Construction Analyst to verify on site

Resources

None

Rehab/Renovation

The requirements of this standard must be followed by all rehab projects.

Cost Implications

Low or no additional cost

MaineHousing Green Building Standards

SECTION 5 R4

ENERGY EFFICIENCY – INTERIOR LIGHTING FIXTURES

Standard

Research, specify, and provide as appropriate, automatic lighting controls to minimize energy use in unoccupied or infrequently occupied spaces within project buildings.

Intent

To save energy by turning off or reducing unnecessary lighting.

Requirements

Provide automatic on/off lighting controls activated by occupant load and/or natural light sensors or other “smart” control systems for lights or groups of lights in common areas such as stairways, corridors, community rooms, public toilet facilities, offices, laundries, etc. while still maintaining minimum lighting levels, particularly in egress routes, as required by applicable codes.

Verification

1. Design specifications and/or drawings that clearly indicate functional intent consistent with this standard provided by designer of record.
2. Commissioning Agent will review and verify that opportunities have been explored to the maximum extent feasible, consistent with the goals and objectives of this standard.
3. Installation and proper operation by Construction Analyst.

Resources

Green Building Products 2nd Edition, Edited by Wilson, Piep Korn, Maling, Battisto, New Society Publishers.

Rehab/Renovation

The requirements of this standard must be followed where building lighting systems improvements are included within the renovation project scope.

Cost Implications

Minor added costs for additional sensor/switches/controls/wiring with very likely considerable energy costs savings over the life of the project.

MaineHousing Green Building Standards

SECTION 6 R1 INSPECTION/COMMISSIONING

Standard

Commissioning required for projects of five units or more with central mechanical systems

Intent

To verify that systems are operating as designed and specified

Requirements

The Owner shall retain a qualified third party to:

1. Review the mechanical systems design and equipment selections during the design phases with regard to their compatibility with the overall building design, energy conservation, systems function, and code compliance; and
2. provide quality assurance and test monitoring during construction to help assure that the design intent is met.
3. Augment and advise the project team.
4. Commissioning and commissioning report is required for:
 - a. Boilers & Controls
 - b. Air-conditioning Systems & Controls
 - c. Ventilation Systems & Controls

Verification

Periodic reports documenting the review and recommendations relative to the systems design as the project design evolves from the concept stage through to the completion of the construction documents. During construction, periodic field reports of physical inspections of the project at various stages of completion should be provided. Reviews and comments of the system's shop drawings process, systems test monitoring, test results, and a concluding document shall be provided stating that, in the opinion of the Commissioning Agent, the building systems have or have not been designed and/or installed properly.

In summary, the specifics related to commissioning of MaineHousing's projects will likely evolve over time. It is hoped that the mechanical engineering community can assist in the evolution of this process and ongoing comments and suggestions are welcomed.

Resources

None

Rehab/Renovation

The requirements of this standard must be followed where central mechanical system replacements in projects of five or more units are included within the scope of the renovation project.

Cost Implications

Additional costs contingent upon size and complexity of central mechanical systems.

MaineHousing Green Building Standards

SECTION 6 R2 INSPECTION/COMMISSIONING

Standard

For each project, a representative number of units, as determined by MaineHousing, must be "Blower Door" tested to verify effectiveness of air sealing.

Intent

Verify that the building meets MaineHousing requirements for effective air sealing to prevent heat loss and creation of cold surfaces that can cause condensation and mold growth.

Requirement

1. Blower Door test conducted with calibrated equipment operated by a trained and qualified technician to be performed before the drywall is installed if polyethylene is the air barrier & after installation if airtight drywall approach (ADA).
2. Maximum building envelope leakage is to not exceed 0.25 cubic feet per minute per square foot at 50 pascals negative pressure (0.25 CFM/SF @ 50 PA).

The SF (Square Foot) reference in the standard is the total building envelope square footage area measured using the inside surface dimensions. The intent is to analyze the effectiveness of the air sealing.

Example: A building that is 8' tall (single story) and has dimensions that is 24' by 24' would have an envelope SF of:

$$\begin{array}{r} \text{walls: } 4 \text{ walls } 8' \times 24' = 384 \\ \text{floor: } 24 \times 24 = 576 \\ \text{roof: } 24 \times 24 = \underline{576} \\ \hline 1,536 \text{ SF of Envelope} \end{array}$$

3. Air sealing individual units may have no real bearing on building envelope heat loss if the building shell is leaky. Therefore, MaineHousing requires building shell air sealing from design through to construction completion.

A blower door very precisely measures the amount of "hole" in a single continuous surface – imagine the six sides of a large closed cardboard box. A blower door test then tells you how much air will move through the total surface area under any given pressure. If you place several smaller closed boxes inside the larger one and then try to test the individual boxes, you will get a number for each but it is relatively meaningless because the blower door can't – without multiple doors &/or a lot of complicated "sub-tests," isolate the small box surface leakage from the surrounding big box surface leakage.

