PROJECT MANUAL FOR:

Mercy Hospital
ED Renovations

Portland, Maine

Project No. 03089

DATED: June 7, 2004

Issued for Construction

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AIA Document A121/CMc and AGC Document 565

Standard Form of Agreement Between Owner and Construction Manager

where the Construction Manager is also

THE CONSTRUCTOR

1991 EDITION

THIS DOCUMENT HAS IMPORTANT LEGAL CONSEQUENCES; CONSULTATION WITH AN ATTORNEY IS ENCOURAGED WITH RESPECT TO ITS COMPLETION OR MODIFICATION.

The 1987 Edition of AIA Document A201, General Conditions of the Contract for Construction, is referred to herein. This Agreement requires modification if other general conditions are utilized.

AGREEMENT

made as of the day of in the year of
(In words, indicate day, month and year)

BETWEEN the Owner:
(Name and address)

and the Construction Manager:
(Name and address)

The Project is:
(Name, address and brief description)

The Architect is:
(Name and address)

The Owner and Construction Manager agree as set forth below.

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STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONSTRUCTION MANAGER WHERE THE CONSTRUCTION MANAGER IS ALSO THE CONSTRUCTOR

ARTICLE 1

GENERAL PROVISIONS

1.1 RELATIONSHIP OF PARTIES

The Construction Manager accepts the relationship of trust and confidence established with the Owner by this Agreement, and covenants with the Owner to furnish the Construction Manager's reasonable skill and judgment and to cooperate with the Architect in furthering the interests of the Owner. The Construction Manager shall furnish construction administration and management services and use the Construction Manager's best efforts to perform the Project in an expeditious and economical manner consistent with the interests of the Owner. The Owner shall endeavor to promote harmony and cooperation among the Owner, Architect, Construction Manager and other persons or entities employed by the Owner for the Project.

1.2 GENERAL CONDITIONS

For the Construction Phase, the General Conditions of the Contract shall be the 1987 Edition of AIA Document A201, General Conditions of the Contract for Construction, which is incorporated herein by reference. For the Preconstruction Phase, or in the event that the Preconstruction and Construction Phases proceed concurrently, AIA Document A201 shall apply to the Preconstruction Phase only as specifically provided in this Agreement. The term "Contractor" as used in AIA Document A201 shall mean the Construction Manager.

ARTICLE 2

CONSTRUCTION MANAGER'S RESPONSIBILITIES

The Construction Manager shall perform the services described in this Article. The services to be provided under Paragraphs 2.1 and 2.2 constitute the Preconstruction Phase services. If the Owner and Construction Manager agree, after consultation with the Architect, the Construction Phase may commence before the Preconstruction Phase is completed, in which case both phases shall proceed concurrently.

2.1 PRECONSTRUCTION PHASE

2.1.1 PRELIMINARY EVALUATION

The Construction Manager shall provide a preliminary evaluation of the Owner's program and Project budget requirements, each in terms of the other.

2.1.2 CONSULTATION

The Construction Manager with the Architect shall jointly schedule and attend regular meetings with the Owner and Architect. The Construction Manager shall consult with the Owner and Architect regarding site use and improvements, and the selection of materials, building systems and equipment. The Construction Manager shall provide recommendations on construction feasibility; actions designed to minimize adverse effects of labor or material shortages; time requirements for procurement, installation and construction completion; and factors related to construction cost including estimates of alternative designs or materials, preliminary budgets and possible economies.

2.1.3 PRELIMINARY PROJECT SCHEDULE

When Project requirements described in Subparagraph 3.1.1 have been sufficiently identified, the Construction Manager shall prepare, and periodically update, a preliminary Project schedule for the Architect's review and the Owner's approval. The Construction Manager shall obtain the Architect's approval of the portion of the preliminary Project schedule relating to the performance of the Architect's services. The Construction Manager shall coordinate and integrate the preliminary Project schedule with the services and activities of the Owner, Architect and Construction Manager. As design proceeds, the preliminary Project schedule shall be updated to indicate proposed activity sequences and durations, milestone dates for receipt and approval of pertinent information, submittal of a Guaranteed Maximum Price proposal, preparation and processing of shop drawings and samples, delivery of materials or equipment requiring long-lead time procurement, Owner's occupancy requirements showing portions of the Project having occupancy priority, and proposed date of Substantial Completion. If preliminary Project schedule updates indicate that previously approved schedules may not be met, the Construction Manager shall make appropriate recommendations to the Owner and Architect.

2.1.4 PHASED CONSTRUCTION

The Construction Manager shall make recommendations to the Owner and Architect regarding the phased issuance of Drawings and Specifications to facilitate phased construction of the Work, if such phased construction is appropriate for the Project, taking into consideration such factors as economies, time of performance, availability of labor and materials, and provisions for temporary facilities.

2.1.5 PRELIMINARY COST ESTIMATES

2.1.5.1 When the Owner has sufficiently identified the Project requirements and the Architect has prepared other basic design criteria, the Construction Manager shall prepare, for the review of the Architect and approval of the Owner, a preliminary cost estimate utilizing area, volume or similar conceptual estimating techniques.

2.1.5.2 When Schematic Design Documents have been prepared by the Architect and approved by the Owner, the Construction Manager shall prepare for the review of the Architect and approval of the Owner, a more detailed estimate with supporting data. During the preparation of the Design Development Documents, the Construction Manager shall update and refine this estimate at appropriate intervals agreed to by the Owner, Architect and Construction Manager.

2.1.5.3 When Design Development Documents have been prepared by the Architect and approved by the Owner, the

Construction Manager shall prepare a detailed estimate with supporting data for review by the Architect and approval by the Owner. During the preparation of the Construction Documents, the Construction Manager shall update and refine this estimate at appropriate intervals agreed to by the Owner, Architect and Construction Manager.

2.1.5.4 If any estimate submitted to the Owner exceeds previously approved estimates or the Owner's budget, the Construction Manager shall make appropriate recommendations to the Owner and Architect.

2.1.6 SUBCONTRACTORS AND SUPPLIERS

The Construction Manager shall seek to develop subcontractor interest in the Project and shall furnish to the Owner and Architect for their information a list of possible subcontractors, including suppliers who are to furnish materials or equipment fabricated to a special design, from whom proposals will be requested for each principal portion of the Work. The Architect will promptly reply in writing to the Construction Manager if the Architect or Owner know of any objection to such subcontractor or supplier. The receipt of such list shall not require the Owner or Architect to investigate the qualifications of proposed subcontractors or suppliers, nor shall it waive the right of the Owner or Architect later to object to or reject any proposed subcontractor or supplier.

2.1.7 LONG-LEAD TIME ITEMS

The Construction Manager shall recommend to the Owner and Architect a schedule for procurement of long-lead time items which will constitute part of the Work as required to meet the Project schedule. If such long-lead time items are procured by the Owner, they shall be procured on terms and conditions acceptable to the Construction Manager. Upon the Owner's acceptance of the Construction Manager's Guaranteed Maximum Price proposal, all contracts for such items shall be assigned by the Owner to the Construction Manager, who shall accept responsibility for such items as if procured by the Construction Manager. The Construction Manager shall expedite the delivery of long-lead time items.

2.1.8 EXTENT OF RESPONSIBILITY

The Construction Manager does not warrant or guarantee estimates and schedules except as may be included as part of the Guaranteed Maximum Price. The recommendations and advice of the Construction Manager concerning design alternatives shall be subject to the review and approval of the Owner and the Owner's professional consultants. It is not the Construction Manager's responsibility to ascertain that the Drawings and Specifications are in accordance with applicable laws, statutes, ordinances, building codes, rules and regulations. However, if the Construction Manager recognizes that portions of the Drawings and Specifications are at variance therewith, the Construction Manager shall promptly notify the Architect and Owner in writing.

2.1.9 EQUAL EMPLOYMENT OPPORTUNITY AND AFFIRMATIVE ACTION

The Construction Manager shall comply with applicable laws, regulations and special requirements of the Contract Documents regarding equal employment opportunity and affirmative action programs.

2.2 GUARANTEED MAXIMUM PRICE PROPOSAL AND CONTRACT TIME

2.2.1 When the Drawings and Specifications are sufficiently complete, the Construction Manager shall propose a Guaranteed Maximum Price, which shall be the sum of the estimated Cost of the Work and the Construction Manager's Fee.

2.2.2 As the Drawings and Specifications may not be finished at the time the Guaranteed Maximum Price proposal is prepared, the Construction Manager shall provide in the Guaranteed Maximum Price for further development of the Drawings and Specifications by the Architect that is consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include such things as changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated by Change Order.

2.2.3 The estimated Cost of the Work shall include the Construction Manager's contingency, a sum established by the Construction Manager for the Construction Manager's exclusive use to cover costs arising under Subparagraph 2.2.2 and other costs which are properly reimbursable as Cost of the Work but not the basis for a Change Order.

2.2.4 BASIS OF GUARANTEED MAXIMUM PRICE

The Construction Manager shall include with the Guaranteed Maximum Price proposal a written statement of its basis, which shall include:

- **.1** A list of the Drawings and Specifications, including all addenda thereto and the Conditions of the Contract, which were used in preparation of the Guaranteed Maximum Price proposal.
- **.2** A list of allowances and a statement of their basis.
- **.3** A list of the clarifications and assumptions made by the Construction Manager in the preparation of the Guaranteed Maximum Price proposal to supplement the information contained in the Drawings and Specifications.
- **.4** The proposed Guaranteed Maximum Price, including a statement of the estimated cost organized by trade categories, allowances, contingency, and other items and the fee that comprise the Guaranteed Maximum Price.
- **.5** The Date of Substantial Completion upon which the proposed Guaranteed Maximum Price is based, and a schedule of the Construction Documents issuance dates upon which the date of Substantial Completion is based.

2.2.5 The Construction Manager shall meet with the Owner and Architect to review the Guaranteed Maximum Price proposal and the written statement of its basis. In the event that the Owner or Architect discovers any inconsistencies or inaccuracies in the information presented, they shall promptly notify the Construction Manager, who shall make appropriate adjustments to the Guaranteed Maximum Price proposal, its basis or both.

2.2.6 Unless the Owner accepts the Guaranteed Maximum Price proposal in writing on or before the date specified in the proposal for such acceptance and so notifies the Construction Manager, the Guaranteed Maximum Price proposal shall not be effective without written acceptance by the Construction Manager.

2.2.7 Prior to the Owner's acceptance of the Construction Manager's Guaranteed Maximum Price proposal and issuance of a Notice to Proceed, the Construction Manager shall not incur any cost to be reimbursed as part of the Cost of the Work, except as the Owner may specifically authorize in writing.

2.2.8 Upon acceptance by the Owner of the Guaranteed Maximum Price proposal, the Guaranteed Maximum Price and its basis shall be set forth in Amendment No. 1. The Guaranteed Maximum Price shall be subject to additions and deductions by a change in the Work as provided in the Contract Documents and the date of Substantial Completion shall be subject to adjustment as provided in the Contract Documents.

2.2.9 The Owner shall authorize and cause the Architect to revise the Drawings and Specifications to the extent necessary to reflect the agreed-upon assumptions and clarifications contained in Amendment No. 1. Such revised Drawings and Specifications shall be furnished to the Construction Manager in accordance with schedules agreed to by the Owner, Architect and Construction Manager. The Construction Manager shall promptly notify the Architect and Owner if such revised Drawings and Specifications are inconsistent with the agreed-upon assumptions and clarifications.

2.2.10 The Guaranteed Maximum Price shall include in the Cost of the Work only those taxes which are enacted at the time the Guaranteed Maximum Price is established.

2.3 CONSTRUCTION PHASE

2.3.1 GENERAL

2.3.1.1 The Construction Phase shall commence on the earlier of:

(1) the Owner's acceptance of the Construction Manager's Guaranteed Maximum Price proposal and issuance of a Notice to Proceed, or

(2) the Owner's first authorization to the Construction Manager to:

(a) award a subcontract, or

(b) undertake construction Work with the Construction Manager's own forces, or

(c) issue a purchase order for materials or equipment required for the Work.

2.3.2 ADMINISTRATION

2.3.2.1 Those portions of the Work that the Construction Manager does not customarily perform with the Construction Manager's own personnel shall be performed under subcontracts or by other appropriate agreements with the Construction Manager. The Construction Manager shall obtain bids from Subcontractors and from suppliers of materials or equipment fabricated to a special design for the Work from the list previously reviewed and, after analyzing such bids, shall deliver such bids to the Owner and Architect. The Owner shall then determine, with the advice of the Construction Manager and subject to the reasonable objection of the Architect, which bids will be accepted. The Owner may designate specific persons or entities from whom the Construction Manager shall obtain bids; however, if the Guaranteed Maximum Price has been established, the Owner may not prohibit the Construction Manager from obtaining bids from other qualified bidders. The Construction Manager shall not be required to contract with anyone to whom the Construction Manager has reasonable objection.

2.3.2.2 If the Guaranteed Maximum Price has been established and a specific bidder among those whose bids are delivered by the Construction Manager to the Owner and Architect (1) is recommended to the Owner by the Construction Manager; (2) is qualified to perform that portion of the Work; (3) has submitted a bid which conforms to the requirements of the Contract Documents without reservations or exceptions, but the Owner requires that another bid be accepted, then the Construction Manager may require that a change in the Work be issued to adjust the Contract Time and the Guaranteed Maximum Price by the difference between the bid of the person or entity recommended to the Owner by the Construction Manager and the amount of the subcontract or other agreement actually signed with the person or entity designated by the Owner.

2.3.2.3 Subcontracts and agreements with suppliers furnishing materials or equipment fabricated to a special design shall conform to the payment provisions of Subparagraphs 7.1.8 and 7.1.9 and shall not be awarded on the basis of cost plus a fee without the prior consent of the Owner.

2.3.2.4 The Construction Manager shall schedule and conduct meetings at which the Owner, Architect, Construction Manager and appropriate Subcontractors can discuss the status of the Work. The Construction Manager shall prepare and promtly distribute meeting minutes.

2.3.2.5 Promptly after the Owner's acceptance of the Guaranteed Maximum Price proposal, the Construction Manager shall prepare a schedule in accordance with Paragraph 3.10 of AIA Document A201, including the Owner's occupancy requirements.

2.3.2.6 The Construction Manager shall provide monthly written reports to the Owner and Architect on the progress of the entire Work. The Construction Manager shall maintain a daily log containing a record of weather, Subcontractors working on the site, number of workers, Work accomplished, problems encountered and other similar relevant data as the Owner may reasonably require. The log shall be available to the Owner and Architect.

2.3.2.7 The Construction Manager shall develop a system of cost control for the Work, including regular monitoring of actual costs for activities in progress and estimates for uncompleted tasks and proposed changes. The Construction Manager shall identify variances between actual and estimated costs and report the variances to the Owner and Architect at regular intervals.

2.4 PROFESSIONAL SERVICES

The Construction Manager 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 Construction Manager has specifically agreed in writing to provide such services. In such event, the Construction Manager shall cause such services to be performed by appropriately licensed professionals.

2.5 UNSAFE MATERIALS

In addition to the provisions of Paragraph 10.1 in AIA Document A201, if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered but not created on the site by the Construction Manager, the Construction Manager shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. The Owner, Construction Manager and Architect shall then proceed in the same manner described in Subparagraph 10.1.2 of AIA Document A201. The Owner shall be responsible for obtaining the services of a licensed laboratory to verify the presence or absence

of the material or substance reported by the Construction Manager 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 Construction Manager 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 Construction Manager and 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 Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Construction Manager and Architect have no reasonable objection.

ARTICLE 3

OWNER'S RESPONSIBILITIES

3.1 INFORMATION AND SERVICES

3.1.1 The Owner shall provide full information in a timely manner regarding the requirements of the Project, including a program which sets forth the Owner's objectives, constraints and criteria, including space requirements and relationships, flexibility and expandability requirements, special equipment and systems, and site requirements.

3.1.2 The Owner, upon written request from the Construction Manager, shall furnish evidence of Project financing prior to the start of the Construction Phase and from time to time thereafter as the Construction Manager may request. Furnishing of such evidence shall be a condition precedent to commencement or continuation of the Work.

3.1.3 The Owner shall establish and update an overall budget for the Project, based on consultation with the Construction Manager and Architect, which shall include contingencies for changes in the Work and other costs which are the responsibility of the Owner.

3.1.4 STRUCTURAL AND ENVIRONMENTAL TESTS, SURVEYS AND REPORTS

In the Preconstruction Phase, the Owner shall furnish the following with reasonable promptness and at the Owner's expense, and the Construction Manager shall be entitled to rely upon the accuracy of any such information, reports, surveys, drawings and tests described in Clauses 3.1.4.1 through 3.1.4.4, except to the extent that the Construction Manager knows of any inaccuracy:

3.1.4.1 Reports, surveys, drawings and tests concerning the conditions of the site which are required by law.

3.1.4.2 Surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a written legal description of the site. The surveys and legal information shall include, as applicable, grades and lines of streets, alleys, pavements and adjoining property and structures; adjacent drainage; rights-of-way, restrictions, easements, encroachments, zoning, deed restrictions, boundaries and contours of the site; locations, dimensions and necessary data pertaining to existing buildings, other improvements and trees; and information concerning available utility services and lines, both public and private, above and below grade, including inverts and depths. All information on the survey shall be referenced to a project benchmark.

3.1.4.3 The services of geotechnical engineers when such services are requested by the Construction Manager. Such services may include but are not limited to test borings, test pits, determinations of soil bearing values, percolation tests, evaluations of hazardous materials, ground corrosion and resistivity tests, including necessary operations for anticipating subsoil conditions, with reports and appropriate professional recommendations.

3.1.4.4 Structural, mechanical, chemical, air and water pollution tests, tests for hazardous materials, and other laboratory and environmental tests, inspections and reports which are required by law.

3.1.4.5 The services of other consultants when such services are reasonably required by the scope of the Project and are requested by the Construction Manager.

3.2 OWNER'S DESIGNATED REPRESENTATIVE

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. This representative shall have the authority to make decisions on behalf of the Owner concerning estimates and schedules, construction budgets, and changes in the Work, and shall render such decisions promptly and furnish information expeditiously, so as to avoid unreasonable delay in the services or Work of the Construction Manager.

3.3 ARCHITECT

The Owner shall retain an Architect to provide the Basic Services, including normal structural, mechanical and electrical engineering services, other than cost estimating services, described in the edition of AIA Document B141 current as of the date of this Agreement. The Owner shall authorize and cause the Architect to provide those Additional Services described in AIA Document B141 requested by the Construction Manager which must necessarily be provided by the Architect for the Preconstruction and Construction Phases of the Work. Such services shall be provided in accordance with time schedules agreed to by the Owner, Architect and Construction Manager. Upon request of the Construction Manager, the Owner shall furnish to the Construction Manager a copy of the Owner's Agreement with the Architect, from which compensation provisions may be deleted.

3.4 LEGAL REQUIREMENTS

The Owner shall determine and advise the Architect and Construction Manager of any special legal requirements relating specifically to the Project which differ from those generally applicable to construction in the jurisdiction of the Project. The Owner shall furnish such legal services as are necessary to provide the information and services required under Paragraph 3.1.

ARTICLE 4

COMPENSATION AND PAYMENTS FOR PRECONSTRUCTION PHASE SERVICES

The Owner shall compensate and make payments to the Construction Manager for Preconstruction Phase services as follows:

4.1 COMPENSATION

4.1.1 For the services described in Paragraphs 2.1 and 2.2 the Construction Manager's compensation shall be calculated as follows:

(State basis of compensation, whether a stipulated sum, multiple of Direct Personnel Expense, actual cost, etc. Include a statement of reimbursable cost items as applicable.)

4.1.2 Compensation for Preconstruction Phase services shall be equitably adjusted if such services extend beyond from the date of this Agreement or if the originally contemplated scope of services is significantly modified.

4.1.3 If compensation is based on a multiple of Direct Personnel Expense, Direct Personnel Expense is defined as the direct salaries of the Construction Manager's personnel engaged in the Project and the portion of the cost of their mandatory and customary contributions and benefits related thereto, such as employment taxes and other statutory employee benefits, insurance, sick leave, holidays, vacations, pensions and similar contributions and benefits.

4.2 PAYMENTS

4.2.1 Payments shall be made monthly following presentation of the Construction Manager's invoice and, where applicable, shall be in proportion to services performed.

4.2.2 Payments are due and payable ( ) days from the date the Construction Manager's invoice is received by the Owner. Amounts unpaid after the date on which payment is due shall bear interest at the rate entered below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon.)

(Usury laws and requirements under the Federal Truth in Lending Act, similar state and local consumer credit laws and other regulations at the Owner's and Construction Manager's principal places of business, the location of the Project and elsewhere may affect the validity of this provision. Legal advice should be obtained with respect to deletions or modifications, and also regarding requirements such as written disclosures or waivers.)

ARTICLE 5

COMPENSATION FOR CONSTRUCTION PHASE SERVICES

The Owner shall compensate the Construction Manager for Construction Phase services as follows:

5.1 COMPENSATION

5.1.1 For the Construction Manager's performance of the Work as described in Paragraph 2.3, the Owner shall pay the Construction Manager in current funds the Contract Sum consisting of the Cost of the Work as defined in Article 7 and the Construction Manager's Fee determined as follows:

(State a lump sum, percentage of actual Cost of the Work or other provision for determining the Construction Manager's Fee, and explain how the Construction Manager's Fee is to be adjusted for changes in the Work.)

5.2 GUARANTEED MAXIMUM PRICE

5.2.1 The sum of the Cost of the Work and the Construction Manager's Fee are guaranteed by the Construction Manager not to exceed the amount provided in Amendment No. 1, subject to additions and deductions by changes in the Work as provided in the Contract Documents. Such maximum sum as adjusted by approved changes in the Work is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Construction Manager without reimbursement by the Owner.

(Insert specific provisions if the Construction Manager is to participate in any savings.)

5.3 CHANGES IN THE WORK

5.3.1 Adjustments to the Guaranteed Maximum Price on account of changes in the Work subsequent to the execution of Amendment No. 1 may be determined by any of the methods listed in Subparagraph 7.3.3 of AIA Document A201.

5.3.2 In calculating adjustments to subcontracts (except those awarded with the Owner's prior consent on the basis of cost plus a fee), the terms "cost" and "fee" as used in Clause 7.3.3.3 of AIA Document A201 and the terms "costs" and "a reasonable allowance for overhead and profit" as used in Subparagraph 7.3.6 of AIA Document A201 shall have the meanings assigned to them in that document and shall not be modified by this Article 5. Adjustments to subcontracts awarded with the Owner's prior consent on the basis of cost plus a fee shall be calculated in accordance with the terms of those subcontracts.

5.3.3 In calculating adjustments to the Contract, the terms "cost" and "costs" as used in the above-referenced provisions of AIA Document A201 shall mean the Cost of the Work as defined in Article 6 of this Agreement and the terms "and a reasonable allowance for overhead and profit" shall mean the Construction Manager's Fee as defined in Subparagraph 5.1.1 of this Agreement.

5.3.4 If no specific provision is made in Subparagraph 5.1.1 for adjustment of the Construction Manager's Fee in the case of changes in the Work, or if the extent of such changes is such, in the aggregate, that application of the adjustment provisions of Subparagraph 5.1.1 will cause substantial inequity to the Owner or Construction Manager, the Construction Manager's Fee shall be equitably adjusted on the basis of the fee established for the original Work.

ARTICLE 6

COST OF THE WORK FOR CONSTRUCTION PHASE

6.1 COSTS TO BE REIMBURSED

6.1.1 The term "Cost of the Work" shall mean costs necessarily incurred by the Construction Manager in the proper performance of the Work. Such costs shall be at rates not higher than those customarily paid at the place of the Project except with prior consent of the Owner. The Cost of the Work shall include only the items set forth in this Article 6.

6.1.2 LABOR COSTS

.1 Wages of construction workers directly employed by the Construction Manager to perform the construction of the Work at the site or, with the Owner's agreement, at off-site workshops.

.2 Wages or salaries of the Construction Manager's supervisory and administrative personnel when stationed at the site with the Owner's agreement.

(If it is intended that the wages or salaries of certain personnel stationed at the Construction Manager's principal office or offices other than the site office shall be included in the Cost of the Work, such personnel shall be identified below.)

.3 Wages and salaries of the Construction Manager's supervisory or administrative personnel engaged, at factories, workshops or on the road, in expediting the production or transportation of materials or equipment required for the Work, but only for that portion of their time required for the Work.

.4 Costs paid or incurred by the Construction Manager for taxes, insurance, contributions, assessments and benefits required by law or collective bargaining agreements, and, for personnel not covered by such agreements, customary benefits such as sick leave, medical and health benefits, holidays, vacations and pensions, provided that such costs are based on wages and salaries included in the Cost of the Work under Clauses 6.1.2.1 through 6.1.2.3.

6.1.3 SUBCONTRACT COSTS

Payments made by the Construction Manager to Subcontractors in accordance with the requirements of the subcontracts.

6.1.4 COSTS OF MATERIALS AND EQUIPMENT INCORPORATED IN THE COMPLETED CONSTRUCTION

.1 Costs, including transportation, of materials and equipment incorporated or to be incorporated in the completed construction.

.2 Costs of materials described in the preceding Clause 6.1.4.1 in excess of those actually installed but required to provide reasonable allowance for waste and for spoilage. Unused excess materials, if any, shall be handed over to the Owner at the completion of the Work or, at the Owner's option, shall be sold by the Construction Manager; amounts realized, if any, from such sales shall be credited to the Owner as a deduction from the Cost of the Work.

6.1.5 COSTS OF OTHER MATERIALS AND EQUIPMENT, TEMPORARY FACILITIES AND RELATED ITEMS

.1 Costs, including transportation, installation, maintenance, dismantling and removal of materials, supplies, temporary facilities, machinery, equipment, and hand tools not customarily owned by the construction workers, which are provided by the Construction Manager at the site and fully consumed in the performance of the Work; and cost less salvage value on such items if not fully consumed, whether sold to others or retained by the Construction Manager. Cost for items previously used by the Construction Manager shall mean fair market value.

.2 Rental charges for temporary facilities, machinery, equipment, and hand tools not customarily owned by the construction workers, which are provided by the Construction Manager at the site, whether rented from the Construction Manager or others, and costs of transportation, installation, minor repairs and replacements, dismantling and removal thereof. Rates and quantities of equipment rented shall be subject to the Owner's prior approval.

.3 Costs of removal of debris from the site.

.4 Reproduction costs, costs of telegrams, facsimile transmissions and long-distance telephone calls, postage and express delivery charges, telephone service at the site and reasonable petty cash expenses of the site office.

.5 That portion of the reasonable travel and subsistence expenses of the Construction Manager's personnel incurred while traveling in discharge of duties connected with the Work.

6.1.6 MISCELLANEOUS COSTS

.1 That portion directly attributable to this Contract of premiums for insurance and bonds.

(If charges for self insurance are to be included, specify the basis of reimbursement.)

.2 Sales, use or similar taxes imposed by a governmental authority which are related to the Work and for which the Construction Manager is liable.

.3 Fees and assessments for the building permit and for other permits, licenses and inspections for which the Construction Manager is required by the Contract Documents to pay.

.4 Fees of testing laboratories for tests required by the Contract Documents, except those related to nonconforming Work other than that for which payment is permitted by Clause 6.1.8.2.

.5 Royalties and license fees paid for the use of a particular design, process or product required by the Contract Documents; the cost of defending suits or claims for infringement of patent or other intellectual property rights arising from such requirement by the Contract Documents; payments made in accordance with legal judgments against the Construction Manager resulting from such suits or claims and payments of settlements made with the Owner's consent; provided, however, that such costs of legal defenses, judgments and settlements shall not be included in the calculation of the Construction Manager's Fee or the Guaranteed Maximum Price and provided that such royalties, fees and costs are not excluded by the last sentence of Subparagraph 3.17.1 of AIA Document A201 or other provisions of the Contract Documents.

.6 Data processing costs related to the Work.

.7 Deposits lost for causes other than the Construction Manager's negligence or failure to fulfill a specific responsibility to the Owner set forth in this Agreement.

.8 Legal, mediation and arbitration costs, other than those arising from disputes between the Owner and Construction Manager, reasonably incurred by the Construction Manager in the performance of the Work and with the Owner's written permission, which permission shall not be unreasonably withheld.

.9 Expenses incurred in accordance with the Construction Manager's standard personnel policy for relocation and temporary living allowances of personnel required for the Work, in case it is necessary to relocate such personnel from distant locations.

6.1.7 OTHER COSTS

.1 Other costs incurred in the performance of the Work if and to the extent approved in advance in writing by the Owner.

6.1.8 EMERGENCIES AND REPAIRS TO DAMAGED OR NONCONFORMING WORK

The Cost of the Work shall also include costs described in Subparagraph 6.1.1 which are incurred by the Construction Manager:

.1 In taking action to prevent threatened damage, injury or loss in case of an emergency affecting the safety of persons and property, as provided in Paragraph 10.3 of AIA Document A201.

.2 In repairing or correcting damaged or nonconforming Work executed by the Construction Manager or the Construction Manager's Subcontractors or suppliers, provided that such damaged or nonconforming Work was not caused by the negligence or failure to fulfill a specific responsibility to the Owner set forth in this Agreement of the Construction

Manager or the Construction Manager's foremen, engineers or superintendents, or other supervisory, administrative or managerial personnel of the Construction Manager, or the failure of the Construction Manager's personnel to supervise adequately the Work of the Subcontractors or suppliers, and only to the extent that the cost of repair or correction is not recoverable by the Construction Manager from insurance, Subcontractors or suppliers.

6.1.9 The costs described in Subparagraphs 6.1.1 through 6.1.8 shall be included in the Cost of the Work notwithstanding any provision of AIA Document A201 or other Conditions of the Contract which may require the Construction Manager to pay such costs, unless such costs are excluded by the provisions of Paragraph 6.2.

6.2 COSTS NOT TO BE REIMBURSED

6.2.1 The Cost of the Work shall not include:

.1 Salaries and other compensation of the Construction Manager's personnel stationed at the Construction Manager's principal office or offices other than the site office, except as specifically provided in Clauses 6.1.2.2 and 6.1.2.3.

.2 Expenses of the Construction Manager's principal office and offices other than the site office except as specifically provided in Paragraph 6.1.

.3 Overhead and general expenses, except as may be expressly included in Paragraph 6.1.

.4 The Construction Manager's capital expenses, including interest on the Construction Manager's capital employed for the Work.

.5 Rental costs of machinery and equipment, except as specifically provided in Subparagraph 6.1.5.2.

.6 Except as provided in Clause 6.1.8.2, costs due to the negligence of the Construction Manager or to the failure of the Construction Manager to fulfill a specific responsibility to the Owner set forth in this Agreement.

.7 Costs incurred in the performance of Preconstruction Phase Services.

.8 Except as provided in Clause 6.1.7.1, any cost not specifically and expressly described in Paragraph 6.1.

.9 Costs which would cause the Guaranteed Maximum Price to be exceeded.

6.3 DISCOUNTS, REBATES AND REFUNDS

6.3.1 Cash discounts obtained on payments made by the Construction Manager shall accrue to the Owner if (1) before making the payment, the Construction Manager included them in an Application for Payment and received payment therefor from the Owner, or (2) the Owner has deposited funds with the Construction Manager with which to make payments; otherwise, cash discounts shall accrue to the Construction Manager. Trade discounts, rebates, refunds and amounts received from sales of surplus materials and equipment shall accrue to the Owner, and the Construction Manager shall make provisions so that they can be secured.

6.3.2 Amounts which accrue to the Owner in accordance with the provisions of Subparagraph 6.3.1 shall be credited to the Owner as a deduction from the Cost of the Work.

6.4 ACCOUNTING RECORDS

6.4.1 The Construction Manager shall keep full and detailed accounts and exercise such controls as may be necessary for proper financial management under this Contract; the accounting and control systems shall be satisfactory to the Owner. The Owner and the Owner's accountants shall be afforded access to the Construction Manager's records, books, correspondence, instructions, drawings, receipts, subcontracts, purchase orders, vouchers, memoranda and other data relating to this Project, and the Construction Manager shall preserve these for a period of three years after final payment, or for such longer period as may be required by law.

ARTICLE 7
CONSTRUCTION PHASE

7.1 PROGRESS PAYMENTS

7.1.1 Based upon Applications for Payment submitted to the Architect by the Construction Manager and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Construction Manager as provided below and elsewhere in the Contract Documents.

7.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

7.1.3 Provided an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment to the Construction Manager not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than days after the Architect receives the Application for Payment.

7.1.4 With each Application for Payment, the Construction Manager shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner or Architect to demonstrate that cash disbursements already made by the Construction Manager on account of the Cost of the Work equal or exceed (1) progress payments already received by the Construction Manager; less (2) that portion of those payments attributable to the Construction Manager's Fee; plus (3) payrolls for the period covered by the present Application for Payment.

7.1.5 Each Application for Payment shall be based upon the most recent schedule of values submitted by the Construction Manager in accordance with the Contract Documents. The schedule of values shall allocate the entire Guaranteed Maximum Price among the various portions of the Work, except that the Construction Manager's Fee shall be shown as a single separate item. The schedule of values shall be 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 Construction Manager's Applications for Payment.

7.1.6 Applications for Payment shall show the percentage completion of each portion of the Work as of the end of the period covered by the Application for Payment. The percentage completion shall be the lesser of (1) the percentage of that portion of the Work which has actually been completed or (2) the percentage obtained by dividing (a) the expense which has actually been incurred by the Construction Manager on account of that portion of the Work for which the Construction Manager has made or intends to make actual payment prior to the next Application for Payment by (b) the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values.

7.1.7 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Guaranteed Maximum Price properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values. Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Subparagraph 7.3.7 of AIA Document A201, even though the Guaranteed Maximum Price has not yet been adjusted by Change Order.

.2 Add that portion of the Guaranteed Maximum Price properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing.

.3 Add the Construction Manager's Fee, less retainage of percent (%). The Construction Manager's Fee shall be computed upon the Cost of the Work described in the two preceding Clauses at the rate stated in Subparagraph 5.1.1 or, if the Construction Manager's Fee is stated as a fixed sum in that Subparagraph, shall be an amount which bears the same ratio to that fixed-sum Fee as the Cost of the Work in the two preceding Clauses bears to a reasonable estimate of the probable Cost of the Work upon its completion.

.4 Subtract the aggregate of previous payments made by the Owner.

.5 Subtract the shortfall, if any, indicated by the Construction Manager in the documentation required by Subparagraph 7.1.4 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's accountants in such documentation.

.6 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Paragraph 9.5 of AIA Document A201.

7.1.8 Except with the Owner's prior approval, payments to Subcontractors shall be subject to retention of not less than percent (%). The Owner and the Construction Manager shall agree upon a mutually acceptable procedure for review and approval of payments and retention for subcontracts.

7.1.9 Except with the Owner's prior approval, the Construction Manager shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

7.1.10 In taking action on the Construction Manager's Applications for Payment, the Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Construction Manager and shall not be deemed to represent that the Architect has made a detailed examination, audit or arithmetic verification of the documentation submitted in accordance with Subparagraph 7.1.4 or other supporting data; that the Architect has made exhaustive or continuous on-site inspections or that the Architect has made examinations to ascertain how or for what purposes the Construction Manager has used amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's accountants acting in the sole interest of the Owner.

7.2 FINAL PAYMENT

7.2.1 Final payment shall be made by the Owner to the Construction Manager when (1) the Contract has been fully performed by the Construction Manager except for the Construction Manager's responsibility to correct nonconforming Work, as provided in Subparagraph 12.2.2 of AIA Document A201, and to satisfy other requirements, if any, which necessarily survive final payment; (2) a final Application for Payment and a final accounting for the Cost of the Work have been submitted by the Construction Manager and reviewed by the Owner's accountants; and (3) a final Certificate for Payment has then been issued by the Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

7.2.2 The amount of the final payment shall be calculated as follows:

.1 Take the sum of the Cost of the Work substantiated by the Construction Manager's final accounting and the Construction Manager's Fee; but not more than the Guaranteed Maximum Price.

.2 Subtract amounts, if any, for which the Architect withholds, in whole or in part, a final Certificate for Payment as provided in Subparagraph 9.5.1 of AIA Document A201 or other provisions of the Contract Documents.

.3 Subtract the aggregate of previous payments made by the Owner.

If the aggregate of previous payments made by the Owner exceeds the amount due the Construction Manager, the Construction Manager shall reimburse the difference to the Owner.

7.2.3 The Owner's accountants will review and report in writing on the Construction Manager's final accounting within 30 days after delivery of the final accounting to the Architect by the Construction Manager. Based upon such Cost of the Work as the Owner's accountants report to be substantiated by the Construction Manager's final accounting, and provided the other conditions of Subparagraph 7.2.1 have been met, the Architect will, within seven days after receipt of the written report of the Owner's accountants, either issue to the Owner a final Certificate for Payment with a copy to the Construction Manager, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding a certificate as provided in Subparagraph 9.5.1 of AIA Document A201. The time periods stated in this Paragraph 7.2 supersede those stated in Subparagraph 9.4.1 of AIA Document A201.

7.2.4 If the Owner's accountants report the Cost of the Work as substantiated by the Construction Manager's final accounting to be less than claimed by the Construction Manager, the Construction Manager shall be entitled to proceed in accordance with Article 9 without a further decision of the Architect. Unless agreed to otherwise, a demand for mediation or arbitration of the disputed amount shall be made by the Construction Manager within 60 days after the Construction Manager's receipt of a copy of the Architect's final Certificate for Payment. Failure to make such demand within this 60-day period shall result in the substantiated amount reported by the Owner's accountants becoming binding on the Construction Manager. Pending a final resolution of the disputed amount, the Owner shall pay the Construction Manager the amount certified in the Architect's final Certificate for Payment.

7.2.5 If, subsequent to final payment and at the Owner's request, the Construction Manager incurs costs described in Paragraph 6.1 and not excluded by Paragraph 6.2 (1) to correct nonconforming Work, or (2) arising from the resolution of disputes, the Owner shall reimburse the Construction Manager such costs and the Construction Manager's Fee, if any, related thereto on the same basis as if such costs had been incurred prior to final payment, but not in excess of the Guaranteed Maximum Price. If the Construction Manager has participated in savings, the amount of such savings shall be recalculated and appropriate credit given to the Owner in determining the net amount to be paid by the Owner to the Construction Manager.

ARTICLE 8

INSURANCE AND BONDS

8.1 INSURANCE REQUIRED OF THE CONSTRUCTION MANAGER

During both phases of the Project, the Construction Manager shall purchase and maintain insurance as set forth in Paragraph 11.1 of AIA Document A201. Such insurance shall be written for not less than the following limits, or greater if required by law:

8.1.1 Workers' Compensation and Employers' Liability meeting statutory limits mandated by State and Federal laws. If (1) limits in excess of those required by statute are to be provided or (2) the employer is not statutorily bound to obtain such insurance coverage or (3) additional coverages are required, additional coverages and limits for such insurance shall be as follows:

8.1.2 Commercial General Liability including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury, and Broad Form Property Damage (including coverage for Explosion, Collapse and Underground hazards):

$ _____ Each Occurrence

$ _____ General Aggregate

$ _____ Personal and Advertising Injury

$ _____ Products-Completed Operations Aggregate

.1 The policy shall be endorsed to have the General Aggregate apply to this Project only.

.2 Products and Completed Operations insurance shall be maintained for a minimum period of at least ( ) year(s) after either 90 days following Substantial Completion or final payment, whichever is earlier.

.3 The Contractual Liability insurance shall include coverage sufficient to meet the obligations in AIA Document A201 under Paragraph 3.18.

8.1.3 Automobile Liability (owned, non-owned and hired vehicles) for bodily injury and property damage:

$ _____ Each Accident

8.1.4 Other coverage:

(If Umbrella Excess Liability coverage is required over the primary insurance or retention, insert the coverage limits. Commercial General Liability and Automobile Liability limits may be attained by individual policies or by a combination of primary policies and Umbrella and/or Excess Liability policies.)

8.2 INSURANCE REQUIRED OF THE OWNER

During both phases of the Project, the Owner shall purchase and maintain liability and property insurance, including waivers of subrogation, as set forth in Paragraphs 11.2 and 11.3 of AIA Document A201. Such insurance shall be written for not less than the following limits, or greater if required by law:

8.2.1 Property Insurance:

$ _____ Deductible Per Occurrence

$ _____ Aggregate Deductible

8.2.2 Boiler and Machinery insurance with a limit of:

$ _____

(If not a blanket policy, list the objects to be insured.)

8.3 PERFORMANCE BOND AND PAYMENT BOND

8.3.1 The Construction Manager *(Insert "shall" or "shall not")* furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Construction Manager's usual source and the cost thereof shall be included in the Cost of the Work. The amount of each bond shall be equal to percent (%) of the Contract Sum.

8.3.2 The Construction Manager shall deliver the required bonds to the Owner at least three days before the commencement of any Work at the Project site.

ARTICLE 9

MISCELLANEOUS PROVISIONS

9.1 DISPUTE RESOLUTION FOR THE PRECONSTRUCTION PHASE

9.1.1 Claims, disputes or other matters in question between the parties to this Agreement which arise prior to the commencement of the Construction Phase or which relate solely to the Preconstruction Phase services of the Construction Manager or to the Owner's obligations to the Construction Manager during the Preconstruction Phase, shall be resolved by mediation or by arbitration.

9.1.2 Any mediation conducted pursuant to this Paragraph 9.1 shall be held in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect, unless the parties mutually agree otherwise. Demand for mediation shall be filed in writing with the other party to this Agreement and with the American Arbitration Association. Any demand for mediation shall be made within a reasonable time after the claim, dispute or other matter in question has arisen. In no event shall the demand for mediation be made after the date when institution of legal or equitable proceedings based upon such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

9.1.3 Any claim, dispute or other matter in question not resolved by mediation shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect unless the parties mutually agree otherwise.

9.1.4 Demand for arbitration shall be filed in writing with the other party to this Agreement and with the American Arbitration Association. A demand for arbitration may be made concurrently with a demand for mediation and shall be made within a reasonable time after the claim, dispute or other matter in question has arisen. In no event shall the demand for arbitration be made after the date when institution of legal or equitable proceedings based upon such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

9.1.5 No arbitration arising out of or relating to the Contract Documents 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, Construction Manager 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, Construction Manager, a separate contractor as described in Article 6 of AIA Document A201 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 or Construction Manager or a separate contractor as described in Article 6 of AIA Document A201 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 agreement to arbitration of a dispute not described in such consent or with a person or entity not named or described therein. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional per-

son or entity duly consented to by parties to this Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

9.1.6 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.

9.2 DISPUTE RESOLUTION FOR THE CONSTRUCTION PHASE

9.2.1 Any other claim, dispute or other matter in question arising out of or related to this Agreement or breach thereof shall be settled in accordance with Article 4 of AIA Document A201, except that in addition to and prior to arbitration, the parties shall endeavor to settle disputes by mediation in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect unless the parties mutually agree otherwise. Any mediation arising under this Paragraph shall be conducted in accordance with the provisions of Subparagraphs 9.1.2 and 9.1.3.

9.3 OTHER PROVISIONS

9.3.1 Unless otherwise noted, the terms used in this Agreement shall have the same meaning as those in the 1987 Edition of AIA Document A201, General Conditions of the Contract for Construction.

9.3.2 EXTENT OF CONTRACT

This Contract, which includes this Agreement and the other documents incorporated herein by reference, represents the entire and integrated agreement between the Owner and Construction Manager and supersedes all prior negotiations, representations or agreements, either written or oral. This Agreement may be amended only by written instrument signed by both the Owner and Construction Manager. If anything in any document incorporated into this Agreement is inconsistent with this Agreement, this Agreement shall govern.

9.3.3 OWNERSHIP AND USE OF DOCUMENTS

The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Construction Manager, are for use solely with respect to this Project. They are not to be used by the Construction Manager, Subcontractors, Sub-subcontractors or suppliers on other projects, or for additions to this Project outside the scope of the Work, without the specific written consent of the Owner and Architect. The Construction Manager, Subcontractors, Sub-subcontractors and suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the execution of their Work under the Contract Documents.

9.3.4 GOVERNING LAW

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

9.3.5 ASSIGNMENT

The Owner and Construction Manager 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. 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.

ARTICLE 10

TERMINATION OR SUSPENSION

10.1 TERMINATION PRIOR TO ESTABLISHING GUARANTEED MAXIMUM PRICE

10.1.1 Prior to execution by both parties of Amendment No. 1 establishing the Guaranteed Maximum Price, the Owner may terminate this Contract at any time without cause, and the Construction Manager may terminate this Contract for any of the reasons described in Subparagraph 14.1.1 of AIA Document A201.

10.1.2 If the Owner or Construction Manager terminates this Contract pursuant to this Paragraph 10.1 prior to commencement of the Construction Phase, the Construction Manager shall be equitably compensated for Preconstruction Phase services performed prior to receipt of notice of termination; provided, however, that the compensation for such services shall not exceed the compensation set forth in Subparagraph 4.1.1.

10.1.3 If the Owner or Construction Manager terminates this Contract pursuant to this Paragraph 10.1 after commencement of the Construction Phase, the Construction Manager shall, in addition to the compensation provided in Subparagraph 10.1.2, be paid an amount calculated as follows:

- **.1** Take the Cost of the Work incurred by the Construction Manager.
- **.2** Add the Construction Manager's Fee computed upon the Cost of the Work to the date of termination at the rate stated in Paragraph 5.1 or, if the Construction Manager's Fee is stated as a fixed sum in that Paragraph, an amount which bears the same ratio to that fixed-sum Fee as the Cost of Work at the time of termination bears to a reasonable estimate of the probable Cost of the Work upon its completion.
- **.3** Subtract the aggregate of previous payments made by the Owner on account of the Construction Phase.

The Owner shall also pay the Construction Manager fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Construction Manager which the Owner elects to retain and which is not otherwise included in the Cost of the Work under Clause 10.1.3.1. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Construction Manager shall, as a condition of receiving the payments referred to in this Article 10, execute and deliver all such papers and take all such steps, including the legal assignment of such subcontracts and other contractual rights of the Construction Manager, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Construction Manager under such subcontracts or purchase orders.

Subcontracts, purchase orders and rental agreements entered into by the Construction Manager with the Owner's written approval prior to the execution of Amendment No. 1 shall contain provisions permitting assignment to the Owner as described above. If the Owner accepts such assignment, the Owner shall reimburse or indemnify the Construction Manager with respect to all costs arising under the subcontract, purchase order or rental agreement except those which would not have been reimbursable as Cost of the Work if the contract had not been terminated. If the Owner elects not to accept the assignment of any subcontract, purchase order or rental agreement which would have constituted a Cost of the Work had this agreement not been terminated, the Con-

struction Manager shall terminate such subcontract, purchase order or rental agreement and the Owner shall pay the Construction Manager the costs necessarily incurred by the Construction Manager by reason of such termination.

10.2 TERMINATION SUBSEQUENT TO ESTABLISHING GUARANTEED MAXIMUM PRICE

Subsequent to execution by both parties of Amendment No. 1, the Contract may be terminated as provided in Article 14 of AIA Document A201.

10.2.1 In the event of such termination by the Owner, the amount payable to the Construction Manager pursuant to Subparagraph 14.1.2 of AIA Document A201 shall not exceed the amount the Construction Manager would have been entitled to receive pursuant to Subparagraphs 10.1.2 and 10.1.3 of this Agreement.

10.2.2 In the event of such termination by the Construction Manager, the amount to be paid to the Construction Manager under Subparagraph 14.1.2 of AIA Document A201 shall not exceed the amount the Construction Manager would be entitled to receive under Subparagraphs 10.1.2 or 10.1.3 above, except that the Construction Manager's Fee shall be calculated as if the Work had been fully completed by the Construction Manager, including a reasonable estimate of the Cost of the Work for Work not actually completed.

10.3 SUSPENSION

The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201; in such case, the Guaranteed Maximum Price, if established, shall be increased as provided in Subparagraph 14.3.2 of AIA Document A201 except that the term "cost of performance of the Contract" in that Subparagraph shall be understood to mean the Cost of the Work and the term "profit" shall be understood to mean the Construction Manager's Fee as described in Subparagraphs 5.1.1 and 5.3.4 of this Agreement.

ARTICLE 11
OTHER CONDITIONS AND SERVICES

This Agreement entered into as of the day and year first written above.

OWNER:	CONSTRUCTION MANAGER:
By: _____	By: _____
Date: _____	Date: _____
ATTEST: _____	ATTEST: _____

CAUTION: You should sign an original AIA document which has this caution printed in red. An original assures that changes will not be obscured as may occur when documents are reproduced.

AMENDMENT NO. 1 TO AGREEMENT BETWEEN OWNER AND CONSTRUCTION MANAGER

Pursuant to Paragraph 2.2 of the Agreement, dated between *(Owner)* and *(Construction Manager)*, for *(the Project)*, the Owner and Construction Manager establish a Guaranteed Maximum Price and Contract Time for the Work as set forth below.

ARTICLE I

GUARANTEED MAXIMUM PRICE

The Construction Manager's Guaranteed Maximum Price for the Work, including the estimated Cost of the Work as defined in Article 6 and the Construction Manager's Fee as defined in Article 5, is

Dollars ($).

This Price is for the performance of the Work in accordance with the Contract Documents listed and attached to this Amendment and marked Exhibits A through F, as follows:

Exhibit A	Drawings, Specifications, addenda and General, Supplementary and other Conditions of the Contract on which the Guaranteed Maximum Price is based, pages	through	, dated
Exhibit B	Allowance items, pages	through	, dated
Exhibit C	Assumptions and clarifications made in preparing the Guaranteed Maximum Price, pages	through	, dated
Exhibit D	Completion schedule, pages	through	, dated
Exhibit E	Alternate prices, pages	through	, dated
Exhibit F	Unit prices, pages	through	, dated

ARTICLE II

CONTRACT TIME

The date of Substantial Completion established by this Amendment is:

OWNER:	CONSTRUCTION MANAGER:
By: _____	By: _____
Date: _____	Date: _____
ATTEST: _____	ATTEST: _____

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AIA Document A201

General Conditions of the Contract for Construction

THIS DOCUMENT HAS IMPORTANT LEGAL CONSEQUENCES: CONSULTATION WITH ANA TTORNEY IS ENCOURAGED WITH RESPECT TO ITS MODIFICATION

1987 EDITION

TABLE OF ARTICLES

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

INDEX

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 or (3) 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, wherever located and whenever issued, 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, construction systems, standards and workmanship for the Work, and performance of related services.

1.1.7 THE PROJECT MANUAL
The Project Manual is the volume usually assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

1.2 EXECUTION, CORRELATION AND INTENT

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

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

1.2.3 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

1.2.4 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.

1.2.5 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 OWNERSHIP AND USE OF ARCHITECT'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS

1.3.1 The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect's service through which the Work to be executed by the Contractor is described. The Contractor may retain one contract 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, and unless otherwise indicated the Architect shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyright. All copies of them, 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 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 and Architect. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect. 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 copyright or other reserved rights.

1.4 CAPITALIZATION

1.4.1 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.

1.5 INTERPRETATION

1.5.1 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.

ARTICLE 2
OWNER

2.1 DEFINITION

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 term "Owner" means the Owner or the Owner's authorized representative.

2.1.2 The Owner upon reasonable written request shall furnish to the Contractor in writing information which is 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 at the time of execution of the Agreement and, within five days after any change, information of such change in title, recorded or unrecorded.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.1 The Owner shall, at the request of the Contractor, prior to execution of the Agreement and promptly from time to time thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. *[Note: Unless such reasonable evidence were furnished on request prior to the execution of the Agreement, the prospective contractor would not be required to execute the Agreement or to commence the Work.]*

2.2.2 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.

2.2.3 Except for permits and fees 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.

2.2.4 Information or services under the Owner's control shall be furnished by the Owner with reasonable promptness to avoid delay in orderly progress of the Work.

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.

2.2.6 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Article 6 (Construction by Owner or by Separate Contractors), Article 9 (Payments and Completion) and Article 11 (Insurance and Bonds).

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 accordance with the Contract Documents, the Owner, by written order signed personally or by an agent specifically so empowered by the Owner in writing, may order 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 second seven-day period. If the Contractor within such second seven 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 cost of correcting such deficiencies, including compensation for the Architect's additional services and expenses 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 DEFINITION

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.