MaineHousing Green Building Standards

SECTION 6 R2 INSPECTION/COMMISSIONING

Generally speaking, testing individual units in a large building will reveal the air leaks – you can feel the air coming in – but if you can't see the path, it won't tell you if the air is coming from the outside, from the basement &/or attic or from another unit. We care because exterior air has to be heated while basement/attic or adjoining unit air may be contaminated with something.

Another issue in large buildings is shell leakage. It is quite possible for the units to have very little leakage while the shell leaks considerably. Blower door testing of individual units – without some detective work – likely won't define shell leakage. We care because the heating system is sized by exterior wall & ceiling surface. If the shell is leaky, all the interior walls are “washed” in exterior air, making them radiate heat at the same rate as the exterior walls and this vastly increases the building heat load.

It is highly unlikely that units constructed within a MaineHousing project will expect to accomplish “air sealing” utilizing only polyethylene. It is more likely that through the diligent use of caulking at wall plates and door and window installations; attention to tightly sealing any and all penetrations in framing members, including top and bottom plates of walls; and assuring a continuous and tight drywall installation, including air sealing above ceilings, in party walls, in and around cabinetry; that blower door testing will most effectively be conducted after the completion of the drywall work. As to “verification” the intent is to test and investigate how effective the air sealing measures have been executed by performing blower door testing. Such “verification” is not intended to be quantitative – it is meant to be more qualitative, i.e., by looking for and identifying “leaks” in the air seal utilizing equipment (infrared camera), visual, and/or other “telltale” (smoke, powder) methods. It is further important to understand that once leaks are identified, they must be corrected. This may prove to be difficult or impossible based on the type of construction.

Verification

1. Blower Door test report(s) completed by a trained and qualified technician
2. Verify that any unwanted leakage areas identified by the test are sealed after the test
3. Verify that test results demonstrate that the building meets the envelope leakage requirements of the International Energy Conservation Code (IECC) 2004 Supplement

Resources

The Energy Conservatory:

www.energyconservatory.com/

Infiltec:

www.infiltec.com/inf-bd.htm

Home Energy Magazine:

www.homeenergy.org/archive/hem.dis.anl.gov/eehem/94/940110.html

MaineHousing Green Building Standards

SECTION 6 R2 INSPECTION/COMMISSIONING

Rehab/Renovation

The requirements of this standard must be followed where envelope air sealing is included within the scope of the renovation project.

Cost Implications

Blower Door tests cost \$150 - \$200 / unit tested

MaineHousing Green Building Standards

SECTION 6 R3 INSPECTION/COMMISSIONING

Standard

A representative sampling of ducted air distribution systems, as determined by MaineHousing, must be tested to verify effectiveness of duct sealing.

Intent

Verify that the ductwork meets MaineHousing requirements for effective air sealing to optimize performance and prevent heat loss.

Requirement

Duct test conducted with calibrated equipment conducted by a trained and qualified technician.

Verification

Duct tightness test report(s) completed by a trained and qualified technician.
Verify that the leakage areas identified by the test are sealed after the test.

Resources

The Energy Conservatory:

www.energyconservatory.com/

Home Energy Magazine:

www.homeenergy.org/archive/hem.dis.anl.gov/eehem/99/991114.html

Testing Methodology:

www.epb.lbl.gov/publications/lbnl-47308.pdf

Rehab/Renovation

The requirements of this standard must be followed where ducted distribution systems are included in the project.

Cost Implications

Low additional cost

MaineHousing Green Building Standards

SECTION 7 R1

INDOOR ENVIRONMENTAL QUALITY

Standard

Position and size operable windows and glazing systems to take advantage of natural ventilation, cooling and daylighting.

Intent

Optimize daylighting and passive ventilation opportunities

Requirement

1. Operable windows to the east and west to take advantage of summer ventilation
2. Shading to reduce overheating

Verification

Review of 50% building plans

Resources

None

Rehab/Renovation

The requirements of this standard must be followed to the extent possible where window & glazing system replacements are included within the scope of the renovation project.

Cost Implications

No to low additional cost

MaineHousing Green Building Standards

SECTION 7 R2 INDOOR ENVIRONMENTAL QUALITY

Standard

Use low VOC paint

Intent

Protect installers and occupants from irritating and/or harmful indoor air contaminants

Requirement

Volatile Organic Compound (VOC) emissions from paints & coatings must not exceed the VOC limits of Green Seal's standard GS-11 requirements.