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.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Subparagraph 2.2.2 and shall at once report to the Architect errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner or Architect for damage resulting from errors, inconsistencies or omissions in the Contract Documents unless the Contractor recognized such error, inconsistency or omission and knowingly failed to report it to the Architect. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Architect, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

3.2.2 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect at once.

3.2.3 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Paragraph 3.12.

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 Contract Documents give other specific instructions concerning these matters.

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 performing portions of the Work under a contract with the Contractor.

3.3.3 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.

3.3.4 The Contractor shall be responsible for inspection of portions of Work already performed under this Contract 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 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 with the requirements of the Contract 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 under 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 or portions thereof 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 bearing on 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 full responsibility for such Work and shall bear the attributable costs.

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 against which the Contractor makes reasonable objection.

3.8.2 Unless otherwise provided in the Contract Documents:

.1 materials and equipment under an allowance shall be selected promptly by the Owner to avoid delay in the Work;

.2 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.3 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 and not in the allowances;

.4 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 3.8.2.2 and (2) changes in Contractor's costs under Clause 3.8.2.3.

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 conform to the most recent schedules.

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 changes and selections made during construction, and in addition 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 the way 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.

3.12.5 The Contractor shall review, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by 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 made by the Contractor which are not required by the Contract Documents may be returned without action.

3.12.6 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect. Such Work shall be in accordance with approved submittals.

3.12.7 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.

3.12.8 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 the Architect has given written approval to

the specific 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.

3.12.10 Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents.

3.12.11 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

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

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 AND PATENTS

3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of 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. However, if the Contractor has reason to believe that the required design, process or product is an infringement of 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, 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) including loss of use resulting therefrom, but only to the extent caused in whole or in part by 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 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 this Paragraph 3.18 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' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

3.18.3 The obligations of the Contractor under this Paragraph 3.18 shall not extend to the liability of the Architect, the Architect's consultants, and agents and employees of any of them arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Architect, the Architect's consultants, and agents and employees of any of them provided such

giving or failure to give is the primary cause of the injury or damage.

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 In case of termination of employment of the Architect, the Owner shall appoint an architect against whom the Contractor makes no reasonable objection and whose status under the Contract Documents shall be that of the former architect.

4.1.4 Disputes arising under Subparagraphs 4.1.2 and 4.1.3 shall be subject to arbitration.

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 the 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 correction period described in Paragraph 12.2. The Architect will advise and consult with the Owner. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument in accordance with other provisions of the Contract.

4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine in general if the Work is being performed in a manner indicating that the Work, when 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 quality or quantity of the Work. On the basis of onsite observations as an architect, the Architect will keep the Owner informed of progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work.

4.2.3 The Architect will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Paragraph 3.3. The Architect will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Con-tractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

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 through the Architect. 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 observations and 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 which does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable for implementation of the intent of the Contract Documents, the Architect will have authority to require additional 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 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. The Architect's response to such requests will be made with reasonable promptness and within any time limits agreed upon. 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 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 made by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

4.3.2 Decision of Architect. Claims, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for action as provided in Paragraph 4.4. A decision by the Architect, as provided in Subparagraph 4.4.4, shall be required as a condition precedent to arbitration or litigation of a Claim between the Contractor and Owner as to all such matters arising prior to the date final payment is due, regardless of (1) whether such matters relate to execution and progress of the Work or (2) the extent to which the Work has been completed. The decision by the Architect in response to a Claim shall not be a condition precedent to arbitration or litigation in the event (1) the position of Architect is vacant, (2) the Architect has not received evidence or has failed to render a decision within agreed time limits, (3) the Architect has failed to take action required under Subparagraph 4.4.4 within 30 days after the Claim is made, (4) 45 days have passed after the Claim has been referred to the Architect or (5) the Claim relates to a mechanic's lien.

4.3.3 Time Limits On Claims. Claims by either party must be made 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 made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner.

4.3.4 Continuing Contract Performance. Pending final resolution of a Claim including arbitration, unless otherwise agreed in writing the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

4.3.5 Waiver of Claims: Final Payment. 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.

4.3.6 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 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.

4.3.7 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 10.3. 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 the procedure established herein.

4.3.8 Claims for Additional Time

4.3.8.1 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.

4.3.8.2 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 and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction.

4.3.9 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, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, 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 first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in Subparagraphs 4.3.7 or 4.3.8.

4.4 RESOLUTION OF CLAIMS AND DISPUTES

4.4.1 The Architect will review Claims and take one or more of the following preliminary actions within ten days of receipt of a Claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Architect expects to take action, (3) reject the Claim in whole or in part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The Architect may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

4.4.2 If a Claim has been resolved, the Architect will prepare or obtain appropriate documentation.

4.4.3 If a Claim has not been resolved, the party making the Claim shall, within ten days after the Architect's preliminary response, take one or more of the following actions: (1) submit additional supporting data requested by the Architect, (2) modify the initial Claim or (3) notify the Architect that the initial Claim stands.

4.4.4 If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven days, which decision shall be final and binding on the parties but subject to arbitration. Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor's default, the Architect may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

4.5 ARBITRATION

4.5.1 Controversies and Claims Subject to Arbitration. Any controversy or Claim arising out of or related to the Contract, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator or arbitrators may be entered in any court having jurisdiction thereof, except controversies or Claims relating to aesthetic effect and except those waived as provided for in Subparagraph 4.3.5. Such controversies or Claims upon which the Architect has given notice and rendered a decision as provided in Subparagraph 4.4.4 shall be subject to arbitration upon written demand of either party. Arbitration may be commenced when 45 days have passed after a Claim has been referred to the Architect as provided in Paragraph 4.3 and no decision has been rendered.

4.5.2 Rules and Notices for Arbitration. Claims between the Owner and Contractor not resolved under Paragraph 4.4 shall, if subject to arbitration under Subparagraph 4.5.1, be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect, unless the parties mutually agree otherwise. Notice of demand for arbitration shall be filed in writing with the other party to the Agreement between the Owner and Contractor and with the American Arbitration Association, and a copy shall be filed with the Architect.

4.5.3 Contract Performance During Arbitration. During arbitration proceedings, the Owner and Contractor shall comply with Subparagraph 4.3.4.

4.5.4 When Arbitration May Be Demanded. Demand for arbitration of any Claim may not be made until the earlier of (1) the date on which the Architect has rendered a final written decision on the Claim, (2) the tenth day after the parties have presented evidence to the Architect or have been given reasonable opportunity to do so, if the Architect has not rendered a final written decision by that date, or (3) any of the five events described in Subparagraph 4.3.2.

4.5.4.1 When a written decision of the Architect states that (1) the decision is final but subject to 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.

4.5.4.2 A demand for arbitration shall be made within the time limits specified in Subparagraphs 4.5.1 and 4.5.4 and Clause 4.5.4.1 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.

4.5.5 Limitation on Consolidation or Joinder. No arbitration arising out of or relating to the Contract Documents 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 dispute 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.

4.5.6 Claims and Timely Assertion of Claims. A party who files 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. When a party fails to include a Claim through oversight, inadvertence or excusable neglect, or when a Claim has matured or been acquired subsequently, the arbitrator or arbitrators may permit amendment.

4.5.7 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. The Contract Sum shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued. However, no increase in the Contract Sum 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 change.

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 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 shall 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 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 If the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted.

ARTICLE 6
CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTIONAND 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 elsewhere in the Contract Documents.

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 and Contract Sum 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 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 contractors' 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 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor.

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 Claims and other disputes and matters in question between the Contractor and a separate contractor shall be subject to the provisions of Paragraph 4.3 provided the separate contractor has reciprocal obligations.

6.2.6 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Paragraph 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 as described in Paragraph 3.15, the Owner may clean up and allocate the cost among those responsible as the Architect determines to be just.

ARTICLE 7
CHANGES IN THE WORK

7.1 CHANGES

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.

7.1.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive 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.

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

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 and stating a proposed basis for 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' or workmen's 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;
.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 Pending final determination of cost to the Owner, amounts not in dispute may be included in Applications for Payment. 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 If the Owner and Contractor do not agree with the adjustment in Contract Time or the method for determining it, the adjustment or the method shall be referred to the Architect for determination.

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. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

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. 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 a notice to proceed given 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 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 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 elsewhere in the Contract Documents.

9.3.1.1 Such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders.

9.3.1.2 Such applications may not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier because of a dispute or other reason.

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 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 observations at the site 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, 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 minor deviations from the Contract Documents correctable 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 decide not to certify payment and 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 decide not to certify payment or, because of

subsequently discovered evidence or subsequent observations, 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 opinion to protect the Owner from loss because of:

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims;

.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 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.

9.7 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, which shall be accomplished as provided in Article 7.

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 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. The Contractor shall proceed promptly to complete and correct items on the list. 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. 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 in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. The Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion. 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. 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.

9.8.3 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Architect, the Owner shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in 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 Subparagraph 11.3.11 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 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 observations 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 said 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 cancelled 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 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. The making of final payment shall constitute a waiver of claims by the Owner as provided in Subparagraph 4.3.5.

9.10.4 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. Such waivers shall be in addition to the waiver described in Subparagraph 4.3.5.

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.

10.1.2 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless, by written agreement of the Owner and Contractor, or in accordance with final determination by the Architect on which arbitration has not been demanded, or by arbitration under Article 4.

10.1.3 The Contractor shall not be required pursuant to Article 7 to perform without consent any Work relating to asbestos or polychlorinated biphenyl (PCB).

10.1.4 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, 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 is asbestos or polychlorinated biphenyl (PCB) 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) including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Owner, anyone directly or indirectly employed by the Owner or anyone for whose acts the Owner 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 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 Subparagraph 10.1.4.

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.

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 EMERGENCIES

10.3.1 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 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' or workmen's 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 which are sustained (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (2) by another person;

.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; and

.7 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 cancelled 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 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. Optionally, the Owner may purchase and maintain other insurance for self-protection against claims which may arise from operations under the Contract. The Contractor shall not be responsible for purchasing and maintaining this optional Owner's liability insurance unless specifically required by the Contract Documents.

11.3 PROPERTY INSURANCE

11.3.1 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 in the amount of the initial Contract Sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis without voluntary 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 11.3 to be covered, whichever is earlier. This insurance shall include interests of the owner, the Contractor, Subcontractors and Sub-subcontractors in the Work.

11.3.1.1 Property insurance shall be on an all-risk policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, falsework, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's services and expenses required as a result of such insured loss. Coverage for other perils shall not be required unless otherwise provided in the Contract Documents.

11.3.1.2 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, then the Owner shall bear all reasonable costs properly attributable thereto.

11.3.1.3 If the property insurance requires minimum deductibles and such deductibles are identified in the Contract Documents, the Contractor shall pay costs not covered because of such deductibles. If the Owner or insurer increases the required minimum deductibles above the amounts so identified or if the Owner elects to purchase this insurance with voluntary deductible amounts, the Owner shall be responsible for payment of the additional costs not covered because of such increased or voluntary deductibles. If deductibles are not identified in the Contract Documents, the Owner shall pay costs not covered because of deductibles.

11.3.1.4 Unless otherwise provided in the Contract Documents, this property insurance shall cover portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also portions of the Work in transit.

11.3.2 **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.

11.3.3 **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.

11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or for other special hazards 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.

11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, adjoining 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 11.3.7 for damages caused by fire or other perils covered by this separate property

insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

11.3.6 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 11.3. 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 cancelled or allowed to expire until at least 30 days' prior written notice has been given to the Contractor.

11.3.7 **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 perils to the extent covered by property insurance obtained pursuant to this Paragraph 11.3 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.

11.3.8 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 11.3.10. 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.

11.3.9 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 4.5. If after such loss no other special agreement is made, replacement of damaged property shall be covered by appropriate Change Order.

11.3.10 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 be made, arbitrators shall be chosen as provided in Paragraph 4.5. The Owner as fiduciary shall, in that case, make settlement with insurers in accordance with directions of such arbitrators. If distribution of insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

11.3.11 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 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 PERFORMANCE BOND AND PAYMENT BOND

11.4.1 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.

11.4.2 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 observation 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 observe

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 charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs 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.

12.2 CORRECTION OF WORK

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

12.2.2 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. This period of one year 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. This obligation under this Subparagraph 12.2.2 shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

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 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Paragraph 2.4. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Architect, the Owner may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice,
the Owner may upon ten additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Architect's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to' cover such amount, the Contractor shall pay the difference to the Owner.

12.2.5 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.

12.2.6 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 time period of one year 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.

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. 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.

13.3 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 the Architect may observe 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 the Architect may observe such procedures. The Owner shall bear such costs except as provided in Subparagraph 13.5.3.

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, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses.

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.

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 days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor, for any of the following reasons:

.1 issuance of an order of a court or other public authority having jurisdiction;

.2 an act of government, such as a declaration of national emergency, making material unavailable;

.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;

.4 if repeated suspensions, delays or interruptions 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; or

.5 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 If one of the above reasons exists, the Contractor may, upon seven additional 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.

14.1.3 If the Work is stopped for a period of 60 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 14.1.2.

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.

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.

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, such excess shall be paid to the Contractor. If such costs 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 An adjustment shall be made for increases in the cost of performance of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. 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 this Contract.

14.3.3 Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.

SUPPLEMENTARY GENERAL CONDITIONS

GENERAL CONDITIONS

The "General Conditions of the Contract for Construction", AIA Document A-201, Fourteenth Edition (1987), Articles 1 through 14 inclusive, is a part of this Contract.

SUPPLEMENTARY CONDITIONS

The following supplements modify, delete and/or add to the General Conditions. Where any article, paragraph or subparagraph in the General Conditions is supplemented by one of the following paragraphs, the provisions of such article, paragraph or subparagraph shall remain in effect and the supplemental provisions shall be considered as added thereto. Where any article, paragraph, or subparagraph in the General Conditions is amended, voided or superseded by any of the following paragraphs, the provisions of such article, paragraph or subparagraph not so amended, voided, or superseded shall remain in effect.

MODIFICATIONS TO VARIOUS ARTICLES OF THE AIA GENERAL CONDITIONS

ARTICLE 1 - GENERAL PROVISIONS

1.1.1..1 In the event of conflict or discrepancies among the contract Documents, the Documents shall be construed according to the following priorities:

Highest Priority:	**Modifications**
Second Priority:	**Agreement**
Third Priority:	**Addenda – later date to take precedence**
Fourth Priority:	**Modified General Conditions**
Fifth Priority:	**Division 1 – General requirements**
Sixth Priority:	**Drawings and Specifications**

1.1.1.2 In the event of uncertainty as to the type or quality of materials to be supplied, the Specifications shall govern, unless otherwise directed by written Addendum.

1.1.1.3 Except for special agreements in Paragraph 3.18, nothing contained in the Contract Documents shall be construed to create any contractual relationship of any kind between the Architect and the Contractor.

1.1.1.4 In the event of a discrepancy between the Drawings and the Specifications, the Specifications shall govern.

1.2.1 Add the following at the end of the first sentence:

"One of the signed sets shall be deposited with the Architect."

1.2.3 Add the following:

"All work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such work is to be done by others. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract."

1.2.4 Add the following:

"The Contractor and all subcontractors shall refer to all of the Drawings, including those showing primarily the work of the mechanical, electrical and other specialized trades, and to all of the Parts of the Project Manual and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results."

1.2.6-
1.2.12 Add the following new paragraphs:

"1.2.6 All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Documents.

1.2.7 Where codes, standards, requirements, and publications of public and private bodies are referred to in the Specifications, references shall be understood to be the latest revision prior to the date of receiving bids, except where otherwise indicated. The GMP is to be confirmed when the Construction Manager receives from the Architect the listing of the code versions that are required.

1.2.8 Where no explicit quality or standards for materials or workmanship are established for work, such work is to be of good quality for the intended use and consistent with the quality of the surrounding work and of the construction of the Project generally.

1.2.9 All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents.

1.2.10 The Mechanical, Electrical and Fire Protection Drawings are diagrammatic only, and are not intended to show the alignment, physical locations or configurations of work. Such work shall be installed without additional cost to the Owner to clear all obstructions, permit proper clearances for the work of other trades, and present an orderly appearance where exposed. Prior to beginning such Work, the Contractor shall review with other trades the exact alignment, physical location and configuration of the Mechanical, Electrical and Fire Protection installations and demonstrating to the Contractor's satisfaction that the installations will comply with the preceding sentence.

1.2.11 Test boring or soil test information included with the Contract Documents or otherwise made available to the Contractor was obtained by the Owner for use by the Architect in the design of the Project or Work. The Owner does not hold out such information to the Contractor as an accurate or approximate indication of subsurface

conditions. Claims for extra cost or extension of time resulting from a reliance by the Contractor on such information shall be allowed as provided in subparagraph 4.3.6.

1.2.12 Where the Work is to fit with existing conditions or work to be performed by others, the Contractor shall fully and completely join the Work with such conditions or work, unless otherwise specified."

ARTICLE 2 - OWNER

2.1.1 Delete the second sentence of subparagraph 2.1.1.

2.1.2 Change to read as follows:

"The Owner shall furnish to the Contractor within 15 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."

2.2.1 Delete subparagraph 2.2.1

2.2.4 Change to read as follows:

"Information or services required of the Owner hereunder shall be furnished by the Owner with reasonable promptness after receipt from the Contractor of a written request for such information or services."

2.2.5 Delete subparagraph 2.2.5 in its entirety and substitute the following:

"The Owner will furnish the Contractor copies of drawings and specifications free of charge.

(a) Drawings and specifications issued by the Architect will be forwarded to a reproduction service of the Contractor's choice. The reproduction service will bill the Owner direct.

2.2.6 Add the following paragraph:

"The Owner shall forward all instructions to the Contractor through the Architect or through the Owner's designated Representative."

2.4.1 In the third sentence of subparagraph 2.4.1, replace the words "Change Order" with the words "Construction Change Directive," and delete the forth sentence.

ARTICLE 3 - CONTRACTOR

3.1.1 Change the second sentence to read as follows:

"The term 'Contractor' is synonymous with the term 'Construction Manager' as Constructor, and means the Contractor or the Contractor's authorized representatives."

3.2.1 Change subparagraph 3.2.1 to read as follows:

"Before starting the Work, and at frequent intervals during the progress thereof, the Contractor shall carefully study and compare the Contract Documents with each other and with the information furnished by the Owner pursuant to subparagraph 2.2.2 and shall at once report to the Architect any error, inconsistency or omission the Contractor may discover. Any necessary change shall be ordered as provided in Article 7, subject to the requirements of Paragraph 1.2 and other provisions of the Contract Documents. If the Contractor discovers such errors, inconsistencies or omissions and knowingly proceeds with the Work without such notice to the Architect, the Contractor shall bear all costs arising there from."

3.2.4-
3.2.5 Add the following subparagraphs:

"3.2.4 The Contractor shall give the Architect timely notice of any additional Drawings, Specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work.

3.2.5 The Contractor shall not proceed with any work not clearly and consistently defined in sufficient detail in the Contract Documents, but shall request additional drawings or instructions from the Architect as provided in subparagraph 3.2.4. If the Contractor proceeds with such work without obtaining further Drawings, Specification or instructions, he shall correct the incorrect work at his own expense."

3.3.2 Change the words "under a contract with the Contractor." to read as follows:

"for or on behalf of the Contractor or any of it's Subcontractors."

3.3.5 Add the following:

"3.3.5 The Contractor shall coordinate and supervise the work performed by Subcontractors so that the work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the work. The Contractor and all Subcontractors shall, at all times, afford each trade, any separate contractor, or the Owner, every reasonable opportunity for the installation of work and the storage of materials."

3.4.1 Add the following sentence to the end of subparagraph 3.4.1:

"The word "provide" shall mean furnish and install complete, including connections, unless otherwise specified."

3.5.2-
3.5.9 Add the following new paragraphs:

"3.5.2 The Contractor shall be responsible for determining that all materials furnished for the Work meet all requirements of the Contract Documents. The Architect may require the Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports of past tests by qualified testing laboratories, reports of studies by

qualified experts, or other evidence which, in the opinion of the Architect, would lead to a reasonable certainty that any material used, or proposed to be used, in the Work meets the requirements of the Contract Documents. All such data shall be furnished at the Contractor's expense. This provision shall not require the Contractor to pay for periodic testing of different batches of the same material, unless such testing is specifically required by the Contract Documents to be performed at the Contractor's expense.

3.5.3 In all cases in which a manufacturer's name, trade name or other proprietary designation is used in connection with materials or articles to be furnished under this Contract, the Contractor shall furnish the product of the named manufacturer(s) without substitution, unless a written request for a substitute has been submitted by the Contractor and approved in writing by the Architect as provided in subparagraph 3.5.4.

3.5.4 If the Contractor proposes to use a material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the material is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.

3.5.5. In requesting approval of deviation or substitutions, the Contractor shall provide evidence leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that otherwise attainable. If, in the opinion of the Architect, the evidence presented by the Contractor does not provide a sufficient basis for such reasonable certainty, the Architect shall reject such substitution or deviation without further investigation.

3.5.6 The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes on the basis of their suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve proposed substitutes, which, in the Architects opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the project. In order to permit coordinated design of color and finishes the Contractor shall furnish the substituted material in any color, finish, texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the Owner.

3.5.7 Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the Contractor, unless such substitution was made at the written request or direction of the Owner and the Architect. Warranties will be passed through as received.

3.5.8 The warranty provided in this paragraph 3.5 shall be in addition to and not in limitation of any other warranty required by the Contract Documents or otherwise prescribed by law.

3.5.9 The Contractor shall procure and deliver to the Architect, no later than the date claimed by the Contractor as the date of Substantial Completion, all special warranties required by the Contract Documents."

3.9.1 Change the first sentence to read as follows:

"The Contractor shall employ a competent superintendent, reasonably acceptable to the Owner, and necessary assistants who shall be in attendance at the Project site full time during the progress of the Work until the date of Substantial Completion, and for such additional time thereafter as the Architect may determine to be necessary for the expeditious completion of the Work. The Contractor shall remove the superintendent if requested to do so in writing by the Owner, and shall promptly replace him with a competent person reasonably acceptable to the Owner. Any such request for removal by the Owner shall be for reasonable cause."

3.9.2 Add the following subparagraph.

"3.9.2 The Contractor shall arrange for and attend job meetings with the Architect and such other persons as the Architect may from time to time wish to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor's own superintendent. An authorized representative of any Subcontractor or Sub-subcontractor shall attend such meeting if the representative's presence is requested by the Architect. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings, including costs, payments, change orders, time schedules and manpower. Any notices required under the Contract may be served on such representatives."

3.12.9 Add the following sentence at the end of the paragraph:

"Unless such written notice has been given, the Architect's approval of a resubmitted Shop Drawing, Product Data or Sample shall not constitute approval of any changes not requested on the prior submittal."

3.13.1 Change to read as follows:

"The right of possession of the premises and the improvements made thereon by the Contractor shall remain at all times with the Owner. The Contractors right to entry and use thereof arises solely from the permission granted by the Owner under the Contract Documents. The Contractor shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, the Contract Documents and permits and/or directions of the Architect and shall not unreasonably encumber the premises with his materials. The Owner shall not be liable to the Contractor, the Subcontractors, their employees or anyone else with respect to the conditions of the premises, except only for a condition caused directly and solely by the negligence of the Owner."

3.13.2 Add the following subparagraph:

"3.13.2 The Contractor shall maintain clear access for use by any emergency vehicle at all times. Maintain clear paths of egress from building exits at all times."

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

4.1.4 Delete subparagraph 4.1.4.

4.2.7 In subparagraph 4.2.7, add to the end of the first sentence, "and only to the extent which the Architect believes desirable to protect the Owner's interest." Change the second sentence to read:

"The Architect's action will be taken with reasonable promptness, while allowing sufficient time in the Architect's professional judgment to permit adequate review, taking into account the time periods set forth in the latest schedule prepared by the Contractor and reviewed by the Architect pursuant to subparagraph 8.2.4 through 8.2.10." In the fifth sentence, delete the words "unless otherwise specifically stated by the Architect."

4.2.11 Delete the last sentence of subparagraph 4.2.11 and substitute the following:

"The Architect may, as he judges desirable, issue additional drawings or instructions indicating in greater detail the construction or design of the various parts of the work; such drawings or instruction may be affected by a notice to the Contractor, and provided such drawings or instructions are reasonable consistent with the previously existing Contract Documents, the Work shall be executed in accordance with such additional drawings or instructions without additional cost or extension of contract time. If the Contractor claims additional cost or extension or contract time on account of such additional drawings or instructions, he shall give the notice provided in subparagraph 4.3.5."

4.3.2 Change to read as follows:

"Claims arising prior to final payment or the earlier termination of the Contract shall be referred initially to the Architect for action as provided in Paragraph 4.4."

4.3.3 Revise the last sentence of subparagraph 4.3.3 to read as follows:

"Any change or addition to a previously made Claim shall be made by timely written notice in accordance with this subparagraph 4.3.3."

4.3.7 Change to read as follows:

"If the Contractor claims that any acts or omissions of the Owner or the Architect, including any instruction or orders, whether oral, written, by Drawings, or otherwise, involve extra cost or time, and the Contractor has not received a written acknowledgment by the Owner or Architect that extra payment will be made or time extended on account thereof, the Contractor shall promptly so notify the Architect in writing of such Claim and shall not proceed with the Work relating to such Claim until the Contractor has received a further written order to proceed in accordance with Paragraph 4.4 except, as provided in Paragraph 10.6, in the case of as emergency affecting life or property. No Claim by the Contractor on account of such acts, omissions, instruction or orders shall be valid unless the Contractor has so notified the Architect, before proceeding, and has received the further written order to proceed."

4.3.8.1 Add the following to the end of subparagraph 4.3.8.1:

"The Contractor shall have the burden of demonstrating the effect of the claimed delay on the Contract Time, and shall furnish the Architect with such documentation relating thereto as the Architect may reasonably require."

4.4 Replace Paragraph 4.4 with the following:

"4.4 REVIEW OF CLAIMS BY ARCHITECT

4.4.1 The Architect shall review Claims and may (1) defer any action with respect to all or any part of a Claim and request additional information from either party; (2) decline to render a decision for any reason which he deems appropriate (including but not limited to the fact that the Claim involves allegations of fault on the part of the Architect); or (3) render a decision on all or a part of the Claim. The Architect shall notify the parties in writing of his disposition of such Claim.

If the Architect renders a decision or declines to render a decision, either party may proceed in accordance with Paragraph 4.5. If the Architect decides that the Work relating to such Claim should proceed regardless of his disposition of such Claim, the Architect shall issue to the Contractor a written order to proceed. The Contractor shall proceed as instructed, and all rights of both parties with respect to such Claim shall be deemed to have been reserved."

4.5 Replace Paragraph 4.5 with the following:

"4.5 LITIGATION

4.5.1 Either party may pursue any Claim against the other in any court having jurisdiction, provided the party has first complied with the provisions of Paragraph 4.3 and 4.4 with respect to such Claim. The word "litigation" shall be deemed to replace the word "arbitration" wherever the latter word appears in the Contract Documents.

4.5.2 Except where such condition is expressly prohibited by law, an award or judgment against the Owner in accordance with the procedure described in Paragraph 4.5 shall be a condition precedent to the filing by the Contractor or any subcontractor or Sub-subcontractor of an attachment or lien of any nature against the real estate on which the Work is situated or against the Owner's property. Lien rights are per current law."

ARTICLE 6: CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1.4 Delete subparagraph 6.1.4.

6.2.4 Add the following at the end of subparagraph 6.2.4:

"If such separate contractor sues or initiates any litigation against the Owner on account of any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend such proceedings at the Owner's expense, and if any judgment or award against the Owner arises therefrom the Contractor shall pay or satisfy it and shall reimburse the Owner for all attorneys' fees and court or litigation costs which the Owner has incurred."

ARTICLE 8 - TIME

8.3.1 In subparagraph 8.3.1, delete the words "pending arbitration" in line seven.

8.3.3- Add new subparagraph 8.3.4 and 8.3.5 as follows:

"8.3.4 No claim for delay shall be allowed on account of failure of the Architect to furnish Drawings, Specifications or instructions or to return Shop Drawings or Samples until 15 days after receipt by the Architect by registered or certified mail of written demand for such instructions, Drawings, or Samples, and not then unless such claim be reasonable.

8.3.5 The Contractor hereby agrees that the Contractor shall have no claims for damages of any kind against the Owner or the Architect on account of any delay in the commencement of the Work and/or any delay or suspension of the Work or any portion of the Work, whether such delay is caused by the Owner, the Architect or otherwise. The Contractor acknowledges that the Contractor's sole remedy for any such delay and/or suspension will be an extension of time as provided in this Article."

ARTICLE 9 - PAYMENT & COMPLETION

9.3.1 Delete the first twelve words of the first sentence of subparagraph 9.3.1.

In the last sentence of subparagraph 9.3.1, delete "....if provided for elsewhere in the Contract Documents."; and insert "...as provided for in the agreement between Owner and Contractor."

9.3.3 Change subparagraph 9.3.3 to read as follows:

"The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in this Article 9 as "liens." The Contractor further agrees that the submission of any Application for Payment shall conclusively be deemed to waive all liens with respect to said Work to which the Contractor may then be entitled, provided that such waiver of the lien rights shall not waive the Contractor's right to payment for such work."

9.3.4 Add the following new paragraph:

"9.3.4 Each Application for Payment or periodic estimate requesting payment shall be accompanied by (a) a waiver of liens from each Subcontractor or (b) a certificate from each Subcontractor stating that the Subcontractor has been paid all amounts due the Subcontractor on the basis of the previous periodic payment to the Contractor, or else stating the amount not so paid and the reason for the discrepancy. In the event of any such discrepancy, the Contractor shall furnish the Contractor's own written explanation to the Owner through the Architect. Such waiver or certificate shall be in a form acceptable to the Owner.

"Release of Liens" will be required of the Contractor, Subcontractors, and major material suppliers as shown on the list provided by the General Contractor."

9.5.1 In subparagraph 9.5.1, change item .6 and add new items as follows:

".6 reasonable evidence that the Work will not be completed within the Contract Time, and that retainage currently held by the Owner would not be adequate to cover actual or liquidated damage for the anticipated delay;

.8 a lien or attachment is filed contrary to subparagraph 4.5.9; or

.9 failure of mechanical trade or electrical trade subcontractors to comply with mandatory requirements for maintaining record drawings. The Contractor shall check record drawings each month. Written confirmation that the record drawings are current will be required by the Architect before approval of the Contractor's monthly payment requisition. Any withholding of payment is to be limited to only those subcontractors that are not in compliance."

9.5.3 Add the following new paragraphs:

"9.5.3 In no event will any materials and/or equipment be deemed delivered and suitable stored at the site (or at some other location agreed upon in writing), unless in the judgment of the Architect, the following requirements are met:

9.5.3.1 The materials and/or equipment are ready for and actually scheduled for prompt use.

9.5.3.2 The materials and/or equipment meet the requirements of the Contract Documents.

9.5.3.3 Specific detailed documentation is delivered to the Architect, which would clearly establish that materials and/or equipment are for use on this Project.

9.5.3.4 Documentation is delivered to the Architect which would clearly establish that materials and/or equipment for use on this project is covered by insurance.

9.5.3.5 The Contractor can and will adequately protect the materials and/or equipment until they are incorporated in the work.

9.5.3.6 The Contractor will pay storage charges and related expenses, if materials and/or equipment are stored at some other location agreed upon in writing.

9.5.3.7 The Contractor will submit notarized release of lien waivers from all subcontractor and major materials suppliers."

9.6.5 Delete subparagraph 9.6.5.

9.7.1 Delete the words "or awarded by arbitration" from line 6 of subparagraph 9.7.1.

9.8.1 Add at the end of subparagraph 9.8.1:

"and only minor items which can be corrected or completed without any material interference with the Owner's use of the Work remain to be corrected or completed."

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.1.2 In subparagraph 10.1.2, add the phrase ",or other materials classified as hazardous," in the first sentence after "(PCB)".

10.1.3 In subparagraph 10.1.3, add the phrase ",or other materials classified as hazardous." after "(PCB)".

10.1.4 In subparagraph 10.1.4, add the phrase ",or other materials classified as hazardous," in the first sentence after "(PCB)".

10.2.1.2 In subparagraph 10.2.1.2, delete the "and" at the end of the subparagraph.

10.2.1.3 In subparagraph 10.2.1.3, add the word "and" to the end of the subparagraph.

10.2.1.4 Add the following new subparagraph:

".4 any other property of the Owner, whether or not forming part of the Work, located at the site or adjacent thereto in areas to which the Contractor has access."

10.2.8-
10.2.12 Add the following new paragraphs:

"10.2.8 The Contractor shall provide and maintain in good operating condition suitable and adequate fire protection equipment and services, and shall comply with all reasonable recommendations regarding fire protection made by the representatives of the fire insurance company carrying insurance on the work or by the local fire chief or fire marshal. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.

10.2.9 The Contractor shall be responsible for all existing pipe lines, conduits, poles, wiring and other utilities that in any way interfere with the work, whether or not they are specifically shown on the drawings. He shall notify the proper authorities and see that all items to be maintained are protected, supported, or relocated as necessary to adjust then to the new work. Any damage to active utilities shall be corrected by the Contractor at no cost to the Owner. This shall only apply in the event that negligence is proven.

10.2.10 The Contractor shall at all times protect excavations, trenches, buildings and materials from rain water, ground water, and from water of any other origin and shall remove promptly any accumulation of water. He shall provide and operate all pumps, piping and other equipment necessary to achieve this end. The Contractor shall also remove any snow or ice that might cause damage or delay.

10.2.11 During the progress of the work and at all times prior to the date of Substantial Completion or Occupancy of the Work by the Owner, whichever is earlier, the contractor shall provide temporary heat, ventilation, and enclosure, adequate to prevent damage to completed work or work in progress, or to materials stored on the premises. The permanent heating and ventilation systems may be used for these purposes only if and as specifically provided for in the Contract Documents.

10.2.12 The Contractor shall take all precautions necessary to prevent loss or damage caused by vandalism, theft, burglary, pilferage, or unexplained disappearance of property

of the Owner located within those areas of the Project to which the Contractor has access. The Contractor shall reimburse the Owner for any such loss, damage or injury except such as may be directly caused by agents or employees of the Owner."

10.3.2 Add the following subparagraph:

"10.3.2 The Contractor shall furnish the Owner and the Architect, in writing, the names, addresses and telephone numbers of members of the Contractor's organization to be called in the event of an out-of-hours emergency at the project site."

ARTICLE 11 - INSURANCE AND BONDS

11.1 - CONTRACTOR'S LIABILITY INSURANCE

11.1.1 In the first sentence following the word "located" insert the words: "and to which the Owner has no reasonable objection"...

11.1.2 Add the following to subparagraph 11.1.2:

"11.1.2.1 Worker's Compensation and other benefits as required by laws of the State of Maine.

11.1.2.2 Employer's Liability with a limit of at least $ 500,000 each accident.

11.1.2.3 Commercial General Liability including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability sufficient to meet obligations under paragraph 3.18, Personal Injury, and Broad Form Property Damage (including coverage for Explosion, Collapse and Underground hazards:

Bodily Injury and Property Damage	
Each Occurrence	$ 1,000,000
Aggregate	$ 2,000,000

Products and Completed Operations	
Personal Injury	$ 1,000,000
Aggregate	$ 2,000,000

Comprehensive Automobile
Each Occurrence $ 1,000,000
Owned X Non-owned X

11.1.2.4 The Contractor shall procure All Risk Insurance covering all Contractor's equipment with a provision for Waiver of Subrogation against the Owner."

11.1.4 Add the following subparagraph:

"11.1.4 Furnish one copy of Certificates herein required for each copy of the agreement; specifically set forth evidence of all coverage required by subparagraph 11.1.2 and 11.4.1 The form of the certificate shall be AIA Document G705. The Contractor shall furnish the

Owner copies of any endorsements that are subsequently issued amending coverage or limits."

11.4.2 Change to read as follows:

"The Contractor shall furnish copies of Bonds, including subcontractor's bonds, to the Owner."

Add the following new Article 15:

"ARTICLE 15 - ADDITIONAL CONDITIONS

15.1 It is hereby understood and mutually agreed by and between the Contractor and the Owner, that the date of the beginning and time for completion as specified in the contract of the work to be done hereunder are essential conditions of this contract, and it is further mutually understood and agreed that the work embraced in this contract shall be commenced upon issuance of Notice to Proceed by the Owner.

15.2 The Contractor agrees that said work shall be prosecuted at such rate of progress as will insure full completion thereof with the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time for the completion of same taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

15.6 The Owner shall have the right to enter the premises for the purpose of doing work not covered by the Contract Documents. This provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the work, or the restoration of any damaged work except such as may be caused by agents or employees of the Owner not party to this Contract."

END OF SUPPLEMENTARY CONDITIONS

DRAWING LIST

	General
GI001	TITLE SHEET
GI002	WALL TYPES, FIRESTOPPING DETAILS & TYPICAL MOUNTING HEIGHTS
GI003	CODE COMPLIANCE PLAN & SUMMARY
	Architectural
A-001	PHASING PLAN
AD101	DEMOLITION PLAN
AE100	EXISTING EQUIPMENT PLAN
AE101	FIRST FLOOR PLAN
AE102	REFLECTED CEILING PLAN
AE103	ROOF PLAN
AE201	EXTERIOR ELEVATIONS
AE301	SECTIONS
AE501	SECTIONS, DETAILS & INTERIOR ELEVATIONS
AE601	EQUIPMENT & FURNISHINGS SCHEDULE
AE602	ROOM FINISH SCHEDULE AND DETAILS
AE603	DOOR SCHEDULES, DOOR AND WINDOW ELEVATIONS AND DETAILS
AF101	FLOOR FINISH PLANS
	Structural
SF101	ROOF TOP UNIT ED SUPPORT FRAME
	Mechanical
M-001	LEGEND & ABBREVIATIONS
MD101	MECHANICAL DEMOLITION PLAN
MH101	HVAC DUCTWORK PLAN
MH102	MECHANICAL ROOF PLAN
MP101	HVAC PIPING PLAN
M401	PART PLANS & SCHEMATIC
M501	DETAILS
M601	SCHEDULES
	Plumbing
PD101	MEDICAL GAS & SUPPLY PIPING DEMOLITION PLAN
PL101	DWV PIPING PLAN
PL102	MEDICAL GAS & SUPPLY PIPING PLAN
PL601	SCHEDULES & DETAILS
	Electrical
E-001	LEGEND & GENERAL NOTES
ED101	ELECTRICAL DEMOLITION PLAN
EP101	POWER PLAN
EP102	POWER & SYSTEMS ROOF PLAN
EL101	LIGHTING PLAN
EY101	SYSTEMS PLAN
E-401	POWER PART PLAN
EP601	PANEL SCHEDULES
EL601	LIGHT FIXTURE SCHEDULE

SECTION 01100

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Project consists of the renovation of existing Emergency Department.

1. Project Location:
   a. Mercy Hospital
      144 State Street
      Portland, Maine 04101
2. Owner: Same as above.

B. Architect Identification: The Contract Documents are prepared for the Project by SMRT Inc., 144 Fore Street, P.O. Box 618, Portland, Maine, 04104.

C. Construction Manager: H. P. Cummings Construction Company, One Greenwood Park, P.O. Box 297 Winthrop, Maine 04364 is Construction Manager for this Project and is Project's Constructor. In Divisions 1 through 16 Specifications, the terms "Construction Manager" and "Contractor" are synonymous.

D. Project Coordinator: Bill Connolly has been appointed by Owner to serve as the Owner's Project Coordinator.

1.3 CONTRACT

A. Project will be constructed under a general construction contract between the Owner and Construction Manager.

1.4 USE OF PREMISES

A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period as designated on the construction documents. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.5 WORK UNDER OTHER CONTRACTS

A. Separate Contract: Owner will award separate contracts for performance of certain construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

B. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.6 OWNER-FURNISHED PRODUCTS

A. Owner will furnish the following items to be installed by the Contractor:
   1. Owner-furnished and Contractor-Installed items are identified on the drawings and specifications for each trade.
   2. Owner-Furnished items may consist of existing items to be relocated, which are also identified on the drawings and/or specifications.

B. The Work includes providing support systems to receive Owner's equipment and plumbing, mechanical, and electrical connections.

   1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
   2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
   3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
   4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
   5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
   6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
   7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
   8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
   9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
   10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.

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

beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

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

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

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

1.8 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

SECTION 01140

WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy of site and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.3 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations.

B. Partial Owner Occupancy: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.

3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will provide, operate, and maintain mechanical and electrical systems serving occupied portions of building.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01140

SECTION 01230

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

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

1.4 PROCEDURES

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Replace ACT ceiling and light fixtures in Main Entrance Lobby 1210.

B. Alternate No. 2: Substitute walk-off mat flooring in place of rubber tile in 1210, 1210A and 1187A.

C. Alternate No. 3: Replace aluminum window system adjacent to new automatic sliding door.

D. Alternate No. 4: Substitute Marmoleum in place of VCT in the following rooms: 1139A, 1141, 1181, 1188, 1189, 1190, 1191, 1192, 1193, 1196, 1197, 1198, 1199, 1201, 1202, 1204, 1205, 1205B, 1205C, 1206A, 1206B, 1206C, and 1208.

E. Alternate No. 5: Substitute sheet vinyl in place of VCT in the following rooms: 1185, 1186, 1194, 1200, 1203 and 1207.

END OF SECTION 01230

SECTION 01250

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
   1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions." Form is included at end of Part 3.

1.4 PROPOSAL REQUESTS

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

   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within (7) seven business days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

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

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

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

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

C. Proposal Request Form: Architect and Contractor shall use "AIA Document G709, Proposal Request." Form is included at end of Part 3.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on SMRT Change Order form included at end of Part 3.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on SMRT Construction Change Directive form included at end of Part 3. The Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 The forms following the end of this section will be utilized for Contract Modifications as described above.

A. AIA Document G710, SUPPLEMENTAL INSTRUCTIONS

B. AIA Document G709, PROPOSAL REQUEST

C. SMRT Change Order Form

D. SMRT Construction Change Directive

END OF SECTION 01250

SECTION 01290

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
   1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
   2. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   3. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

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

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

   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

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

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

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

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

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

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

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

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

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

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

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

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

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

B. Payment Application Times: The date for each progress payment is the 25th day of each month, as indicated in the Agreement between Owner and Contractor. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 25 days before the date for each progress payment. If an Application for Payment is received by the Architect after the application date above, payment shall be made by the Owner not later than 20 days after the Architect receives the Application for Payment.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

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

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

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments.

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

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

1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.

a. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

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

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

SECTION 01310

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 1 Section "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule.
2. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

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

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

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

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

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

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

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

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

1.4 SUBMITTALS

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

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

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

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

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.6 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within **3 business** days of the meeting.

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

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

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

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

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner and Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

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

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

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

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

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule,

in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

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

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

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

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

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

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

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01320

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Construction Schedule.
   2. Submittals Schedule.
   3. Field condition reports.
   4. Special reports.

B. Related Sections include the following:

   1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
   4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.
   5. Division 1 Section "Closeout Procedures" for submitting photographic negatives as Project Record Documents at Project closeout.

1.3 SUBMITTALS

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

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

B. Preliminary Construction Schedule: Submit **two** printed copies.

C. Contractor's Construction Schedule: Submit **two** printed copies of initial schedule.

D. Daily Construction Reports: Submit **two** copies at **weekly** intervals.

E. Material Location Reports: Submit **two** copies at **monthly** intervals.

F. Daily Field Condition Reports: Submit **two** copies at **weekly** intervals.

G. Special Reports: Submit **two** copies at time of unusual event.

1.4 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Discuss constraints, including phasing, area separations, interim milestones, and partial Owner occupancy.
2. Review delivery dates for Owner-furnished products.
3. Review schedule for work of Owner's separate contracts.
4. Review time required for review of submittals and resubmittals.
5. Review requirements for tests and inspections by independent testing and inspecting agencies.
6. Review time required for completion and startup procedures.
7. Review and finalize list of construction activities to be included in schedule.
8. Review submittal requirements and procedures.
9. Review procedures for updating schedule.

1.5 COORDINATION

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

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

1. Secure time commitments for performing critical elements of the Work from parties involved.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

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

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.

2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

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

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

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

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

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

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

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

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

1. Phasing: Arrange list of activities on schedule by phase.

2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner, such as installation and reinstallation of Imaging equipment.
3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

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

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

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

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

7. Other Constraints: Insert additional constraints not indicated elsewhere.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Commencement of Construction for each phase, Substantial Completion for each phase, and Final Completion.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.

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

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

2.3 CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for commencement of the Site and Structural Work

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.4 REPORTS

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

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. As the Work progresses, indicate Actual Completion percentage for each activity.

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

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

END OF SECTION 01320

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
1. Division 1 Section "Payment Procedures" for submitting Applications for Payment.
2. Division 1 Section "Project Management and Coordination" for submitting Coordination Drawings.
3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals and for erecting mockups.
5. Division 1 Section "Closeout Procedures" for submitting warranties Project Record Documents and operation and maintenance manuals.

1.3 SUBMITTALS

A. Sample Submittal: Submit first project submittal within one week of Notice to Proceed. First project submittal shall be a sample of the Contractor's submittal review stamp incorporating the specified compliance statement. Submittal shall also demonstrate correct transmittal form, submittal format, numbering, etc. for project.

1.4 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action including product data submittals and shop drawings. Refer to Part 2.

B. Informational Submittals: Written information that does not require Architect's approval such as test reports, certifications, maintenance data, insurance certificates, etc. Refer to Part 2. Submittals may be rejected for not complying with requirements.

1.5 SUBMITTAL PROCEDURES

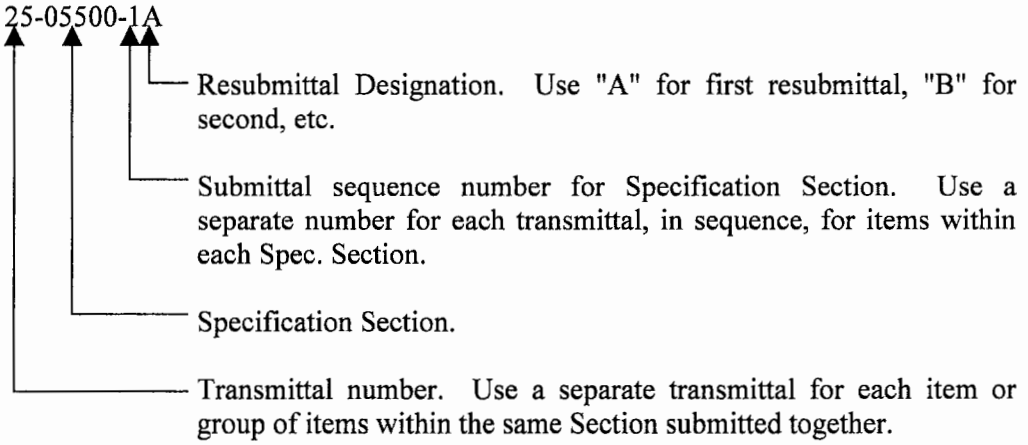
A. General: Copies of Architectural Floor Plan drawings in digital format will be provided for a fee by the architect to those requesting same in accordance with the "Authorization Statement for Electronic Transfer" form. (Example attached herein). Information provided in digital format is for the sole information and use of the authorizing entity. Further copying or transfer of this information is prohibited by copyright.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

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

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
   1. Initial Review: Allow 21 days for review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination. Submittal review periods will apply only with the submittal and approval of the submittal schedule.
   2. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a permanent label or title block on each submittal for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space approximately 4 by 8 inches (100 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
   3. Submittal tracking number: Mark each submittal with a tracking number as follows:



   4. Include the following information on label for processing and recording action taken:
      a. Project name.

b. Date.
c. Name and address of Architect.
d. Name and address of Contractor.
e. Name and address of subcontractor.
f. Name and address of supplier.
g. Name of manufacturer.
h. Submittal tracking number.
i. Drawing number and detail references, as appropriate.
j. Identification of submittal as an ACTION SUBMITTAL (requiring return) or INFORMATIONAL SUBMITTAL (requiring no return).
k. Other necessary identification.

F. Deviations: Submit only specified products. Highlight, encircle, or otherwise identify minor deviations from the Contract Documents on submittals. Deviations not specifically approved and later found to be in conflict with Contract Documents may be rejected. Refer to Division 1 Section "Product Requirements" for substitution requirements.

G. Transmittal: Package each submittal individually and appropriately for review and handling. Submittals transmitted together will be reviewed and returned together. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
3. Transmittal Form: Provide locations on form for the following information:
a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Submittal tracking number.
g. Submittal purpose and description.
h. Submittal and transmittal distribution record.
i. Remarks.
j. Signature of transmitter.

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

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

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.
   1. Number of Copies: Submit the number of copies of each submittal the Contractor requires plus those required for reviewers, unless otherwise indicated. Architect will retain two copies. Mark up and retain one returned copy as a Project Record Document.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's written recommendations.
      b. Manufacturer's product specifications.
      c. Manufacturer's installation instructions.
      d. Standard color charts.
      e. Manufacturer's catalog cuts.
      f. Wiring diagrams showing factory-installed wiring.
      g. Printed performance curves.
      h. Operational range diagrams.
      i. Mill reports.
      j. Standard product operating and maintenance manuals.
      k. Compliance with recognized trade association standards.
      l. Compliance with recognized testing agency standards.
      m. Application of testing agency labels and seals.
      n. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Include the following information, as applicable:
      a. Dimensions.
      b. Identification of products.
      c. Fabrication and installation drawings.
      d. Roughing-in and setting diagrams.
      e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
      f. Shopwork manufacturing instructions.
      g. Templates and patterns.
      h. Schedules.
      i. Design calculations.
      j. Compliance with specified standards.
      k. Notation of coordination requirements.
      l. Notation of dimensions established by field measurement.
   2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
   3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).

4. Number of Copies: Submit one reproducible print and two blue- or black-line prints. Architect will return the reproducible print. At the Contractor's option, a black line print may be submitted as the reproducible print.

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

E. Samples: Prepare physical units of materials or products, including the following:
1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
2. Samples for Selection:
   a. When indicated, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   b. When indicated, submit full-size units or samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
3. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:
   a. Generic description of Sample.
   b. Product name or name of manufacturer.
   c. Sample source.
4. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
   a. Size limitations.
   b. Compliance with recognized standards.
   c. Availability.
   d. Delivery time.
5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
   a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
   b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
6. Number of Samples for Selection: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
   a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
7. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

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

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

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

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

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

L. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

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

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

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

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

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

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

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

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

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

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

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

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

N. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.

4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

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

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

Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

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

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

T. Material Safety Data Sheets: Submit information directly to Owner. If submitted to Architect, Architect will not review this information but will return it with no action taken.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
   1. Stamp or statement shall include the following: "The Contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto or will do so, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents."

3.2 ARCHITECT'S ACTION

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

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

- ☐ APPROVED
- ☐ PROVIDE AS NOTED
- ☐ REJECTED
- ☐ REVISE AND RESUBMIT
- ☐ RESUBMIT SPECIFIED ITEM
- ☐ INFORMATIONAL SUBMITTAL FOR RECORD ONLY
- ☐ NOT A REQUIRED SUBMITTAL - NOT REVIEWED

This review was performed for the limited purpose of determining general conformance with the design concept of the project and general compliance with the formation given in the Contract Documents. Modifications or comments made on the submittal during this review don not relieve the Contractor from compliance with the requirements of the drawings and specifications. Approval of a specific item does not include approval of the assembly of which the item is a component. The Contractor is responsible for: quantities and dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of the work of all trades; and for performing all work in a safe and satisfactory manner.

SMRT, Inc.

Date _____

By _____

C. The action stamp above will be appropriately marked and executed to indicate whether the submittal returned is approved for unrestricted release, final-but-restricted release, returned for resubmittal, or not approved.
   1. Final Unrestricted Release/Approved: When the Architect/Engineer marks a submittal or a part of a submittal "APPROVED", the Work covered by the submittal or part of a submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
      a. Marking: "APPROVED"
   2. Final-But-Restricted Release/Conditionally Approved: When the Architect/Engineer marks a submittal or part of a submittal "PROVIDE AS NOTED," the Work covered by the submittal or part of a submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
      a. Marking: "PROVIDE AS NOTED"
   3. Returned for Resubmittal/Not Approved: When the Architect/Engineer marks a submittal or part of a submittal "REVISE AND RESUBMIT," do not proceed with Work covered by the submittal or part of a submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
      a. Do not use, or allow others to use, submittals marked "REVISE AND RESUBMIT" at the Project Site or elsewhere where Work is in progress.
      b. Marking: "REVISE AND RESUBMIT" or "RESUBMIT SPECIFIC ITEM"
   4. Not approved: When the Architect/Engineer marks a submittal or part of a submittal "REJECTED", the Work covered by the submittal or part of a submittal does not conform to the contract documents. Submittal of specified item is required prior to proceeding with Work covered by the submittal.
   5. Informational Submittal: Informational submittal items are filed for project record only. Informational submittals do not require an action, though they may cause a reaction if the information reported identifies a problem to be resolved. Refer to specific submittals for further information.
   6. Not a Required Submittal: When the Architect/Engineer marks a submittal or part of a submittal "NOT A REQUIRED SUBMITTAL - NOT REVIEWED", the submittal is not required and approval is not required. All copies may be returned with no action taken.