1. Non-flat: 150 g/L
2. Flat: 50 g/L

Verification

Manufacturers cut sheets and submittals

Resources

Sustainable ABC:

www.sustainableabc.com/m_p_f_a.html

Zero VOC Paint Guide:

www.aqmd.gov/prdas/brochures/paintguide.html

Green Seal:

www.greenseal.org (Charge for publication)

Sourcebook for Green & Sustainable Building:

www.greenbuilder.com/sourcebook/FinishesAdhesives.html

Rehab/Renovation

The requirements of this standard must be followed where interior painting is included within the scope of the renovation project.

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 7 R3

INDOOR ENVIRONMENTAL QUALITY

Standard

Use low VOC adhesives & sealants

Intent

Protect installers and occupants from irritating and/or harmful indoor air contaminants

Requirement

Volatile Organic Compound (VOC) emissions from adhesives and sealants must not exceed VOC limits of South Coast Air Quality Management District Rule #1168 AND sealants used as fillers must meet the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51
(Attach tables)

Verification

Manufacturers cut sheets and submittals

Resources

South Coast Air Quality Management District:
www.aqmd.gov/rules/html/r1168.html
Bay Area Air Quality Management District:
www.baaqmd.gov

MaineHousing Green Building Standards

SECTION 7 R3 INDOOR ENVIRONMENTAL QUALITY

SUMMARY OF REFERENCED STANDARDS

South Coast Rule #1168 by the South Coast Air Quality Management District
(www.aqmd.gov/rules/html/r1168.html)

Limits on VOCs in grams per liter for adhesives and sealants used on interior of building are as follows:

	VOC Limit (g/L)
Welding and Installation	
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesive	150
Wood Flooring Adhesive	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single Ply Roof Membrane Adhesives	250
PVC Welding	510
CPVC Welding	490
ABS Welding	400
Plastic Cement Welding	350
Adhesive Primer for Plastic	650
Contact Adhesive	250
Special Purpose Contact Adhesive	250
Substrates	
Metal to metal	30
Plastic foams	50
Porous material except wood	50
Wood	30
Fiberglass	80

MaineHousing Green Building Standards

SECTION 7 R3 INDOOR ENVIRONMENTAL QUALITY

Limits on VOCs in grams per liter for sealants and sealant primers per South Coast Rule #1168 by the South Coast Air Quality Management District:

	VOC Limit (g/L)
Sealants	
Architectural	250
Other	420
Sealant Primers	
Architectural – nonporous	250
Architectural – porous	775
Other	750

Limits on VOCs in grams per liter for Sealants used as Fillers per Bay Area Air Quality Management District, Reg. 8 Rule 51

	VOC Limit (g/L)
Sealants	
Architectural	250
Other	420
Sealant Primers	
Architectural- Nonpourous	250
Architectural- Pourous	775
Other	750

Rehab/Renovation

The requirements of this standard must be followed where adhesives and sealants are included within the scope of the renovation project.

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 7 R4 INDOOR ENVIRONMENTAL QUALITY

Standard

If carpet is installed it must meet CRI low emission label standard

Intent

Protect installers and occupants from irritating and/or harmful indoor air contaminants

Requirement

Carpet systems must meet or exceed Carpet & Rug Institute (CRI) Green Label Indoor Air Quality Test Program.

Verification

Manufacturers cut sheets & submittals verifying that carpet systems meet CRI Air Quality test requirements.

Resources

Carpet & Rug Institute:
www.carpet-rug.com

Limits on VOCs in grams per liter for carpets, cushion, and adhesives per the Carpet and Rug Institute Green Label Testing Program:

	Emission factor limit (mg/m ² /hr)
Carpets	
Total VOCs	0.5
4 - Phenylcyclohexane	0.05
Formaldehyde	0.05
Styrene	0.4
Cushion	
Total VOCs	1
4 - Phenylcyclohexane	0.3
Formaldehyde	0.05
Styrene	0.05
Adhesives	
Total VOCs	10
Formaldehyde	0.05
2 - Ethyl - 1 - Hexanol	3

MaineHousing Green Building Standards

SECTION 7 R4

INDOOR ENVIRONMENTAL QUALITY

Rehab/Renovation

The requirements of this standard must be followed where carpet installation is included within the scope of the renovation project.

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 7 R5 INDOOR ENVIRONMENTAL QUALITY

Standard

No carpet in kitchens, bathrooms or within 3' of entry doors

Intent

Prevent the growth of mold and mildew in carpet systems

Requirement

Do not install carpet in kitchens, bathrooms or within 3 feet of entry doors

Verification

1. Construction drawings highlighting carpet system installation requirements
2. Construction Analyst to verify on site

Resources

None

Rehab/Renovation

The requirements of this standard must be followed in all rehab projects

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 8 R1 MATERIALS

Standard

Use framing and finish lumber harvested from sustainably managed forests OR local / regional materials OR durable materials.