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

END OF SECTION 01330

SMRT

ARCHITECTURE
ENGINEERING
PLANNING

AUTHORIZATION STATEMENT For ElectronicTransfer

Project No.: **Project Name:**

ORDERED BY: *(Type Company name, contact, and address)*

DESCRIPTION OF SERVICE: Providing electronic base drawing information.

FEE BASIS: ☐ $ (Minimum $250 per request) ☐ Fee Waived

TERMS AND CONDITIONS: All documents and information prepared by SMRT, Inc. for this project, including information in electronic format, are instruments of our service, and are for use solely with respect to this project. SMRT, Inc. retains all common law, statutory and other reserved rights, including the copyright for these instruments of service.

Use of design information in electronic format from SMRT, Inc. does not represent review or approval of the user's work by the design professional. Making this information available in electronic format, in no way implies that the recipient is required by SMRT, Inc. to use it. Use of information supplied by SMRT, Inc. in electronic format is at the sole risk and liability of the user. The user agrees to waive any claim against SMRT, Inc. and our employees, and to defend, indemnify, and hold them harmless from any claim or liability that allegedly arises from the use of information furnished in electronic format.

The decision to use design information in electronic format obligates the user to verify the accuracy of the design against hardcopy representation of the design bearing the same issuance date. Information supplied in electronic format represents the most current status of the design at the date of the drawing's issuance. It is the user' s responsibility to verify that the electronic information in their possession stays current throughout the life of the project, and to update the information as required to maintain it current. The user is also responsible to compare design information received in electronic format with field measurements and conditions prior to their making use of the information.

Information provided in digital format is for the sole information and use of the authorizing entity. Further copying or transfer of this information is prohibited by copyright. Payment for information in electronic format is due in full prior to transmittal of the information.

AUTHORIZATION: I/We hereby grant permission or have obtained permission for SMRT, Inc. to perform the above services.

APPROVED/ACCEPTED BY: *(Type Company name)*

SIGN HERE: _____

Print or type signer's name here: _____

SMRT, INC.

_____
Project Manager

Date: _____

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PO Box 618
Portland, Maine 04104
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207 772-1070
www.smrtinc.com

SECTION 01400

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

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

C. Related Sections include the following:

1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
3. Divisions 2 through 16 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

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

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

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

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

1.4 DELEGATED DESIGN

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

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

1.5 REGULATORY REQUIREMENTS

A. Copies of Regulations: Obtain copies of the following regulations and retain at Project site to be available for reference by parties who have a reasonable need:

1. NFPA 101, Life Safety Code, 2000 Edition

2. BOCA National Building Code, 1999 Edition

3. National Electric Code (NFPA 70), 1999 Edition

4. State of Maine Internal Plumbing Rules, latest Edition

1.6 SUBMITTALS

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

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

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

1. Specification Section number and title.
2. Description of test and inspection.

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

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

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

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

1.7 QUALITY ASSURANCE

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

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

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

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

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing

engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

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

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

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

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

1. Contractor responsibilities include the following:

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

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

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

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

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

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

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.

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

C. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

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

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

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

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

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

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

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

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

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

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Site and Structural Work and within 30 days of date of Notice of Award for entire project.

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

PART 2 - PRODUCTS (Not Used)

PART 3 -EXECUTION

3.1 REPAIR AND PROTECTION

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

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

2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

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

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

END OF SECTION 01400

SECTION 01420

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

1.3 INDUSTRY STANDARDS

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

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

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

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

D. Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity.

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

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	 (800) 872-2253 (202) 272-5434
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online Available from General Services Administration www.fss.gsa.gov/pub/fed-specs.cfm	 (215) 697-6257 (202) 619-8925

	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	 (800) 872-2253 (202) 272-5434

1.4 ABBREVIATIONS AND ACRONYMS

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

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AAN	American Association of Nurserymen (See ANLA)	
AASHTO	American Association of State Highway and Transportation Officials www.aashto.org	(202) 624-5800
ACI	American Concrete Institute/ACI International www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AFPA	American Forest & Paper Association (See AF&PA)	
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association	(202) 824-7000

	www.aga.org	
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association www.hardboard.org	(847) 934-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America www.alca.org	(800) 395-2522 (703) 736-9666
ALSC	American Lumber Standard Committee	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen) www.anla.org	(202) 789-2900
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400

ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industries International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (See WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(817) 326-6300
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
CCFSS	Center for Cold-Formed Steel Structures www.umr.edu/~ccfss	(573) 341-4471
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137

CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FGMA	Flat Glass Marketing Association (See GANA)	
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association) www.glasswebsite.com/gana	(785) 271-0208
GTA	Glass Tempering Division of Glass Association of North America	

	(See GANA)	
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	(613) 233-1510
I3A	International Imaging Industry Association (Formerly: PIMA - Photographic & Imaging Manufacturers Association) www.pima.net	(914) 698-7603
ITS	Intertek Testing Services www.itsglobal.com	(800) 345-3851 (607) 753-6711
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association) www.lma.org	(201) 664-2700
LSGA	Laminated Safety Glass Association (See GANA)	
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
ML/SFA	Metal Lath/Steel Framing Association	

	(See SSMA)	
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NAAMM	North American Association of Mirror Manufacturers (See GANA)	
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NAIMA	North American Insulation Manufacturers Association (The) www.naima.org	(703) 684-0084
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(414) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFPA	National Fire Protection Association www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council	(301) 589-6372

	www.nfrc.org	
NGA	National Glass Association www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association (Formerly: NSA - National Stone Association) www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo and Mosaic Association, Inc. www.ntma.com	(800) 323-9736 (703) 779-1022
NWWDA	National Wood Window and Door Association (See WDMA)	
PDCA	Painting and Decorating Contractors of America www.pdca.com	(800) 332-7322 (703) 359-0826
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (508) 230-3516
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400
RFCI	Resilient Floor Covering Institute www.rfci.com	Contact by mail only
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234

SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.screenmfgassociation.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPRI	SPRI (Single Ply Roofing Institute) www.spri.org	(781) 444-0242
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association) www.ssma.com	(312) 456-5590
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, and Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
WCSC	Window Covering Safety Council	(800) 506-4636

	(Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(212) 661-4261
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

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

BOCA	BOCA International, Inc. www.bocai.org	(708) 799-2300
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials (The) www.iapmo.org	(909) 595-8449
ICBO	International Conference of Building Officials www.icbo.org	(800) 284-4406 (562) 699-0541
ICC	International Code Council, Inc. (Formerly: CABO - Council of American Building Officials) www.intlcode.org	(703) 931-4533

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

EPA	Environmental Protection Agency www.epa.gov	(202) 260-2090
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
OSHA	Occupational Safety & Health Administration	(800) 321-6742

www.osha.gov (202) 693-1999

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1. Not Required.

C. Support facilities include, but are not limited to, the following:
1. Waste disposal facilities.
2. Field offices.
3. Storage and fabrication sheds.
4. Lifts and hoists.
5. Construction aids and miscellaneous services and facilities.

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

E. Related Sections include the following:
1. Division 1 Section 01800 Interim Life Safety Measures
2. Division 1 Section 01850 Dust Control Measures

1.3 QUALITY ASSURANCE

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

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

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

1.4 PROJECT CONDITIONS

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

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

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

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

PART 2 - **PRODUCTS**

2.1 MATERIALS

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

B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry".

C. Roofing: Standard-weight, mineral-surfaced, asphalt shingles or asphalt-impregnated and -coated, mineral-surfaced, roll-roofing sheet.

D. Gypsum Board: Minimum 5/8 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

F. Paint: Comply with requirements in Division 9 Section "Painting."

G. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Field Offices: TBD.

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

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

D. Self-Contained Toilet Units: TBD.

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

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

PART 3 - **EXECUTION**

3.1 INSTALLATION, GENERAL

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

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

3.2 TEMPORARY UTILITY INSTALLATION

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

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

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

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

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

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

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

H. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

I. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

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

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

L. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

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

1. Construct framing, sheathing, and siding using fire-retardant-treated lumber and plywood.
2. Paint exposed lumber and plywood with exterior-grade acrylic-latex emulsion over exterior primer.

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

D. Temporary Elevator Usage: Refer to Division 14 Sections for temporary use of new elevators.

E. Existing Elevator Usage: Use of Owner's existing elevators will be permitted, as long as elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

F. Existing Stair Usage: Use of Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

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

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

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

E. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions of not less than nominal 4-inch (100-mm) studs, 5/8-inch (16-mm) gypsum wallboard with joints taped on occupied side, and 1/2-inch (13-mm) fire-retardant plywood on construction side.
2. Construct dustproof, floor-to-ceiling partitions of not less than nominal 4-inch (100-mm) studs, 2 layers of 3-mil (0.07-mm) polyethylene sheets, inside and outside temporary enclosure. Cover floor with 2 layers of 3-mil (0.07-mm) polyethylene sheets, extending sheets 18 inches (460 mm) up the side walls. Overlap and tape full length of joints. Cover floor with 3/4-inch (19-mm) fire-retardant plywood.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weatherstrip openings.

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

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.

2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition. In occupied facilities the security department must be notified prior to any open -flame device being used.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
8. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

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

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

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

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 01500

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Submittal Procedures" for submitting surveys.
3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - **EXECUTION**

2.1 EXAMINATION

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

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

2.2 PREPARATION

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

1. Notify Owner not less than 3 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

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

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

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

2.3 INSTALLATION

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

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

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

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

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

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

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

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

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

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

2.4 OWNER-INSTALLED PRODUCTS

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

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

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

2.5 PROGRESS CLEANING

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

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

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

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

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

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

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

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

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

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

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

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

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

2.6 STARTING AND ADJUSTING

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

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

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

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

2.7 PROTECTION OF INSTALLED CONSTRUCTION

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

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

2.8 CORRECTION OF THE WORK

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

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

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

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

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

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

END OF SECTION 01700

SECTION 01731

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building for alterations.
2. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.
3. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

    a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS

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

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

1.4 SUBMITTALS

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

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

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

1.5 QUALITY ASSURANCE

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

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

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Conveying systems.
7. Electrical wiring systems.
8. Operating systems of special construction in Division 13 Sections.

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

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

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

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
   a. Preformed metal panels.
   b. Roofing.
   c. Firestopping.
   d. HVAC enclosures, cabinets, or covers.

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

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

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

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

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 PERFORMANCE

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

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

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

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

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

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

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

END OF SECTION 01731

SECTION 01732

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of a building or structure.
2. Repair procedures for selective demolition operations.

B. Related Sections include the following:

1. Division 1 Section "Summary" for use of the premises and phasing requirements.
2. Division 1 Section "Work Restrictions" for restrictions on use of the premises due to Owner or tenant occupancy.
3. Division 1 Section "Construction Progress Documentation" for preconstruction photographs taken before selective demolition.
4. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
5. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
6. Division 1 Section "Interim Life Safety Measures".
7. Division 1 Section "Dust Control Measures" for specific dust control requirements.
8. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
9. Division 16 Sections for demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Owner's Removal and Salvage: Contractor to coordinate with owner on items to be salvaged for owners reuse. Contractor to remove all items and coordinate with owner.. Contractor shall coordinate removal and salvage schedule with Owner, in order to provide Owner adequate time to remove the selected items to be salvaged.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Proposed Dust-Control and Noise-Control Measures: Comply with requirements as defined within Owner's ICRA. Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of temporary partitions and means of egress effected by selective demolition operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

C. Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Maintain access to existing fire-lanes, walkways, corridors, and other adjacent occupied or used facilities.

1. Do not close or obstruct fire-lanes, walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for condition of areas to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
2. Before selective demolition, Owner will remove items to be salvaged before start of the selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site will not be permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

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

1. If possible, retain original Installer or fabricator to patch the exposed Work listed below that is damaged during selective demolition. If it is impossible to engage original Installer or fabricator, engage another recognized experienced and specialized firm.
   a. Preformed metal panels.
   b. Firestopping.
   c. HVAC enclosures, cabinets, or covers.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

D. Utility Requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise, in accordance with Owner's ICRA. See Specification Section 01850.

3.4 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with Owner's ICRA and governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

2. Covered containers.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials promptly.
9. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Removed and Reinstalled Items: Comply with the following:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

E. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

F. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

G. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Division 1 Section "Cutting and Patching."

C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 01732

SECTION 01770

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 1 Section "Construction Progress Documentation" for submitting Final Completion construction photographs and negatives.
3. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
4. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Division 1 Section "Demonstration and Training" for requirements for instruction of Owner's personnel.
6. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

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

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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

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

1.4 FINAL COMPLETION

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

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

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

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

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1. Organize list of spaces in sequential order, proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

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

1.6 PROJECT RECORD DOCUMENTS

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

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

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

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

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

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

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

D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data:

a. Emergency instructions and procedures.
b. System, subsystem, and equipment descriptions, including operating standards.
c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
d. Description of controls and sequence of operations.
e. Piping diagrams.

2. Maintenance Data:

   a. Manufacturer's information, including list of spare parts.
   b. Name, address, and telephone number of Installer or supplier.
   c. Maintenance procedures.
   d. Maintenance and service schedules for preventive and routine maintenance.
   e. Maintenance record forms.
   f. Sources of spare parts and maintenance materials.
   g. Copies of maintenance service agreements.
   h. Copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.8 WARRANTIES

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

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

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
   2. Schedule training with Owner.
   3. Include instruction for the following:
      a. System design and operational philosophy.
      b. Review of documentation.
      c. Operations.
      d. Adjustments.
      e. Troubleshooting.
      f. Maintenance.
      g. Repair.

3.2 FINAL CLEANING

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

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

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

      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural

weathering of exterior surfaces. Restore reflective surfaces to their original condition.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

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

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

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

END OF SECTION 01770

SECTION 01782

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Sections include the following:

1. Division 1 Section "Summary of Multiple Contracts" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
2. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
4. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for products in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

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

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

1.5 COORDINATION

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

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

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

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

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

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

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

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

2.2 MANUALS, GENERAL

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

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

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

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.

6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

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

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

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

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (115-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

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

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (115-by-280-mm), 20-lb/sq. ft. (75-g/sq. m) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

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

2.3 OPERATION MANUALS

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

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

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

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

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

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

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

2.4 PRODUCT MAINTENANCE MANUAL

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

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and

telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

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

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

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

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

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

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

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

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

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

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

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

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

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

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

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

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

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

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

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

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

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

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

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

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

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.

2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

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

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

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

1. Do not use original Project Record Documents as part of operation and maintenance manuals.

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

END OF SECTION 01782

SECTION 01800

INTERIM LIFE SAFETY MEASURES (ILSM)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

B. Contract Documents: Indicate the work of the Contract and related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the Contract Documents include, but are not necessarily limited to the following:

1. Existing conditions and restrictions on the use of the floor.

2. Requirements for partial Owner occupancy of portions of the work prior to substantial completion of the Contract Work.

1.02 SUMMARY OF LIFE SAFETY MEASURES

A. The work of this section can be summarized as follows:

1. The purpose of this Section is to develop and implement actions required to be taken to compensate for hazards posed by Life Safety Code (LSC)Deficiencies whenever they occur during construction, alteration, and/or demolition activities.

2. Exits shall be maintained to provide free and unobstructed egress at all times. If alternative exits must be designated, all construction personnel in adjoining areas shall receive training for egress. Such training shall be provided and documented by the Contractor, and conducted in the presence of the Project Manager. Staff shall receive training for egress from staff.

3. Means of egress in construction areas shall be inspected weekly by the Contractor and a weekly log of these inspections shall be kept by the Contractor.

4. Emergency departments (fire, rescue, security, etc.) shall be provided with free and unobstructed access for emergency services.

5. All fire alarm, detection, and suppression systems shall not be impaired without prior approval by the Project Manager. Temporary systems shall be provided by the Contractor if a fire system is impaired for more than twenty four (24) hours. Any temporary systems shall be inspected and tested monthly by the Contractor; all inspections and tests shall be fully documented. Temporary systems shall be approved by the Project Manager.

6. All temporary construction partitions that compromise a fire or smoke barrier shall be maintained smoke-tight and constructed of non-combustible or limited-combustible materials that will not contribute to the development or spread of a fire. All seams

and joints shall be taped.

7. The Contractor shall provide additional fire-fighting equipment and use training for construction personnel.

8. Smoking, including the use of any tobacco products, is prohibited at all times on any property, including buildings, grounds, and parking garages.

9. The Contractor shall develop and enforce house-keeping, storage, and debris-removal policies that reduce the flammable and combustible fire load of the building to the lowest level necessary for daily operations.

10. The Contractor shall train construction personnel in alternative fire safety procedures when structural or compartmentation features of fire safety are compromised. The Owner shall train hospital staff in these same procedures. The Owner shall also instruct the Contractor as to normal fire response procedures. All training shall be documented.

11. The Owner shall conduct organization-wide safety education programs to ensure awareness of any Life Safety Code deficiencies, construction hazards, and Interim Life Safety Measures. These programs shall be documented.

12. The Owner shall conduct and keep documentation of at least two fire drills per shift, per quarter in areas where existing deficiencies and/or construction activities reduce the level of fire safety required by the Life Safety Code. The Owner shall give the Fire Drill Coordinator a copy of the construction schedule so that the supervisor may implement these fire drills.

13. Construction areas shall be maintained in a secure condition at all times. Doors to temporary partitions shall remain locked at all times.

14. The Owner shall increase hazard surveillance of construction areas as necessary and shall document such surveillance on field report forms.

B. Documentation of all inspection, testing, training, monitoring, surveillance, and evaluation of Interim Life Safety Measures shall be provided by the Contractor and/or the Owner according to their separate responsibilities as defined in this Section.

1.03 MISCELLANEOUS PROVISIONS

A. Temporary Fire Protection

1. Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the type needed to protect against reasonable, predictable, and controllable fire losses. Comply with NFPA 10 "Standard For Portable Fire Extinguishers", and NFPA 241 "Standard For Safeguarding Construction Alterations and Demolition Operations".

2. Provide hand-carried portable, UL-rated, Class "A"fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class "ABC" dry chemical extinguishers of NFPA recommended classes for

exposures.

3. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stair.

4. Store flammable materials in metal containers in fire-safe locations.

5. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairs, and other access routes for fighting fires.

6. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition. Comply with open flame procedure.

7. Collect waste from construction areas daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris, enforcing requirements strictly. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of all waste materials in a lawful manner.

B. Observation: Regular observation of the construction site will be done by the Project Manager. Documentation of deficiencies in life safety and the use of hazardous materials will be completed and sent to the Contractor and the Safety Committee.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION (Reserved).

END OF SECTION 01800

Interim Life Safety Measures
Construction Assessment Form

Building: _____	**Date:** ___/___/___
Location in Building: _____	**Project Start Date:** ___/___/___
Project Manger: _____	**Project Completion Date:** ___/___/___

GUIDELINES	Y	N	NA
1 Will exit egress routes from occupied areas remain unchanged?	____	____	____
2 Will exit stairs remain unobstructed and fire separated?	____	____	____
3 Will fire and Smoke compartmentation remain intact and unchanged?	____	____	____
4 Will fire alarm system remain functional and unchanged?	____	____	____
5. Will fire suppression systems remain functional and unimpaired	____	____	____
6. Will construction area be separated by noncombustible smoke tight partitions?	____	____	____
7 Will non-smoking rules be posted and enforced?	____	____	____
8 Will additional fire -fighting equipment be available in the construction area?	____	____	____
9 Will construction workers be trained in the use of fire extinguishers?	____	____	____
10 Will construction workers be trained in the Facilities fire plan?	____	____	____
11 Will access to the Emergency Department be unobstructed?	____	____	____
12 Will emergency access for the local Fire Department remain unobstructed?	____	____	____
13 Other	____	____	____
Is an Interim Life Safety Measures Plan required?	____	____	____
Safety Officer Signature:	Date:		
Director of Facilities/ Project Manager Signature:	Date:		

Interim Life Safety Plan

Project Name:_____ **Project Manager:** _____

Building: _____ **Location:** _____

Projection Dates of Project: _____

Hours of Operation of Project: _____

Plan:

Additional Rounds Needed: Yes No

Extra Extinguisher/s Needed: Yes No **Location:**

Fire Alarm Devices Disabled: Yes No

Zones:_____ **Mapnets:**_____
_____

Sprinkler System Disabled: Yes No

Egress Routes be Effected: Yes No **Location:**

Areas needing training: _____ **Contact:**

_____ **Contact:**

_____ **Contact:**

_____ **Contact:**

_____ **Contact:**

SECTION 01850

DUST CONTROL MEASURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

B. Contract Documents: Indicate the work of the Contract and related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the Contract Documents include, but are not necessarily limited to the following:

1. Existing conditions and restrictions on the use of the floor.

2. Requirements for partial Owner occupancy of portions of the work prior to substantial completion of the Contract Work.

1.02 SUMMARY OF DUST CONTROL MEASURES

A. The work of this section can be summarized as follows:

1. Refer to attached Infection Control Construction Permit..

2. The purpose of this Section is to develop and implement actions required to be taken to compensate for hazards posed by aspergillus (fungi in dust which may be dislodged during construction).

2. All temporary construction partitions shall be extended from the floor through the suspended ceiling, to the underside of the floor deck above. In areas where the presence of asbestos above the ceiling system prohibits the temporary partitions to be extended to the deck, the temporary partition shall be constructed to the ceiling system, and shall be taped against the ceiling system for a complete seal.

3. The construction area shall be vacuumed prior to beginning construction, using a vacuum cleaner equipped with a HEPA filtering system.

4. All penetrations into the construction area shall be sealed, windows closed, and all supply, exhaust / return air ducts capped when possible. Coordinate this work with the Project Manager.

5. Temporary partitions to isolate the construction site shall have gasketed doors with self-closing latching hardware and dampened walk-off mats both inside and outside the construction area.

6. Negative pressure shall be maintained within the construction site at all times by the use of negative air fans fitted with high-efficiency particulate air (HEPA) filters. Route ductwork from the negative-air fans to the exterior of the building, filtering the

air in the duct prior to being discharged, by means of a standard furnace air filter.

7. Audible and/or visual alarms shall be installed so that any loss of negative pressure in the construction site can be known immediately to those outside the site. Submit suggested alarm type to the Project Manager for approval prior to installation.

8. Provide and install a magnehehelic diaphram-activated negative pressure gauge equal to Dwyer model 2000-0, with a water range of 0-.5", in each negative pressure construction area. Install the negative pressure gauge adjacent to the access door. Route a piece of plastic tubing from the gauge to a space not under construction, and not more than 20' away.

9. Debris removal from the construction site shall be completed by a predetermined route at times when patients are in their rooms with their doors closed. Debris shall be transported in clean containers with tight-fitting covers.

10. Any dust tracked out of the construction site shall be removed immediately. Cleaning in patient-occupied areas shall be with HEPA-filtered vacuum cleaners.

11. All air-handling ducts shall be shut down or covered whenever possible during demolition activities. **This covering or shut-down of air-handling ducts must and shall be approved by the Project Manager prior to modifying existing conditions.**

12. The negative air pressure system shall be activated prior to the commencement of work each day, and remain operating until one-half hour after the stop of work for each day.

13. All temporary partitions shall remain in place until all cleaning within the work areas has been completed.

PART 2 - <u>PRODUCTS</u> (Not applicable).

PART 3 - <u>EXECUTION</u> (Reserved).

Mercy Hospital
Infection Control - Construction Guidelines

Class I	Execute work by methods to lower dust from construction. **Ceiling Tiles:** immediately replace the tiles displaced for visual inspection. **Traffic:** Visitor traffic routes should avoid contact with patients.	Transportation route or storage for clean supplies not near contaminated materials. **Traffic:** Patient movement: lower patients exposure of patients to construction. **Water:** Schedule interruptions during low activity.
Class II in addition to points for Classes above	**Water:** mist work surfaces when cutting. **HVAC's:** Air vents blocked & sealed before starting. Monitor need to change or clean filters during construction. Area contained to 1 room with walls from floor to ceiling: Close door and duct tape frames & door. **Debris:** covered, sealed & taped shut during transport. No elevators used for debris removal. Service Only	**Dust:** wet-mop & place door mats at entrance. Holes in walls not exposed > 4 hrs. Cover if more. **Ceiling:** access panels without barriers must be closed when unattended. **Ceiling Tiles:** Porous: Remove & replace if wet. Nonporous: Remove, clean with dilute hypochiorite & dry before replacement.
Class III In addition to points for Classes above.	Infection Control Specialist consulted. Educate staff regarding risks. Examine design of operational laundry/trash chutes for potential transmission. **Dust Minimization:** partitions must be installed prior to starting (including construction in ceilings). Dust partitions must be sealed from floor to ceiling. **Debris:** Chute for debris removal: HEPA-filtered. Transport debris during low activity period (night best). Site thoroughly cleaned before patient admittance: remove blockage of air vents & wet mop with disinfectant. Increase frequency of cleaning adjacent areas. **Barriers:** Dampers closed temporarily to lower circulation of contaminated air. Assure adjacent air filtering systems are functioning. Thoroughly clean new area before patient admittance. Airtight plastic barrier from floor to ceiling or drywall barrier covered or sealed.	Maintain negative pressure in construction area. Increase air filter change frequency. Fresh air intakes 25 feet from exhaust outlets of vent system, combustion equip, stacks, med/surg vacuum system, plumbing vents, or area near vehicular exhaust or other fumes. Vent system cleaned & balanced after completion of construction. **Carpet:** Avoid in clinical areas (including hallways). Never in areas of frequent spillage or heavy soilage (OR's, ICU's, Labs). **Water:** Mains, branch mains, risers, and branches to a group of fixtures have stop valves. No built-in soap dispensers. Adequate room for single-use

Class III continued.	Plastic seams must be sealed with duct tape. Remove barriers carefully: reduce spread of dust/dirt. Barriers considered debris at disposal. **Ceiling:** Openings from removed tiles covered in plastic and sealed until replaced. **HVAC's:** Bottom of outdoor air intakes serving central system 6 feet above ground or 3 feet above roof. Exhaust system above roof and 75 feet from air intake.	paper towel dispensers and waste disposal. Water lines flushed at site and adjacent areas before patient occupation. Temperatures checked before patient admittance. Floor drains should be avoided. Obtain potable water when needed. **Sinks:** Easily accessible; nearby surfaces are nonporous to resist fungal growth. **Cooling Towers:** New: direct tower drift away from air intake system. Operational: drift eliminators present & biocides used regularly.
Class IV in addition to points for above Classes:	Infection Control Specialist consulted. Relocate patients to area remote from construction areas. **OR & Delivery Rooms:** air supply from ceiling outlets near center of work area. Returns (at least 2 & far apart as feasible) near floor. **Water:** No floor drains.	**Sinks:** Foot, knee, or sensor control units when risk of touch contamination (ex: OR) **Air in OR's:** Must have at least 90% filters. Anesthesia exhaust grills: may be in ceiling. **"Protected Environment Rooms:** HEPA filtered
Isolation Rooms	Negative Pressure: Exhaust to outside or recirculated after HEPA filtration. Separate toilet & sink. Adequate room for handwashing, gowning, & storage of clean & soiled materials.	Positive Pressure > 12 ACH Anteroom (s) recommended for all rooms (at least 1 room for patient with airborne infection). Best [air flow]: Hallway-anteroom-patient room. HEPA-filtered Rooms well sealed.

Mercy Hospital

Infection Control Construction Checklist

Location of Construction:	Project Start Date:	Estimated Duration:
Project Manager:	Name of Contractor:	ICS:
P.M. Phone #:	Contractor Phone #:	ICS Phone #:

Yes	No	Construction Activity. See Section A Below	Yes	No	Infection Control Risk Grou See Section B Below
		Type A: Inspection, non-invasive activity			Group 1: Least Risk
		Type B: Small scale, short duration, and minimal dust generating activity.			Group 2: Medium Risk
		Type C: Activity that generates moderate to high levels of dust requires greater than one work shift for completion.			Group 3: Medium/High Risk
		Type D: Major duration and construction activities requiring consecutive work shifts.			Group 4: Highest Risk

Construction Activity/Infection Control Matrix to Determine Class

**ICS must be consulted when the tool indicates that Class III or Class IV protocols are necessary.

	Construction Activity			
Risk Level	Type "A"	Type "B"	Type "C"	Type"D"
Group 1	I	II	II	III/IV
Group 2	I	II	III	IV
Group 3	I	III	III/IV	IV
Group 4	III	III/IV	III/IV	IV

A) Construction Activity Types:

Type A	Inspection and Non-invasive Activities, Includes, but is not limited to, removal of ceiling tiles for visual inspection limi to 1 tile per 50 square feet, painting (but not sanding), wallcovering, electrical trim work, minor plumbing, and activitie which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection.
Type B	Small scale, short duration activities which create minimal dust. Includes, but is not limited to, installation of telephone and computer cabling, access to chase spaces, cutting of walls or ceiling where dust migration can be controlled.
Type C	Any work, which generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies. Includes, but is not limited to, sanding of walls for construction, minor duct work or electri work above ceilings, major cabling activities, and any activity which cannot be completed within a single work shift.
Type D	Major demolition and construction projects. Includes, but is not limited to, activities which require consecutive work shifts, requires heavy demolition or removal of a complete cabling system, and new construction.

B) Infection Control Risk Groups

Group 1 Lowest	Group 2 Medium	Group 3 Medium High	Group 4 Highest
Office areas	All other patient care units (Ex: Cardiac, Rehab, Neuro) General Medicine Laboratories	Emergency Room Radiology/MRI Post Anesthesia Care Units (PACU) Outpatient Surgery SCU Nuclear Medicine Admission/Discharge units Echocardiography Outpatient	All OR's Sterile Processing Areas Cardiac Cath/Angiography Dialysis Units Oncology Cardiology Anesthesia All Endoscopy Areas Pharmacy Labor & Delivery Newborn Nurseries

Mercy Hospital
Infection Control

New Construction Projects: General Assessment

Initial Risk Assessment:

Patient Care Area:	Yes	No	Patients immunocompromised:	Yes	No
Operating Rooms:	Yes	No			

Discuss Procedures Performed in Area

Sinks/Water:
Must be located outside of patient bathroom and easily accessible for staff use.
Countertops or nearby surfaces must be nonporous to resist fungal growth.
Should have foot, knee, or sensor control units when risk of contamination (ex: OR).
No built-in soap dispensers.
Floor drains should be avoided.

Negative Pressure Rooms:
Must have private bathroom--not shared.
Each new floor must have at least 2.
Should have anteroom.
Must have automatic door closers.

Air Handling:
Protected Environment Rooms should be HEPA-filtered.
OR's: Must have at least 905 efficiency filters.

Sharps Boxes:
Located near point of use in patient room for easy disposal.

Disposal of Contaminated Materials:
Must have adequate and separate space for dirty and clean utility.
Dirty Utility must be conveniently located or have plan for transport of contaminated materials that Minimizes exposure to patients and decreases time contaminated materials accumulate in clinical areas.
ICU's must have an easily accessible hopper.

Carpet:
No carpeting in patient rooms, medication room, hallways of clinical areas, or areas of frequent or heavy spillage (OR, ICU's, Lab).
May be located in Nursing Stations, Conference Rooms or Lounges.

Furniture:
In clinical areas must be covered in WASHABLE material (vinyl or leather--no cloth).

***Unit-specific assessment as per Infection Control**

END OF SECTION 01850

SECTION 06105

MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Wood blocking, cants, and nailers.
   2. Wood furring.
   3. Plywood backing panels.

B. Related Sections include the following:
   1. Division 6 Section "Interior Architectural Woodwork" for interior woodwork not specified in this Section.

1.3 DEFINITIONS

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:

   1. NELMA - Northeastern Lumber Manufacturers Association.
   2. NLGA - National Lumber Grades Authority.
   3. SPIB - Southern Pine Inspection Bureau.
   4. WCLIB - West Coast Lumber Inspection Bureau.
   5. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.

3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.
4. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood Structural Panels:

1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
2. Oriented Strand Board: DOC PS 2.
3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
4. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
5. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:

a. Chromated copper arsenate (CCA).
b. Ammoniacal copper zinc arsenate (ACZA).
c. Ammoniacal, or amine, copper quat (ACQ).

d. Copper bis (dimethyldithiocarbamate) (CDDC).
e. Ammoniacal copper citrate (CC).
f. Copper azole, Type A (CBA-A).
g. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.

2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5516, for plywood.
2. Use treatment that does not promote corrosion of metal fasteners.
3. Use Exterior type for exterior locations and where indicated.
4. Use Interior Type A High Temperature (HT), unless otherwise indicated.

B. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.4 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:

1. Rooftop equipment bases and support curbs.
2. Blocking.
3. Cants.
4. Nailers.

5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:

1. Mixed southern pine; SPIB.
2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; NELMA.
5. Northern species; NLGA.
6. Western woods; WCLIB or WWPA.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Hem-fir or Hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or Spruce-pine-fir, Construction or 2 Common grade; NELMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods, No. 2 Common grade; NELMA.
5. Northern species, No. 2 Common grade; NLGA.
6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 PANEL PRODUCTS

A. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch (13 mm).

B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.7 METAL FRAMING ANCHORS

A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and acceptable to authorities having jurisdiction.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

E. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.

END OF SECTION 06105

SECTION 06402

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Plastic-laminate cabinets and built-ins.
3. Plastic-laminate countertops.
4. Closet and utility shelving.
5. Shop finishing of interior woodwork.

B. Related Sections include the following:
1. Division 6 Section "Miscellaneous Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Division 15 Section " Plumbing Fixtures" for solid surface sinks and countertops.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, fire-retardant-treated materials, cabinet hardware and accessories, and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.

4. Show elevations of each wall where wood panel wainscoting occurs, identifying the location of each joint between panels, corner and wainscot cap details.

C. Samples for Verification:

1. Lumber with or for transparent finish, not less than 50 sq. in. (300 sq. cm), 5 inches (125 mm) wide by 24 inches (600 mm) long, for each species and cut, finished on 1 side and 1 edge.
2. Plastic laminates.

D. Product Certificates: signed by manufacturers of woodwork certifying that products furnished comply with requirements.

E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

F. Qualification Data: For Firms and Persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses of Architects and Owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products Certified participant in AWI's Quality Certification Program. Experienced installer who has completed Architectural woodwork similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species for Transparent Finish: White Oak, Plain sliced.

C. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-2.
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

D. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include:
2. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by the following:
   a. Pionite Decorative surfaces

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing. Provide quantity of hinges recommended by hinge manufacturer for weight and size of door.

C. Wire Pulls: Back mounted, solid metal 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

D. Catches: Magnetic catches, BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports. Knape and Vogt 255 standards and 256 supports or millworker's system utilizing line borings and metal shelf clips.

F. Drawer Slides: BHMA A156.9, B05091; side mounted, full-extension type; bright electro-zinc finish with steel ball-bearings, 100 pound load rating, Accuride model 7432 or equal.

G. Door Locks: BHMA A156.11, E07121. ILCO 9600 series push-button cabinet locks, with hex knob trim. Provide at all cabinet door locations.

H. Drawer Locks: BHMA A156.11, E07041. Provide at all cabinet drawer locations.

I. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
   1. Product: Subject to compliance with requirements, provide "TG3 series" by Doug Mockett & Company Inc.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated, unless noted otherwise.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

L. File Drawer Extrusion: At all drawers labeled as file drawers to be capped on both sides with a hanging file extrusions similar or equal to Kemp Hardware extrusion to fit the thickness of the drawer sides. Drawers to be constructed so that hanging file extrusion accommodates a standard 12" hanging file system.

M. Work Station Brackets: Metal brackets shown mounted under counters and secured to wall to be similar to Gambas Company Inc. brackets, 11 gauge material (1/8" thick), standard powder coat krinkle finish.

2.3 MISCELLANEOUS MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius as indicated on drawings.

D. Complete fabrication, including assembly finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

F. Install glass to comply with applicable requirements in Division 8 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut: White Oak, Plain Sliced. (Match Existing).

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.

E. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

F. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.6 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Vertical Surfaces: Grade HGS.
3. Edges: PVC T-mold matching laminate in color, pattern, and finish.

D. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
    a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
    b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
2. Drawer Sides and Backs: Thermoset decorative panels, or Metabox.
3. Drawer Bottoms: Thermoset decorative panels, or Metabox.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Architect from laminate manufacturer's full range in the following categories:
    a. Solid colors, matte finish.
    b. Wood grains, matte finish.
    c. Patterns, matte finish.

G. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.7 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range in the following categories:

   a. Solid colors, matte finish.
   b. Wood grains, matte finish.
   c. Patterns matte finish.

D. Grain Direction: Parallel to cabinet fronts.

E. Edge Treatment: Matching laminate in color, pattern and finish.

F. Core Material: Particleboard.

G. Core Material at Sinks: Moisture-resistant particleboard made with exterior glue.

H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.8 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 9 painting Sections for finishing opaque-finished architectural woodwork.

D. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Division 9 painting Sections for finishing architectural woodwork not indicated to be shop finished.

E. Shop Priming: Shop apply the prime coat including backpriming, if any, for transparent-finished and opaque-finished items specified to be field finished. Refer to Division 9 painting Sections for material and application requirements.

F. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

G. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen with sheen measured on 60-degree gloss meter per ASTM D 523:

   1. Grade: Custom Economy.
   2. AWI Finish System TR-2: Catalyzed lacquer.
   3. Staining: Match approved sample for color. Match existing wood doors.

4. Sheen: Satin, 30-50 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

K. Refer to Division 9 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402

SECTION 07210

BUILDING INSULATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Concealed building insulation in batt form for sound attenuation and thermal protection.
2. Vapor retarder.

1.03 DEFINITIONS

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data for each type of insulation product specified.

1.05 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristic: ASTM E 84.
2. Fire Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide insulation products of one of the following:

1. Manufacturers of Glass Fiber Insulation:

a. CertainTeed Corp.
b. Knauf Fiber Glass GmbH.
c. Manville: Building Insulations Div., Manville Sales Corp.
d. Owens/Corning Fiberglas Corp.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

B. Manufacturers of Insulating Materials: Must be filed with the Maine State Department of Environmental Protection.

C. Unfaced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing); and as follows:

1. Mineral Fiber Type: Fibers manufactured from glass or slag.

2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

2.03 VAPOR RETARDERS

A. Polyethylene Vapor Retarder: ASTM D 4397, 6.0 mils thick, with a maximum permeance rating of 0.13 perms.

B. Tape for Vapor Retarder: Pressure sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.04 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation or mechanical anchor securely to substrates indicated without damaging or corroding either insulation, vapor barrier, anchors, or substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to

make up total thickness.

3.04 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of insulation.

3.05 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

3.06 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates.

B. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 16 inches o.c.

C. Seal overlapping joints in vapor retarders with adhesives or tape per vapor retarder manufacturer's printed directions. Seal butt joints and fastener penetrations with tape of type recommended by vapor retarder manufacturer. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with tape of type recommended by vapor retarder manufacturer to create an airtight seal between penetrating objects and vapor retarder.

E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with tape or another layer of vapor retarder.

3.07 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07841

THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:

1. Floors.
2. Walls and partitions.
3. Smoke barriers.

B. Related Sections include the following:
1. Division 15 Sections specifying duct and piping penetrations.
2. Division 16 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

1. Penetrations located outside wall cavities.
2. Penetrations located outside fire-resistive shaft enclosures.
3. Penetrations located in construction containing fire-protection-rated openings.
4. Penetrating items larger than 4-inch- (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of through-penetration firestop system product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.

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

D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems 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. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.

C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:.

a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

1) UL in "Fire Resistance Directory."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hilti Construction Chemicals, Inc.
2. Isolatek International.
3. RectorSeal Corporation (The).
4. 3M Fire Protection Products.
5. United States Gypsum Company.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the

qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
    a. Slag-/rock-wool-fiber insulation.
    b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

F. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

G. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

I. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to re-

move smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.

1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.

B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5 IDENTIFICATION

A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to both sides of each Firewall. Label wall with appropriate fire rating. Install the labels a minimum of 10' apart. Contractor's option to use labels or painted stencils.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07841

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following applications:

1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
   b. Joints between plumbing fixtures and adjoining walls, floors, and counters.

B. Related Sections include the following:
1. Division 8 Section "Glazing" for glazing sealants.
2. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
3. Division 9 Section "Acoustical Panel Ceilings" for sealing perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data not required if product is provided as specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

1. Available Products:

a. Dow Corning Corporation; 786 Mildew Resistant.
b. GE Silicones; Sanitary SCS1700.

c. Tremco; Tremsil 200 (clear).

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant : Comply with ASTM C 834, Type P, Grade NF.

B. Available Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

2.5 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type to producing C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

   a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each type of elastomeric sealant and joint substrate.
   b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method B, Exposed Surface Finish Hand Pull Tab or Method C, Field-Applied Sealant Joint Hand Pull Flap in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
4. Inspect tested joints and report on the following:

   a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
   b. Whether sealants filled joint cavities and are free of voids.
   c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07920

SECTION 08111

STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Standard hollow-metal steel frames and borrowed lites.

B. Related Sections include the following:
   1. Division 8 Section "Wood Doors" for wood doors hung in steel frames.
   2. Division 8 Section "Glazing" for glazed lites in standard steel doors and frames.
   3. Division 8 Sections for door hardware for standard steel doors.
   4. Division 9 painting Sections for field painting standard steel doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance and finishes for each type of steel door and frame specified.

B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:

   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details.
   3. Frame details for each frame type, including dimensioned profiles.
   4. Details and locations of reinforcement and preparations for hardware.
   5. Details of anchorages, accessories, joints, and connections.
   6. Details of glazing frames and stops showing glazing.
   7. Details of conduit and preparations for electrified door hardware and controls.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

D. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an ASSA ABLOY Group Company.
3. CURRIES Company; an ASSA ABLOY Group Company.
4. Kewanee Corporation (The).
5. Mesker Door Inc.
6. Pioneer Industries, Inc.
7. Republic Builders Products Company.
8. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.

E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

G. Glazing: Comply with requirements in Division 8 Section "Glazing."

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.

1. Fabricate frames with mitered or coped and welded face corners and seamless face joints. Provide concealed from view mechanical fastening at top and bottom of all removable mullions.
2. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
3. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
3. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

E. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
2. Compression Type for Slip-on Frames: Adjustable compression anchors.

F. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

G. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

H. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide steel.

2.4 STOPS AND MOLDINGS

A. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.5 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
3. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) in height.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
        3) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

    b. Compression Type: Not less than two anchors in each jamb.

4. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

D. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
3. Provide loose stops and moldings on inside of doors and frames.

2.6 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish standard steel door and frames after assembly.

B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

3.3 INSTALLATION

A. General: Provide frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Standard Steel Frames: Install standard steel frames for doors and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    e. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
5. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel frame manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

END OF SECTION 08111

SECTION 08211

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections include the following:
1. Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate doors to be factory finished and finish requirements.
4. Indicate fire ratings for fire doors.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors."

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
   a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flush Wood Doors:

a. Algoma Hardwoods Inc.
b. Lambton Doors.
c. Mohawk Flush Doors, Inc.
d. VT Industries Inc.
e. Marshfield Company.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

1. Grade: Custom (Grade A faces).
2. Species and Cut: Plain sliced White Oak.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Center balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.

B. Adhesives: Do not use adhesives containing urea formaldehyde.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-2.
   a. Use particleboard made with binder containing no urea formaldehyde resin.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

   a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
   b. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

B. Interior Veneer-Faced Doors:

1. Core: Particleboard.
2. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.

   a. 5-inch (125-mm) top-rail blocking.

b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
d. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing.

B. Finish doors at factory.

C. Transparent Finish:

1. Grade: Custom.
2. Finish: NWWDA I.S.1-A System TR-4 conversion varnish.
3. Staining: Match existing where indicated on Drawings.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08211

SECTION 08311

ACCESS DOORS

PART 1 - GENERAL

1.1 RELATED SECTIONS.

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

1.2 SUMMARY

A. This Section includes the following types of access doors:

1. Wall access doors.
2. Fire-rated wall access doors.
3. Ceiling access doors.
4. Fire-rated ceiling access doors.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section "Door Hardware" for mortise or rim cylinder locks.
2. Division 9 Section "Gypsum Board Assemblies" for gypsum board walls and ceilings.
3. Division 9 Section "Acoustical Tile Ceilings" for access tile in suspended or furred acoustical tile ceilings.
4. Division 15 Section "Duct Accessories" for duct access doors.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required).

1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.

C. Shop drawings showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per test method as indicated below, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Test Method for Vertical Installations: ASTM E 152.
2. Test Method for Horizontal Installations: ASTM E 119.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.
1. Furnish and install 22" x 22" (door size), unless otherwise noted or required.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified under "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor Products Inc.
2. Bar-Co, Inc. Div., Alfab, Inc.
3. Cesco Products.
4. Elmdor Manufacturing Co.
5. J.L. Industries.
6. Karp Associates, Inc.
7. Larsen's Manufacturing Co.
8. Milcor, Inc.
9. Nystrom, Inc.
10. The Williams Bros. Corporation of America.

2.2 MATERIALS

A. Steel Sheet: ASTM A 366 (ASTM A 366M) commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.

1. Install in dry and non-sterile environments..

B. Zinc-Coated Steel Sheet: ASTM A 591 (ASTM A 591M), Electrolytic zinc-coated steel sheet with Class C coating and phosphate treatment to prepare surface for painting.

1. Install where "damp" areas are anticipated.

C. Stainless-Steel Sheet: ASTM A 167, Type 304 with No. 4 finish according to ASTM A 480 (ASTM A 480M).

1. Install where continuous damp cleaning and sterile environments required.

2.3 ACCESS DOORS

A. Noninsulated, Fire-Rated Doors for Walls: Self-latching units consisting of frame, trim, door, and hardware, including automatic closer, interior latch release, and complying with the following requirements:

1. Frame: 0.0598-inch- (1.52-mm-) thick steel sheet.
2. Door: 0.0598-inch- (1.52-mm-) thick steel sheet.
3. Hinge: Continuous type.
4. Latches: Bolt type, operated by flush key device (keyed alike).
5. Fire-Protection Rating for Walls: 1-1/2 hours.
6. Tamper resistant screws.

B. Trimless, Flush Access Doors for Gypsum Board: Units consisting of frame, concealed edge trim, door, hardware, and complying with the following requirements:

1. Frame: 0.0598-inch- (1.52-mm-) thick steel sheet.
2. Door: 0.0747-inch- (1.90-mm-) thick steel sheet.
3. Concealed, Gypsum Board Edge Trim: 0.0299-inch (0.76-mm) zinc-coated or galvanized-steel sheet with face flange formed to receive joint compound.
4. Hinge: continuous type.
5. Locks: Bolt type operated by flush key device (keyed alike).
6. Tamper resistant screws.

2.4 FABRICATION

A. General: Manufacture each access door assembly as an integral unit ready for installation.

B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.

C. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for installing access doors.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.

C. Install concealed-frame access doors flush with adjacent finish surfaces.

3.3 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08311

SECTION 08411

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior aluminum-framed storefronts.

    a. Glazing is retained mechanically with gaskets on four sides.

B. Related Sections include the following:

1. Division 7 Section "Building Insulation" for insulation materials field installed with aluminum-framed systems.
2. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
3. Division 8 Section "Sliding Automatic Entrance Doors for automatic entrances.
4. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
5. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:

    a. Deflection exceeding specified limits.
    b. Thermal stresses transferred to building structure.
    c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.

d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.
h. Failure of operating units to function properly.

B. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. Provide sealant that fails cohesively before sealant releases from substrate when tested for adhesive compatibility with each substrate and joint condition required.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

C. Structural-Sealant Joints: Designed to produce tensile or shear stress in structural-sealant joints of less than 20 psi (138 kPa).

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not less than 10 seconds.

F. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

G. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

H. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

I. Water Penetration Under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

1. Maximum Water Leakage: According to AAMA 501.1. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

K. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

    a. Include structural-sealant-glazing quality-control program development and reporting complying with ASTM C 1401 recommendations including, but not limited to, system material qualification procedures, preconstruction sealant-testing program, and procedures and intervals for system fabrication and installation reviews and checks.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

E. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by thermal movements.
   c. Deterioration of metals[**, metal finishes,**] and other materials beyond normal weathering.
   d. Adhesive or cohesive sealant failures.
   e. Water leakage through fixed glazing and framing areas.
   f. Failure of operating components to function properly.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Arch Aluminum & Glass Co., Inc.
2. CMI Architectural Products, Inc.
3. Commercial Architectural Products, Inc.
4. EFCO Corporation.
5. Kawneer.
6. Pittco Architectural Metals, Inc.
7. Tubelite Inc.
8. United States Aluminum.
9. Vistawall Architectural Products.
10. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).

2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: High-performance plastic connectors separate framing members exposed to the exterior from members exposed to the interior.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.5 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Division 7 Section "Building Insulation."

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.6 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Storefront Framing: Fabricate components for assembly using screw-spline system.

2.7 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: Match existing..

2.8 SOURCE QUALITY CONTROL

A. Structural-Sealant-Glazed Systems: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, system material qualification procedures, sealant testing, and system fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing."

G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install insulation materials as specified in Division 7 Section "Building Insulation."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch (3 mm).

END OF SECTION 08411

SECTION 08461

SLIDING AUTOMATIC ENTRANCE DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior single-sliding, automatic entrance door assemblies.

B. Related Sections include the following:

1. Division 8 Section "Aluminum-Framed Entrances and Storefronts".
2. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
3. Division 8 Section "Glazing" for materials and installation requirements of glazing for automatic entrance doors.
4. Division 16 Sections for electrical connections including conduit and wiring for automatic entrance door operators.

1.3 DEFINITIONS

A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

B. Safety Device: Device that prevents a door from opening or closing.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrance doors.

B. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Maintenance Data: For door operators and control systems to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: Products specified shall be represented by a factory authorized and trained distributor. Distributor shall maintain a parts inventory and trained personnel capable of providing service.

C. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.

D. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated. Other systems can be quoted along with information specifically detailing the differences from the following specification.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

F. Power-Operated Door Standard: BHMA A156.10.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

H. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Templates: Obtain and distribute, to the parties involved, templates for doors, frames, and other work specified to be factory prepared for installing automatic entrance doors. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrance doors to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies.

1.8 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic entrance door assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of operators, controls, and hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: 1 years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months full maintenance by skilled employees of automatic entrance door assembly Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance door assembly operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Engage a certified inspector to perform safety inspection after each adjustment or repair, and at end of maintenance period. Submit completed inspection form to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for sliding automatic entrance doors is based on Gyro Tech equipment as manufactured by Nabco Entrances, Inc. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Single-Sliding Units:

    a. Besam Automated Entrance Systems, Inc.
    b. DORMA Automatics; Div. of DORMA Group North America.
    c. Dor-O-Matic, Inc.; an Ingersoll-Rand Company.
    d. Gildor, Inc.
    e. Horton Automatics; Div. of Overhead Door Corporation.
    f. KM Systems, Inc.
    g. Nabco Entrances Inc.
    h. Sierra Automatic Doors, Inc.
    i. Stanley Access Technologies; Div. of The Stanley Works.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221
2. Sheet and Plate: ASTM B 209
3. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Sealants and Joint Fillers: Refer to Division 7 Section "Joint Sealants."

C. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107; of consistency suitable for application.

D. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30-mil (0.76-mm) thickness per coat.

2.3 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

A. General: Provide manufacturer's standard automatic entrance door assemblies including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrance Door

1. Configuration: Single-sliding door, with one sliding leaf and sidelite.

    a. Traffic Pattern: Two way.
    b. Emergency Breakaway Capability: Sliding leaf only
    c. Mounting: Between jambs

2. Combination Activation and Safety Device: Combination motion/presence detector.

3. Finish: Finish framing, door, sidelites, and header with finish matching adjacent storefront.

a. Color: AA-M12-C22-A42 "dark bronze"

2.4 COMPONENTS

A. Framing and Transom Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 4-1/2
2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch (1.6-mm) wall thickness.

B. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch- (45-mm-) thick glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
2. Stile Design: As indicated on Drawings.
3. Rail Design: As indicated on Drawings.

C. Sidelites: Manufacturer's standard 1-3/4-inch- (45-mm-) deep sidelites with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members matching door design.

1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
2. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
3. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.

D. Glazing: As specified in Division 8 Section "Glazing"

E. Headers: Fabricated from minimum 0.125-inch- (3.2-mm-) thick extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

1. Mounting: Surface mounted

F. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.

1. Rollers: Minimum two ball-bearing roller wheels and two antirise rollers for each active leaf.

G. Threshold: Manufacturer's standard threshold members and bottom-guide track system, with stainless-steel ball-bearing-center roller wheels.

H. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

I. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

J. Caution Sign: BHMA A156.10; 6 inches (150 mm) in diameter, with minimum 1/2-inch- (13-mm-) high, black lettering on a yellow background with the words "CAUTION AUTOMATIC DOOR."

K. Emergency Breakaway Sign: BHMA A156.10; red background with 1-inch- (25-mm-) high contrasting letters with the words "IN EMERGENCY PUSH TO OPEN."

2.5 DOOR OPERATORS

A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

1. Door Operator Performance: Provide door operators that will open and close doors and maintain them in fully closed position when subjected to Project's design wind pressures.

B. Electromechanical Operators: Self-contained overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation including spring closing with power off.

1. Operation: Power opening and power closing.
2. Features:

   a. Adjustable opening and closing speeds.
   b. Adjustable backcheck and latching.
   c. Adjustable hold-open time between 0 and 30 seconds.
   d. Obstruction recycle.
   e. On-off/hold-open switch to control electric power to operator.
   f. Energy conservation switch that reduces door-opening width.

3. Mounting: Concealed.

2.6 ACTIVATION AND SAFETY DEVICES

A. Motion Detectors: Self-contained, K-band-frequency, microwave-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds.

1. Provide capability for switching between bi-directional and uni-directional detection.
2. For one-way-traffic entrance doors, detector on egress side shall not be active when doors are fully closed.

B. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.7 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.

B. Emergency Breakaway Hardware: Provide release hardware that allows panel to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf (222 N) according to BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.

C. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn; with minimum 1-inch- (25-mm-) long throw bolt; BHMA A156.5, Grade 1.

1. Cylinders: BHMA A156.5, Grade 1, six-pin mortise type.

a. Keying: Integrate into building master key system.

2. Deadbolts: Steel, mortise type, BHMA A156.5, Grade 1.

D. Automatic Locking: Electrically controlled device mounted in header that automatically locks door against sliding when in closed position. Provide fail safe operation if power fails.

1. Include concealed, vertical-rod exit devices, UL 305, with latching into threshold and overhead carrier assembly and released by push paddle; and that prevent emergency breakout doors from swinging and permit emergency egress.
2. Include locking devices for sidelites to prevent manual breakout.

E. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

F. Weather Sweeps: Manufacturer's standard nylon brush sweep mounted to underside of door bottom.

2.8 FABRICATION

A. General: Factory fabricate automatic entrance door assembly components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Form aluminum shapes before finishing.

2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing

    a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
    b. Reinforce members as required to receive fastener threads.

4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Framing: Provide automatic entrance doors as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are sharp, straight, and free of defects or deformations.
4. Prepare components to receive concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
6. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
7. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
8. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

F. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding weather stripping, mortised into door, at perimeter of sliding doors

G. Activation and Safety Devices: Factory install devices in doors and headers.

1. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:

a. Top Beam: 48 inches (1219 mm).
b. Bottom Beam: 24 inches (610 mm).

2.9 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrance doors.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

B. Entrances: Install automatic entrance doors plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Level recesses for recessed thresholds using nonshrink grout.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.

D. Activation and Safety Devices: Adjust devices to provide detection field and functions indicated.

E. Glazing: Install glazing as specified in Division 8 Section "Glazing."

F. Sealants: Comply with requirements specified in Division 7 Section "Joint Sealants" to provide weathertight installation.

1. Set framing members, thresholds, bottom-guide track system, and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

G. Signage: Provide caution signs on each automatic entrance door, visible from both sides of door. Mount caution signs with centerline 58 inches (1475 mm) above finished floor.

1. Emergency Breakaway Panels: Provide emergency breakaway sign visible to egress side of each automatic entrance door that has emergency breakaway capability. Mount signs adjacent to lock stile with centerline between 36 and 60 inches (900 and 1525 mm) above finished floor.

3.3 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation, for weathertight closure, and complying with requirements in BHMA A156.10.

B. Lubricate operating hardware and other moving parts.

C. Readjust door operators and controls after repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.

D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions.

3.4 CLEANING AND PROTECTION

A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

1. Comply with requirements in Division 8 Section "Glazing" for cleaning and maintaining glass.

END OF SECTION 08461

SECTION 08711

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Furnish and install finish hardware for all doors including:
   a. Swinging doors.
   b. Door silencers and all frames.
   c. Key storage cabinets.
   d. Weatherstripping and thresholds.
   e. Door bottom sound seals for others.

B. Related Sections include the following:

1. Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
2. Division 8 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.

1.3 DOOR HARDWARE ALLOWANCE

A. Door Hardware Selection: Furnish door hardware selected by Architect, in quantities specified in this Section.

B. Submittals: Coordinate and process Submittals and templates for door hardware in same manner as Submittals for other Work.

C. Coordination: Coordinate door hardware with other Work. Furnish Shop Drawings of other Work where required or requested to coordinate installation.

D. Installation: General types and approximate quantities of door hardware are indicated in the Door Hardware Schedule to help estimate installation and other Work not included in door hardware allowance.

1.4 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

    a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

D. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.

1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

F. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware 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. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.

D. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
2) Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch (13 mm) high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
c. Thresholds: Not more than 1/2 inch (13 mm) high.

3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

2.2 HINGES

A. Manufacturers: Provide products by:

1. Type 1:
   a. Full mortise, five knuckle, flush mounted, unless noted otherwise.
   b. Swing clear hinge: Full mortise, five knuckle, flush mounted.
   McKinney Products Company; Div. of ESSEX Industries, Inc. (MCK).
2. Type 2:
   a. Continuous Hinge with edge guard mortises.

B. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).

C. Size: Provide the following hinge Type and height sized for interior door widths noted:

Maximum Interior Door Size (inches)	Hinge Height (inches)	Standard Weight Gauge-0.134	Heavy Weight Gauge-0.180
36 by 84 by 1-3/4	4-1/2	TA-TB2714	N/A
42 by 90 by 1-3/4	4-1/2	Not permitted	T4A-T4B3786
48 by 120 by 1-3/4	5	Not permitted	T4A-T4B3786

D. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

E. Doors with Closers: Antifriction-bearing hinges.

F. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Interior Hinges: Steel, with steel pin.
2. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

G. Nonremovable Pins: Provide on outswinging exterior doors and where indicated (NRP) in the hardware sets.

H. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors, and wood screws for wood doors. Finish screw heads to match surface of hinges.

2.3 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide the following:
1. Corbin-Russwin, Schlage and Sargent are acceptable for this product.
2. Quality Level: Heavy duty commercial type.
3. Locksets and Latchsets:
   a. Heavy duty mortise type with lever handle and LB rose, unless noted otherwise.
   b. Pushbutton Combination Lock: BHMA A156.5, Grade 2, Kaba-Ilco L1000 Series, mechanical pushbutton lock with key override, office function with Corbin-Russwin core.
4. Trim: Provide the following:
   a. Lever: Wrought or Cast.
   b. Escutcheon: LB Rose: L.

B. Functions:

		Sargent	ANSI
1.	Classroom Security Guarded:	38	F32
2.	Electrical (See description below)		
3.	Office	05	F04
4.	Bathroom	65	F22
5.	Passage	15	F01
6.	Service	04	F07

   a. Electrical Function: Card access unlocks trim from outside. Inside trim always operative.

2.4 EXIT DEVICES

A. All exit devices for this project including electrified items, shall be equal to the 80 Series Exit Device, as manufactured.

B. Single Door 8800 series.

C. Pairs of doors 8700 series.

2.5 DOOR BOLTS

A. Surface Bolts: BHMA A156.16 Grade 1

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
2. Hager Companies (HAG).
3. Ives: H. B. Ives (IVS).

C. Provide flush bolts for each leaf scheduled.

D. Bolt Throw:
1. Dutch Door Bolts: Minimum 3/4-inch throw.

2.6 CYLINDERS AND KEYING

A. Manufacturers: Contractor shall furnish all required cylinders and cores to match Owner's existing cylinder and core system.

B. Keying System: Keying is interchangeable cores to match Owner's existing by Sargent & Company.

C. All locks and cylinders shall be 6 pin tumbler key removable and interchangeable core cylinders keyed as required by the owners instruction and operated by one (1) Masterkey.

Group AA-AB-AC-and Grand Masterkey A

D. It is required that the key systems have visual key control and that all keys and cylinders be stamped with the alphanumeric key symbol designated for each key change as recommended by the Nomenclature for Masterkey Systems established by the Door and Hardware Institute.

E. Provide each key removable core cylinder with a construction masterkey core of brass or plastic. The construction cores shall be used by the General Contractor throughout the construction period. One (1) week prior to acceptance of the building, or at the owners request, the successful hardware contractor shall visit the building and by use of a special control key, shall remove the brass or plastic construction cores from all cylinders and replace them with the permanent cores required with each cylinder.

F. Provide a total of 18 Masterkeys: six (6) Masterkeys AA, six (6) AB, and six (6) A, and one (1) special control key for removing the key removable core cylinder. Provide a total of six (6) construction masterkeys for the temporary cores.

G. Provide a minimum of four (4) keys for each keyed different change.

H. Provide a total of 12 spare cores to be turned over to the owners for their use.

2.7 STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

2.8 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide either LCN Closers, Closer-Holder and Powered Operator; by Ingersoll-Rand Company (LCN), & Sargent.

B. Surface-Mounted Closers (Type 1):
1. LCN Series 4041 with Spring Cush Arm, 3077-SC
2. Sargent 280-281

2.9 PROTECTIVE TRIM

A. Kick plates & Armour Plate shall be of the following materials as noted in the hardware set schedule:
1. .050 gauge solid stainless steel 8" high by 2" less door width, beveled top and 2 sides.
2. Kick plates & Armour Plates shall be applied on the push side of all doors where noted.

B. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

2.10 DOOR STOPS AND SILENCERS

A. Door Stops shall be floor mounted, dome type, #440 by Rockwood. Do not mount floor stops where they will impede traffic. Where floor mounted stops will impede traffic, provide wall stops, #400 by Rockwood.

B. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch with 1/8 inch projection; fabricated for drilled-in application to frame.
1. Provide 3 silencers for the strike jamb of hollow metal frames of single doors and two at the head for pairs of doors

2.11 FASTENERS

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means

of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine or Wood Screws: For the following fire-rated applications:

   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:

   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.12 FINISHES

A. With the exceptions of exit devices, door closers, plates, thresholds and weatherstripping, all hardware items shall be furnished in finish US26D.
   1. Exceptions are as follows:
      a. Exit Devices: US32D
      b. Door Closers: Sprayed Aluminum
      c. Plates: US32D
      d. Thresholds: Aluminum
      e. Weatherstripping: Aluminum

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.13 ELECTROMAGNETIC DOOR RELEASE:

A. Where called for in the hardware set numbers, provide a wall or floor mounted electromagnetic door release.

B. The hardware supplier shall verify the voltage required for this item.

C. Products of the following manufacturers will be acceptable for this project:
   1. Rixson-Firemark – 990 Series
   2. LCN – SEM 7800 Series

2.14 PUSH-KICK-MOP ARMOR PLATES:

A. Push plates shall be. 050 gauge solid stainless steel 16" high by 8" wide.

B. Kick plates shall be .050 gauge solid stainless steel 8" high by 2" less door width.

C. Kick plates shall be applied on the push side of all doors where noted.

D. Armor plates shall be .050 gauge solid stainless steel 40" high by 2" less door width.

2.15 ELECTRONIC CARD READER:

A. Provide electronic card reader lock release compatible with existing EMMC card reading system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface

protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, verify location with Architect.
1. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

A. The Hardware Sets listed below indicate the items of hardware required for each opening. It is the bidders responsibility to accurately furnish the proper quantities, items, sizes, weights and functions as required by the plans and this specification. If an opening has, through error, been omitted from the following hardware set numbers listings, it shall be the bidders responsibility to supply hardware of equivalent quality and quantity, as that which is specified for a comparable opening.

HARDWARE SETS

Hardware Set #1

Door Nos. 1129, 1137
Each leaf to have: Lockset (Classroom Security Guarded Function), Hinges, Closer, Kick Plates on Push Side, Stop, Silencers.

Hardware Set #2

Door Nos. 1139A, 1139B, 1139C, 1201
Each leaf to have: Lockset (Electrical Function), Hinges, Kick Plates on Push Side, Closer, Stop, Silencers.

Hardware Set #3

Door Nos. 1175, 1178, 1180A, 1181A, 1183, 1202
Each leaf to have: Lockset (Office Function), Hinges, Stop, Silencers.

Hardware Set #4

Door No. 1180
Each leaf to have: Lockset (Office Function), Hinges, Closer, Stop, Silencers.

Hardware Set #5

Door No. 1182
Each leaf to have: Lockset (Bathroom Function), Hinges, Closer, Stop, Silencers.

Hardware Set #6

Door No. 1196
Each leaf to have: Lockset (Passage Function), Hinges, Stop, Silencers.

Hardware Set #7

Door No. 1203A
Each leaf to have: Lockset (Service Function), Swing-clear Hinges, Armor Plate on Push Side, Stop, Silencers.

Hardware Set #8

Door No. 1203
Each leaf to have: Lockset (Passage Function), Hinges, Closer, Stop, Silencers.

Hardware Set #9

Door No. 1205
Each leaf to have: Hinges, Power-assisted Door Operator, Kick Plates on Both Sides, Stop, Silencers. This door will be card swipe operated only with remote door release. Always exit (Exit Device).

END OF SECTION 08711

SECTION 08800

GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide glass and glazing for the following:

1. Steel framed windows.
2. Doors.
3. Aluminum-framed entrances and storefronts.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Provide 6x6 sample of all glazing types.

1.03 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: AFG Industries, Cardinal IG, Libby Owens Ford, Viracon, or approved equal.

B. Glass:

1. Primary Glass Products: Clear float, tinted float, patterned, and wire glass, ASTM C 1036.
2. Heat-Treated Glass Products: Heat-strengthened, tempered, coated, and spandrel glass, ASTM C 1048.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Inspect framing and report unsatisfactory conditions in writing.

B. Comply with GANA "Glazing Manual" and manufacturers instructions and recommendations. Use manufacturer's recommended spacers, blocks, primers, sealers, gaskets and accessories.

C. Install glass with uniformity of pattern, draw, bow and roller marks.

D. Remove and replace damaged glass and glazing. Wash, polish and protect all glass supplied under this section.

3.02 SCHEDULE

A. Glazing Schedule:

1. Type 1: Clear tempered or laminated glass. Refer to Door Schedule for locations.
2. Type 2: Clear insulated glazing for aluminum storefront system.
3. Type 3: Tinted insulated glazing for aluminum storefront system to match existing.

END OF SECTION 08800

SECTION 09260

GYPSUM BOARD ASSEMBLIES

PART 1 – GENERAL

1.01 RELATED SECTIONS

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

1.02 SUMMARY

A. This Section includes the following:

1. Non-load-bearing steel framing members for gypsum board assemblies. (22 gauge typical).
2. Gypsum board assemblies attached to steel framing.
3. Impact resistant gypsum board.
4. Drywall reveals

1.03 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

B. Related Sections: The following Sections contain requirements that relate to this section:

1. Division 6 Section "Rough Carpentry" for wood framing.
2. Division 7 Section "Joint Sealants" for firestopping systems and fire-resistance-rated joint sealants.

1.04 SUBMITTALS

A. Product Data not required if product is provided as specified.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

3. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer.

C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

D. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.07 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Framing and Furring:

Dietrich Industries, Inc.
Marino/Ware formerly Marino Industries Corp.
Gold Bond Building Products Div., National Gypsum Co.
Unimast Inc.

2. Grid Suspension Assemblies:

Armstrong World Industries, Inc.
Chicago Metallic Corp.
USG Interiors, Inc.

3. Gypsum Board and Related Products:

Domtar
Gold Bond Building Products Div., National Gypsum Co.
United States Gypsum Co.

2.02 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

A. General: Provide components complying with ASTM C 754 for conditions indicated.

B. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190 conducted by a qualified independent testing agency.

C. Wire Ties: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.062 inch (1.6 mm) thick.

D. Wire Hangers: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.162-inch (4.1-mm) diameter.

E. Hanger Rods: Mild steel and zinc coated or protected with rust-inhibitive paint.

F. Flat Hangers: Mild steel and zinc coated or protected with rust-inhibitive paint.

G. Angle-Type Hangers: Angles with legs not less than 7/8 inch (22.2 mm) wide, formed from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet complying with ASTM A 653, G 90 (ASTM A 653M, Z 180) coating designation, with bolted connections and 5/16-inch (8-mm) diameter bolts.

H. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross-furring members that interlock to

form a modular supporting network.

2.03 STEEL PARTITIONS AND SOFFIT FRAMING

A. General: Provide steel framing members complying with the following requirements:

1. Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions:

a. Maximum Deflection: L/360 at 5 lbf per sq. ft.

2. Protective Coating: Manufacturers standard corrosion- resistant coating.

B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 0.329 inch, typical, where required to meet deflection criteria.
2. Depth: 3-5/8 inches, 6 inches or as indicated.

C. Deflection Track: Manufacturer's top runner complying with the requirements of ASTM C 645 and with 2-inch- (50.8-mm-) deep flanges.

D. Deflection Track: Manufacturer's standard top runner designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653 (ASTM A 653M) or ASTM A 568 (ASTM A 568M). Thickness as indicated for studs, and width to accommodate depth of studs, and of the following configuration:

1. Top runner with 2-1/2-inch- (63.5-mm-) deep flanges that either have V-shaped offsets that compress when pressure is applied from construction above or have slots 1 inch (25.4 mm) o.c. that allow fasteners attached to studs through the slots to accommodate structural movement by slipping.

a. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1) Superior Flex Track System (SFT); Delta Star, Inc.
2) SLP-TRK; Metal-Lite, Inc.

E. Fire Rated Deflection Track: Deflection track for fire rating indicated and as manufactured by FireTrak Corp. (800) 394-9875.

F. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:

1. Depth: 7/8 inch.
2. Thickness: 0.0329 inch, unless otherwise indicated.

G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1- 1/4 inches, wall attachment

flange of 7/8 inch, minimum bare metal thickness of 0.0329 inch and depth required to fasten steel members to substrates.

H. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A 653 (ASTM A 653M) or ASTM A 568 (ASTM A 568M) to form 1/2-inch- (12.7-mm-) deep channel of the following configuration:

1. Single- Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single-slotted leg (web), with 1-1/2-inch- (38.1-mm-) wide face connected to flanges by double-slotted or expanded-metal legs (webs).

I. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.04 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.

1. Widths: Provide gypsum board in widths of 48 inches (1219 mm).
2. Thickness: As indicated.

B. Gypsum Wallboard: ASTM C 36 and as follows:

1. Type: Regular for vertical surfaces, unless otherwise indicated.
2. Type: Type X where required for fire-resistive-rated assemblies.
3. Type: Sag-resistant type for ceiling surfaces.
4. Edges: Tapered.
5. Thickness: 5/8 inch.

C. Products: Subject to compliance with requirements, provide one of the following products where proprietary gypsum wallboard is indicated:

1. Gold Bond Building Products Div., Regular, FIRECODE, High-Abuse, and Water-resistant cores, National Gypsum Co.

2. SHEETROCK Brand Gypsum Panels, Regular, FIRECODE, High-Abuse, and Water-resistant cores, United States Gypsum Co.

2.05 TRIM ACCESSORIES

A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal, or metal combined with paper, with metal complying with the following requirement:

a. Sheet steel zinc-coated by hot-dip process.

2. Non Ferrous material at all window head and jamb returns.

a. Vinyl.

3. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

a. Cornerbead on outside corners, unless otherwise indicated.
b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.
c. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
d. One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

4. Fry Reglet Dry wall reveal ½" x ½".

a. Accessories: T intersections.

2.06 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Interior Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

C. Joint Tape for Water-Resistant Gypsum Backing Panel: Use setting-type taping and setting-type, sandable tapping components.

D. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

1. Ready-Mixed Formulation: Factory-mixed product.

a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
b. Topping compound formulated for fill (second) and finish (third) coats.
c. All-purpose compound formulated for both taping and topping compounds.

2. Job-Mixed Formulation: Powder product for mixing with water at Project site.

a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
b. Topping compound formulated for fill (second) and finish (third) coats.
c. All-purpose compound formulated for both taping and topping compounds.

2.07 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot grouting hollow metal door frames.

C. Steel drill screws complying with ASTM C 1002 for the following applications:
   1. Fastening gypsum board to steel members less than 0.033 inch (0.84 mm) thick.

   2. Fastening gypsum board to gypsum board.

D. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.

E. Sound Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing):

   1. Mineral-Fiber Type: Fibers manufactured from glass or slag.

F. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, non-staining, latex sealant complying with ASTM C834 and ASTME90 for testing assemblies.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

B. Before sprayed-on fireproofing is applied, attach offset anchor plates or ceiling rummers (tracks) to surfaces indicated to receive sprayed-on fireproofing. Where offset anchor plates are required, provide continuous units fastened to building structure not more than 24 inches (600 mm) o.c.

B. After sprayed-on fireproofing has been applied, remove only as much fireproofing as needed to complete installation of gypsum board assemblies without reducing thickness of fireproofing below that is required to obtain fire-resistance rating indicated. Protect remaining fireproofing

from damage.

3.03 INSTALLING STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

1. Where building structure abuts ceiling perimeter or penetrates ceiling.
2. Where partition framing and wall furring abut structure except at floor.
   a. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.

D. Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.04 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

A. Suspend ceiling hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

   a. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.

   b. Secure flat, angle, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or otherwise fail.

   c. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

d. Do not attach hangers to steel deck tabs.

e. Do not attach hangers to steel roof deck. Attach hangers to structural members.

f. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Sway-brace suspended steel framing with hangers used for support.

C. Install suspended steel framing components in sizes and at spacings indicated, but not less than that required by the referenced steel framing installation standard.

1. Wire Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring or grid suspension members are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) as measured both lengthwise on each member and transversely between parallel members.

E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.05 INSTALLING STEEL FRAMING FOR PARTITIONS AND SOFFITS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs 3/4 inch short of full height. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. For fire-resistive-rated partitions or other types requiring partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

D. Install steel studs and furring in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum loading requirements specified.

1. Single layer construction: Space studs 16 inches o.c. unless otherwise indicated or to meet deflection criteria.

E. Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.

F. Frame door openings to comply with details indicated, with GA-600, and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install 2 studs at each jamb, unless otherwise indicated.

2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint.

3. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

G. Frame openings other than door openings to comply with details indicated or, if none indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

H. Z-Furring Members:

1. Erect insulation vertically and hold in place with z-furring members spaced 24 inches o.c..

2. Except at exterior corners, securely attach flanges of furring member to wall with screws designed for masonry. Attachment spaced at 24 inches o.c..

3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner or adjacent wall surface. Screw attach short flange of furring channel to web of attached channel.

II. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.06 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound attenuation blankets where indicated prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.

E. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

F. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.

G. Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. Attach gypsum panels to framing provided at openings and cutouts.

I. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.

J. Form control joints and expansion joints at locations indicated and required, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

K. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chase walls that are braced internally.

1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4-to-1/2-inch-wide joints to install sealant.

L. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4-inch-to-1/2-inch-wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

N. Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical

ceilings.

3.07 GYPSUM BOARD APPLICATION METHODS

A. Single-Layer Application: Install gypsum wallboard panels as follows:

1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.

3. Support Spacing: Install furring and metal stud supports at 24" O.C. within single layer on a side applications.

4. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layer on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1(one) framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance -rated assembly.

C. Multi-layer application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least 1 (one) stud or furring members with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions

1. Support Spacing: Install furring and metal stud supports at 16" O. C. within multi-layer on a side applications.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:

1. Fasten with screws.

E. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.08 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install corner beads at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed or semiexposed. Provide edge trim type with face flange formed to receive joint compound except where other

types are indicated.

1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trims can only be installed after gypsum panels are installed.
3. Install U-bead where indicated.

D. Install control joints at locations indicated, and where not indicated according to ASTM C 840, and in locations approved by Architect for visual effect.

3.09 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
2. Level 4 for gypsum board surfaces unless otherwise indicated.

E. For level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories using one of the following combinations of joint compounds (not including prefill), and sand between coats and after last coat.

F. Where level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.

3.10 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION 09260

SECTION 09511

ACOUSTICAL PANEL CEILINGS

PART 1 – GENERAL

1.01 RELATED SECTION

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

1.02 SUMMARY

A. Acoustical panel ceilings installed with exposed suspension systems.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 15 Section for sprinkler heads in acoustical ceilings.
2. Division 15 Section for grilles, registers, and diffusers in acoustical ceilings.
3. Division 16 Section for lighting fixtures in acoustical ceilings.

1.03 SUBMITTALS

A. Product Data not required if product is provided as specified.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for Project.

B. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

C. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

D. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

E. Fire-Performance Characteristics: provide acoustical ceilings that are identical to those tested for the following fire-performance characteristics, per ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting

organization.

1. Surface Burning Characteristics: As follow, 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

1.05 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 damaging units in any way.

1.06 PROJECT CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.07 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 2.0 percent of amount installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 – PRODUCTS

2.01 ACOUSTICAL CEILING UNITS, GENERAL

A. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade (NRC

or NIC' as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).

B. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

C. Textures, and Patterns: Provide products to match appearance characteristics indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard surface textures, and patterns available for acoustical ceiling units and exposed metal suspension system members of quality designated.