Intent

Preserve resources by using certified, regional or durable products

Requirement

Choose one of the following:

1. Use framing and finish lumber milled from logs harvested from sustainably managed forests - credit requires that 25% of wood products (as measured by dollar value) used in the project come from "certified forests".
2. Local / regional materials that are manufactured / harvested / extracted within a 300 mile radius of the project - credit requires 20% of building materials (measured by dollar value)
3. For durable materials - use at least 2 of the following products:
 - Fiber cement siding
 - Composite decking with high recycled content
 - Natural linoleum flooring
 - Ceramic tile bathroom or kitchen flooring
 - Roofing with a warranty of at least 40 years
 - Insulated glass with a warranty of at least 20 years
 - Siding with a warranty of at least 40 years
 - Wood, cork or bamboo flooring

Verification

For certified wood - verify with:

The contractor must verify sustainable forest management through a letter from the sawmill to the lumber yard that declares the percentage of sawlogs harvested from certified forestland that were used in manufacturing lumber sold to the contractor. Certification of the forestland may be by the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), American Tree Farm System (ATFS), Certified Master Logger Program (MLP), or some other established standard, as approved by the state of Maine Department of Conservation, as such standards evolve over time.

For local/regional materials:

Declaration from product vendor or manufacturer stating where product is manufactured

For durable materials:

Manufacturers product information and warranties

MaineHousing Green Building Standards

SECTION 8 R1 MATERIALS

Resources

Maine Department of Conservation:

www.maine.gov-images.informe.org/doc/mfs/fpm/for_cert/forest_cert_brochure.pdf

Rehab/Renovation

The requirements of this standard must be followed to the extent possible where framing or finish material replacement is included within the scope of the renovation project.

Cost Implications

Additional costs, if any, for verification should be very low. FSC certified wood and most durable products will have higher first costs.

MaineHousing Green Building Standards

SECTION 9 R1 RESOURCE EFFICIENCY

Standard

Provide space for recycling containers at convenient location(s) for storage of recyclables

Intent

Encourage building occupants to recycle

Requirement

Provide recycling area /containers for each unit or building

Verification

Verify recycling location on plans

Resources

None

Rehab/Renovation

The requirements of this standard must be met by all rehab projects

Cost Implications

Cost for additional Square Footage required for recycling area

MaineHousing Green Building Standards

SECTION 9 R2 RESOURCE EFFICIENCY

Standard

Non-mercury thermostats

Intent

Prevent the release of mercury into the environment

Requirement

All thermostats must be non-mercury thermostats

Verification

1. Contractor submittals
2. Construction Analyst to verify on site

Resources

Maine Department of Environmental Protection:
www.maine.gov/dep/mercury/

Rehab/Renovation

The requirements of this standard must be followed where thermostat replacements are included within the scope of the renovation project.

Cost Implications

No additional cost

MaineHousing Green Building Standards

SECTION 10 R1 POST OCCUPANCY

Standard

Provide tenants and facility managers with educational materials about green design, building operations, recycling and building maintenance.

Intent

To maintain the 'green' goals of the project after occupancy by educating and involving occupants in the site and building operations and maintenance procedures.

Requirement

1. Introductory presentation to prospective tenants describing design, operations, recycling, site and building maintenance goals
2. Brochure or handout materials containing background information, resources.

Verification

Provide MaineHousing with copies of educational materials

Resources

None

Rehab/Renovation

The requirements of this standard are to educate tenants about all relevant green design and construction measures included within the scope of the renovation project.

Cost Implications

Additional cost to purchase or produce, print and distribute educational materials.

MaineHousing Green Building Standards

SECTION 11 R1 CONSTRUCTION PRACTICES

Standard

Research, specify, and require as appropriate, construction waste and/or debris recycling.

Intent

To minimize impacts to landfills and maximize the recycling of reuseable materials where reuse/recycling facilities are reasonably accessible to the project site.

Requirement

Provide a written construction materials recycling/waste management work plan, provide on-site containers specific to the items targeted in the plan, monitor and document results of the efforts taken, and report all quantifiable results.

Verification

1. Develop and document a construction materials recycling/waste management work plan.
2. Construction Analyst to verify efforts and operations and track any quantifiable results.
3. To determine if recycling facilities are reasonably accessible, an analysis of costs vs. benefits shall be prepared and presented, indicating whether or not this standard can be met.

Resources

Maine Housing and Building Materials Exchange, Gray, Maine
www.mainebme.org

Maine Materials Exchange, Freeport, Maine
www.m2x.com

Commercial Paving and Recycling, Scarborough, Maine
www.cpcrs.com

KTI Biofuels, Lewiston, Maine
www.casella.com

Institutional Recycling Network, Inc., Concord, NH
www.ir-network.com
www.wastemiser.com

Rehab/Renovation

The requirements of this standard must be followed where scheduled building improvements will generate construction wastes and/or debris as part of the renovation project.

Cost Implications

No anticipated added costs – potentially cost benefits to the contractor and the overall construction budget.