2.02 ACOUSTICAL PANELS

A. Mineral Composition:

1. Wetform Mineral Units, square edge. Color to be manufacturers standard white.
2. Product: Subject to compliance with requirements, provide the following or equal:

   A. ACT-1 Armstrong Cortega Item #770 24x24, 5/8" thick, square edge.
   B. ACT-2 Armstrong Cirrus #584, 24x24, ¾" thick, angled tegular

2.03 METAL SUSPENSION SYSTEMS, GENERAL

A. Standard for Metal Suspension Systems: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.

B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated. For exposed suspension members and accessories with painted finish, provide manufacturer's standard white color.

C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.

D. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, prestretched, Class 1 coating, sized so that stress at 3-times hanger design loan (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gage.

E. Edge Moldings and Trim: Metal or extruded plastic of types and profiles indicated or, if not indicated, provide manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated. See paragraph 2.05 for decorative perimeter trim.

For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.04 EXPOSED METAL IN DIRECT-HUNG SUSPENSION SYSTEMS

A. Double Web Steel Suspension System: Manufacturer's standard system roll-formed from prefinished cold-rolled steel sheet with 15/16" wide exposed faces on structural members; other characteristics as follows:

Structural Classification: Intermediate-Duty System.

Finish: Painted white.

B. Carrying Channels: l-l/2 in. steel channels, hot-rolled or cold-rolled, galvanized, not less than 0.475 lbs. per lin. ft.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Manufacturers of Double Web Steel Suspension Systems:

Chicago Metallic Corporation.
Armstrong World Industries, Inc.

2.05 PERIMETER TRIM AND ACCESSORIES

A. Armstrong Axiom "Classic" 8" high curved and straight pieces, #AX8CUR and #AX8STR. Provide splice plates, T-bar connector clips and any other accessories required for proper installation. Color to match grid system. See Drawings for configuration and dimensions.

B. Armstrong Axiom "Knife Edge", #AXKE2STR with #AXKE900C factory-assembled outside 90° corners. Provide splice plates, T-bar connector clips and any other accessories required for proper installation. Color to match grid system. See Drawings for configuration and dimensions.

2.06 MISCELLANEOUS MATERIALS

A. Acoustical Sealant: Resilient, non-staining, non-shrinking, non-hardening, non-skinning, non-drying, non-sag sealant intended for interior sealing of concealed construction joints.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

BA-98; Pecora Corp.
Tremco Acoustical Sealant; Tremco.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and structural framing to which ceiling system attaches or abuts, with

Installer present, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. 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.

B. 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.

3.03 INSTALLATION

A. General: Install acoustical ceiling systems to comply with installation standard referenced below, per manufacturer's instructions and CISCA "Ceiling Systems Handbook."

1. Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C 636 and ASTM E 580 for seismic zone 2.

B. Arrange acoustical units and orient directionally patterned units in a manner shown by reflected ceiling plans.

C. Install suspension systems to comply with ASTM C 636, and design designation No. P225 in UL "Fire Resistance Directory" with hangers supported only from building structural members. Locate hangers not less than 6" from each end and spaced 4'0" along each carrying channel, unless otherwise indicated, leveling to tolerance of 1/8" in 12"0".

D. Suspend ceiling hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices that are secure and appropriate for structure to which hangers are attached as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

5. Do not attach hangers to steel roof deck. Attach hangers to structural members.

E. Install edge moldings of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical units.

1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.

2. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.

F. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

1. Install impaction spring assembly clips in areas indicated and hold down clips in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

2. Do not install panels at fire and smoke dampers until mechanical system has been balanced and tested.

3.04 CLEANING

A. 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 09511

SECTION 09651

RESILIENT FLOORING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Resilient flooring as shown on drawings and in schedules
B. Resilient accessories
C. Sheet Vinyl Flooring

1.03 QUALITY ASSURANCE

A. Manufacturer: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

B. Fire Test Performance: Provide resilient flooring which complies with the following fire test performance criteria as determined by an independent testing laboratory acceptable to authorities having jurisdiction.

Critical Radiant Flux (CRF): Not less than the following rating as per ASTM E 648.

0.45 watts per sq. cm.

Flame Spread: Not more than 75 per ASTM E 84.

Smoke Developed: Not more than 450 per ASTM E 84.

Smoke Density: Not more than 450 per ASTM E 662.

C. Installer's Qualifications: Engage Installer who is certified in writing by resilient flooring manufacturer as qualified for installation of sheet vinyl employing chemically welded seams. Installer must have successfully completed resilient flooring installations similar in material, design and extent to those indicated for this project.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of resilient flooring and accessory.

B. Samples for Initial Selection Purposes: Submit manufacturer's standard color charts in form of

actual sections of resilient flooring, including accessories, showing full range of colors and patterns available, for each type of resilient flooring and accessory required.

C. Certification for Fire Test Performance: Submit certification from independent testing laboratory acceptable to authorities having jurisdiction that resilient flooring complies with fire test performance requirements.

D. Maintenance Instructions: Submit manufacturer's recommended maintenance practices for each type of resilient flooring and accessory required.

1.05 PROJECT CONDITIONS

A. Maintain minimum temperature of 65°F (18°C) in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55°F (13°C) in areas where work is completed.

B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by manufacturer's recommended bond and moisture test.

PART 2 - PRODUCTS

2.01 RESILIENT FLOORING COLORS AND PATTERNS

A. Provide colors and patterns as indicated on Room Finish/Color Schedule, or if not otherwise indicated, as selected by Architect from manufacturer's full range of premium grades.

2.02 MATERIALS

A. Vinyl Composition Tile: FS SS-T-312B (1), Type IV; 12" x 12" unless otherwise indicated, and as follows:

1) ASTM F1066 Composition 1 - Class 2 - asbestos-free with through pattern.
2) Gauge: 1/8".
3) Product: Armstrong World Industries, Inc. (refer to floor finish plan drawings for designations)

B. Sheet Vinyl Flooring: (SVF-1)
1. Armstrong World Industries Medintech.
2. Refer to floor finish plans for colors.
3. Heat weld all seams.
4. Five year warranty.

5. Wearing Surface-smooth
6. Unbacked, ASTM F 1913, 0.080 inch thick
7. Width 6 foot
8. 4" integral base

C. Sheet Vinyl Flooring (SVF-2)
1. Armstrong World Industries, Translations.
2. Refer to floor finish plans for colors
3. Heat weld all seams.
4. Five year warranty
5. Wearing surface smooth
6. Backing ASTM F 1303
7. Width 6.5 feet
8. 4" integral base.

D. Sheet Vinyl Flooring (SVF-3)
1. Armstrong World Industries, connection Corlon.
2. Refer to floor finish plans for colors
3. Secure bond seaming method.
4. Five Year Warranty
5. Wearing surface smooth
6. Backing: ASTM F 1303
7. Width 6 Feet
8. 4" integral base.

2.03 RESILIENT WALL BASE

A. Rubber Wall Base: Provide rubber base complying with FS SS-W-40, Type I, with matching end stops provide preformed or molded corner units, where wrapped corners will not adhere, and as follows:

1. Height: 6", unless indicated otherwise. 4" at all casework
2. Thickness: 1/8"
3. Styles:
   a. Standard top-set cove.
4. Length: 100' or 120' rolls.
5. Finish: Matte.
6. Product: Johnsonite.
7. Color: As indicated on Room Finish/Color Schedule.
8. Outside corners – premolded.
9. Inside corners – pre-molded.

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 – INSPECTION

3.01 INSPECTION

A. Require Installer to inspect subfloor surfaces to determine that they are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.

B. Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds.

C. Do not allow resilient flooring work to proceed until subfloor surfaces are satisfactory.

3.02 PREPARATION

A. Prepare subfloor surfaces as follows:

1. Use leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes and depressions in subfloors.

2. Remove coatings from subfloor surfaces that would prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives, paint, oils, waxes and sealers.

B. Broom clean or vacuum surfaces to be covered, and inspect subfloor.

C. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

D. Use stair-tread-nose filler, according to resilient tread manufacturer's written instruction, to fill nosing substrates that do not conform to tread contours.

3.03 INSTALLATION, GENERAL

A. Install resilient flooring using method indicated in strict compliance with manufacturer's printed instructions. Extend flooring into toe spaces, door reveals, and into closets and similar openings.

B. Scribe, cut, and fit resilient flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets and permanent columns, walls and partitions.

C. Where movable partitions are shown, install resilient flooring before partitions are erected.

D. Maintain reference markers, holes, or openings that are in place or plainly marked for future

cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.

E. Install resilient flooring on covers for telephone and electrical ducts, and other such items as occur within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly cement edges to perimeter of floor around covers and to covers.

F. Tightly cement resilient flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll resilient flooring at perimeter of each covered area to assure adhesion.

G. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.04 INSTALLATION OF TILE FLOORS

A. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

B. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.

C. Lay tile in "checkerboard" fashion with grain reversed in adjacent tiles.

D. Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.

3.05 INSTALLATION OF SHEET FLOORING

A. Lay flooring to provide minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at seams in compliance with manufacturer's recommendations.

B. Integral Flash Cove Base: Cove flooring vertical onto wall to form a 6 inch cove base integral with the floor in accordance with manufacturer's standard details. Install over 6 inch high ½ inch thick exterior plywood butted to bottom edge of drywall above. Support floor coverings at horizontal and vertical junction by cove strip. Drywall edge shall be neatly trimmed and finished with edge molding. Provide manufacturer's sheet vinyl cap strip butted to drywall edge molding. Caulk joint with sealant.

C. Install flooring with adhesives, tools, and procedures in strict accordance with manufacturer's written instructions.

D. Adhesive application: Apply adhesive(s) following flooring manufacturer's instructions. Observe

the recommended trowel notching, spread rates, and open times.

E. Heat weld all seams to match field color. Use tools, materials, methods, and sequence of work in conformance with the written instructions of the flooring manufacturer.

3.06 INSTALLATION OF BASE

A. Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with matching preformed corner units where required to maintain continuous contact. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces. Do not stretch base during installation.

1. Install premolded outside and inside corners before installing straight pieces.

2. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fir without removing more than half the wall base thickness.

B. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.A.

3.09 CLEANING AND PROTECTION

A. Perform following operations immediately upon completion of resilient flooring:

1. Sweep or vacuum floor thoroughly.

2. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.

3. Damp-mop floor being careful to remove black marks and excessive soil.

4. Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturers.

B. Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.

1. Apply protective floor sealer and polish to resilient flooring surfaces free from soil, excess adhesive or surface blemishes. Use commercially available metal cross- linked acrylic product acceptable to resilient flooring manufacturer.

2. Protect resilient flooring against damage from rolling loads for initial period following installation by covering with plywood or hardboard. Use dollies to move stationary equipment or furnishings across floors.

3. Cover resilient flooring with undyed, untreated building paper until inspection for substantial completion.

C. Clean resilient flooring not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Clean resilient flooring by method recommended by resilient flooring manufacturer.

1. Strip protective floor polish, which was applied after completion of installation, prior to cleaning.

2. Reapply 2 coats of sealer after cleaning.

3. Apply floor polish (2 coats).

3.10 EXTRA STOCK

Deliver stock of maintenance materials to Owner. Furnish maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

1. Base: Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof of each different type and color of rubber wall base.
2. Sheet Vinyl - 10% of each type, color and pattern installed.
3. Vinyl Composition Tile: 10% of field and two boxes of each accent tile.

END OF SECTION 09651

SECTION 09654

LINOLEUM FLOOR COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes linoleum floor tile.

B. Related Sections include the following:
   1. Division 9 Section " Resilient Floor Tile" for resilient wall base, reducer strips, and other accessories installed with linoleum floor coverings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

   1. Show locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

C. Samples for Initial Selection: For each type of linoleum floor covering indicated.

   1. Include similar Samples of installation accessories involving color selection.

D. Samples for Verification: In manufacturer's standard size, but not less than full tile sections of each color and pattern of linoleum floor covering required.

   1. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than long, of each color required.

E. Heat-Welded Seam Samples: For each flooring product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to rigid backing and prepared by Installer for this Project.

F. Qualification Data: For Installer.

G. Maintenance Data: For linoleum floor coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project that are competent in techniques required by manufacturer for floor covering installation indicated.

1. Engage an installer who employs workers for this Project that are trained or certified by floor covering manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

C. Mockups: Install mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1. Floor Tile: Store on flat surfaces.
2. Sheet Floor Covering: Store rolls upright.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 72 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every **50** boxes or fraction thereof of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 LINOLEUM FLOOR COVERING **(LFC-1)**

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; Marmorette
2. Forbo Industries, Inc.; Marmoleum.

C. Color and Pattern: As selected by Architect from manufacturer's full range.

D. Tile: Solidified mixture of linoleum cement binder (linseed oil and pine, fossil, or other resins or rosins, or equivalent oxidized oleoresinous binder) and ground cork, wood flour, mineral fillers, and pigments bonded to a fibrous or other suitable backing so that backing is partially embedded in mixture. Patterns and colors extend through entire wear-layer thickness.

1. Nominal Tile Size: Manufacturer's standard.

E. Seaming Method: Standard.

F. Thickness: 0.08 inch (2.0 mm).

G. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by floor covering manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor covering manufacturer for products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

   a. VCT and Asphalt Tile Adhesives: 50 g/L.
   b. Rubber Floor Adhesives: 60 g/L.

C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer.

1. Color: As selected by Architect from manufacturer's full range to contrast with floor covering.

D. Metal Edge Strips: Extruded aluminum with mill finish, of width shown, of height required to protect exposed edge of floor covering, and in maximum available lengths to minimize running joints.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
   b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.

1. Do not install floor coverings until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

B. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

C. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.

D. Install floor coverings on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of floor coverings installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

E. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

F. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

3.4 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

B. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing floor coverings:

1. Remove adhesive and other surface blemishes from floor covering surfaces.
2. Sweep and vacuum floor coverings thoroughly.
3. Damp-mop floor coverings to remove marks and soil.

a. Do not wash floor coverings until after time period recommended by manufacturer.

B. Protect floor coverings against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended in writing by manufacturer.

1. Apply protective floor polish to surfaces that are free of soil, visible adhesive, and surface blemishes.

a. Seal linoleum as recommended by manufacturer but with not less than three coats of floor polish.
b. Use commercially available product acceptable to manufacturer.
c. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover linoleum floor coverings with undyed, untreated building paper until inspection for Substantial Completion.

a. Allow drying room film (yellow film caused by linseed oil oxidation) to disappear before Substantial Completion.

3. Do not move heavy and sharp objects directly over floor covering surfaces. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09654

SECTION 09680

CARPET

PART 1 - GENERAL

1.01 RELATED SECTIONS

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

B.

1.02 SUMMARY

A. Provide carpet and floor preparation.

1.03 SUBMITTALS

A. Submit for approval samples, product data, warranty, maintenance data, extra stock, proposed seaming layout.

1.04 QUALITY ASSURANCE

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

B. Performance: Fire performance meeting requirements of building code and local authorities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Collins & Aikman.

B. Carpet Style:

1. CPT-1 Sonar
2. CPT-2 Timeless Aplexus Accent II
3. CPT-3 Corinth

C. Carpet Cushions:

1. Lifespan backing.

D. Auxiliary Materials:

1. Edge guards.
2. Adhesives, cements and fasteners.

E. Carpet Installation Method: Direct glue down installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with recommendations of Carpet and Rug Institute "Specifier's Handbook".

B. Prepare surfaces and install materials in accordance with manufacturer's instructions and approved submittals. Clean, patch, and level substrate. Install materials in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Install edge guards and reducer strips as required; clean and protect.

3.02 SCHEDULE

A. Refer to floor finish plans for color designations.

END OF SECTION 09680

SECTION 09912

PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and field painting of exposed interior and exterior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Metal lockers.
c. Finished mechanical and electrical equipment.
d. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
a. Furred areas.
b. Ceiling plenums.
c. Pipe spaces.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.

c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
2. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
3. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Initial Selection: For each type of finish-coat material indicated.

1. After color selection, Architect will furnish color chips for surfaces to be coated.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain appropriate primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with an additional 5 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Benjamin Moore & Co. (Benjamin Moore).

2. The Sherwin Williams Company.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality (commercial line) paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Any colors listed that are not Benjamin Moore shall be computer-matched by Benjamin Moore.

C. Colors: As selected by Architect from manufacturer's full range.

2.3 INTERIOR PRIMERS

A. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Benjamin Moore; Pristine Eco Spec Latex Primer Sealer No. 231: Applied at a dry film thickness of not less than 0.8 mils.

2. Benjamin Moore, M43, Acrylic Epoxy Coating, using Catalyst M44-86 for a semi-gloss finish where epoxy paint is scheduled; applied at a dry film thickness of not less than 2 mils in color as selected.

B. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.

1. Benjamin Moore; Pristine Eco Spec Latex Primer Sealer No. 231: Applied at a dry film thickness of not less than 0.8 mils.

2.4 INTERIOR FINISH COATS

A. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

1. Benjamin Moore; Pristine Eco Spec Latex Eggshell Enamel No. 223: Applied at a dry film thickness of not less than 1.4 mils.

B. Interior Semigloss Latex Enamel: Factory-formulated semigloss alkyd enamel for interior application.

1. Benjamin Moore; Pristine Eco Spec Interior Latex Semi-Gloss Enamel No. 224: Applied at a dry film thickness of not less than 1.4 mils.

C. Interior Acrylic Epoxy Coating: Factory-formulated semi-gloss for interior application

1. Benjamin Moore, M43, Acrylic Epoxy Coating, using Catalyst M44-86, applied at a dry film thickness of not less than 2 mils in color as selected.

2.5 INTERIOR CLEAR WOOD FINISHES

A. Interior Waterborne Clear Satin Varnish: Factory-formulated clear satin acrylic-based polyurethane varnish applied at spreading rate recommended by manufacturer.
1. Benjamin Moore; Stays Clear Acrylic Polyurethane No. 423, Satin.

2.6 EXTERIOR PRIMERS

A. Existing EIFS Applications:
1. Sherwin-Williams Loxon Exterior Acrylic Primer, A24W300. Applied at the following minimum thickness: 8 mils wet, 3.2 mils dry.

B. Exposed Non-Insulated Ductwork Applications:
1. Sherwin-Williams DTM Bonding Primer, B66A50. Applied at the following minimum thickness: 8 mils wet, 3.2 mils dry.

2.7 EXTERIOR FINISH COATS

A. Existing EIFS Applications:
1. Sherwin-Williams "Duration" exterior latex acrylic flat coating, K32 Series. Applied at the following minimum thickness: 7 mils wet, 2.8 mils dry per coat.

B. Exposed Non-Insulated Ductwork Applications:

1. Sherwin-Williams DTM Acrylic Semi-Gloss coating, B66-200 series. Applied at the following minimum thickness: 2-4 mils dry per coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

3. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touch-up painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.

3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior low-luster acrylic enamel.

B. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semigloss Alkyd-Enamel Finish: Two finish coats over primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior semigloss alkyd enamel.

C. INTERIOR PAINT COLOR SCHEDULE: (Match Benjamin Moore colors). See finish schedule.

3.7 EXTERIOR PAINT SCHEDULE

A. Existing EIFS
1. 1st Coat: Exterior Acrylic Primer
2. 2nd Coat: Exterior Latex Flat Coating
3. 3rd Coat: Exterior Latex Flat Coating

B. Exposed Non-Insulated Ductwork
1. 1st Coat: Exterior Acrylic Bonding Primer
2. 2nd Coat: Exterior Acrylic Semi-Gloss Coating
3. 3rd Coat: Exterior Acrylic Semi-Gloss Coating

END OF SECTION 09912

SECTION 10265

IMPACT-RESISTANT WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Sheet Protective Wall Covering (PWC).

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for steel angle and bent plate corner guards fabricated from rolled metal.
2. Division 6 Section "Rough Carpentry" for wood blocking and grounds for surface-mounted wall guards, corner guards, and handrails.
3. Division 8 Section "Door Hardware" for stainless-steel and plastic mop, kick, armor, and push plates.

1.3 SUBMITTALS

A. Product Data: Include physical characteristics, such as durability, resistance to fading, and flame resistance, for each impact-resistant wall protection system component indicated.

B. Shop Drawings: Show locations, extent, and installation details of each impact-resistant wall protection system component. Show methods of attachment to adjoining construction.

C. Samples for Verification: For the following products, showing the full range of color and texture variations expected in each impact-resistant wall protection system component. Prepare Samples from the same material to be used for the Work.

1. Sheet or Panels: 6-by-6-inch- (150-by-150-mm-) square Samples of each impact-resistant wall protection system component required.

D. Material Test Reports: From a qualified testing agency indicating compliance of each impact-resistant wall protection system component with requirements indicated, based on tests performed by testing agency within the past five years.

E. Maintenance Data: For each impact-resistant wall protection system component to include in maintenance manuals specified in Division 1.

1. Include recommended methods and frequency for maintaining optimum condition of vinyl plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to vinyl plastic finishes and performance.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of impact-resistant wall protection system components 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. Source Limitations: Obtain each color, grade, finish, and type of impact-resistant wall protection system component from a single source with resources to provide components of consistent quality in appearance and physical properties.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architects approval.

D. Fire-Test-Response Characteristics: Provide impact-resistant wall protection system components with the following surface-burning characteristics, as determined by testing materials identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify impact-resistant wall protection system components with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

E. Impact Strength: Provide impact-resistant wall protection system components with a minimum impact resistance of 25.4 ft-lbf/in. (1356 J/m) of width when tested according to ASTM D 256, Test Method A.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall surface-protection materials in original undamaged packages and containers inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within the storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored. Keep sheet material out of direct sunlight to avoid surface distortion.

2. Store rigid plastic corner-guard covers in a vertical position, and rigid plastic wall guard and handrail covers in a horizontal position for a minimum of 72 hours, or until the plastic material attains the minimum room temperature of 70 deg F (21 deg C).

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install wall surface-protection system components until the space is enclosed and weatherproof and ambient temperature within the building is maintained at not less than 70 deg F (21 deg C) for not less than 72 hours before beginning installation. Do not install rigid plastic wall surface-protection systems until that temperature has been attained and is stabilized.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide impact-resistant wall protection system products by one of the following:

1. American Floor Products Co., Inc.
2. Arden Architectural Specialties, Inc.
3. Balco, Inc.
4. Boston Retail Products.
5. Construction Specialties, Inc.
6. IPC Door and Wall Protection Systems, Inc.
7. Koroseal Wall Protection Systems, Inc.
8. K. J. Miller Corp.
9. Pawling Corporation.

2.2 MATERIALS

A. Extruded Rigid Plastic: Textured, chemical- and stain-resistant, high-impact-resistant, PVC or acrylic-modified vinyl plastic; thickness as indicated; with a minimum impact resistance of 25.4 ft-lbf/in. (1356 J/m) of width when tested according to ASTM D 256, Test Method A.
1. Color and Texture: As selected by Architect from manufacturer's full range for these characteristics.

B. Plastic Sheet Wall Covering Material: Semirigid, textured, chemical- and stain-resistant, high-impact-resistant, PVC or acrylic-modified vinyl plastic sheet; thickness as indicated; with a minimum impact resistance of 25.4 ft-lbf/in. (1356 J/m) of width when tested according to ASTM D 256, Test Method A.
1. Color and Texture: As selected by Architect from manufacturer's full range for these characteristics.

C. Aluminum Extrusions: Provide alloy and temper recommended by the manufacturer for the type of use and finish indicated, but with not less than the strength and durability properties specified in ASTM B 221 (ASTM B 221M) for alloy 6063-T5.

D. Fasteners: Provide aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with aluminum components, hardware, anchors, and other items being fastened. Use theft-proof fasteners where exposed to view.

E. Adhesive: Type recommended by the manufacturer for use with material on the substrate indicated.

2.2 Semirigid Sheet Wall Covering: Semirigid, embossed, fiber-backed, impact-resistant plastic sheets. Sheets shall comply with fire-test-response characteristics specified and be chemical and stain resistant. Provide manufacturer's standard; match moldings and trim as required.

1. Provide protective wall covering (PWC) equal to "Acrovyn" panels by Construction Specialties, Inc.
2. Sheet Size: As required with fewest possible seams.
3. Sheet Thickness: 0.060 inch (1.52 mm).
   a. Refer to the Room Finish Schedule and Interior Elevations on the drawings for location of rooms to receive PWC.

2.3 FABRICATION

A. General: Fabricate impact-resistant wall and door protection systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including thicknesses of components.

B. Preassemble components in the shop to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

D. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnecting members to other construction.

E. Provide inserts and other anchoring devices for connecting components. Fabricate anchoring devices to withstand imposed loads. Coordinate anchoring devices with the supporting structure.

2.4 FINISHES, GENERAL

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which impact-resistant wall protection system components and impact-resistant wall covering materials will be installed.

1. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Impact-Resistant Wall Covering Materials: Wall surfaces to receive impact-resistant wall covering materials shall be dry and free from dirt, grease, loose paint, and scale.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Install impact-resistant wall protection system components level, plumb, and true to line without distortions.

1. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Install aluminum retainers, mounting brackets, and other accessories according to the manufacturer's written instructions.

1. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run.

3.4 CLEANING

A. General: Immediately on completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent. Clean metal components according to the manufacturer's written instructions.

B. Remove excess adhesive using methods and materials recommended by the manufacturer.

C. Remove surplus materials, rubbish, and debris, resulting from installation, on completion of work and leave installation areas in neat, clean condition.

END OF SECTION 10265

SECTION 10503

LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide metal lockers.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Lockers:

1. Manufacturers: Lyon Metal Products, Penco Products, Republic Storage Systems, or approved equal.
2. Type: Wardrobe lockers, sheet steel, 24 gauge (.0239 inch) back and sides, 16 gauge (.0598 inch) top, bottom, and doors.
3. Tier: 6-tier lockers.
4. Face: Solid with punched louvers.
5. Locking: Padlock type.
6. Tops: Sloped.
7. Mounting: Legs with metal base cover.
8. Accessories: Numbered Nameplates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION 10503

SECTION 10520

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.
2. Fire protection cabinets for the following
    a. Portable fire extinguishers.
3. Fire-protection accessories.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide extinguishers listed and labeled by FM.

D. Comply with ADA requirements.

1.5 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

1. Portable Fire Extinguishers:
   a. J.L. Industries, Inc.
   b. Kidde: Walter Kidde, The Fire Extinguisher Co.
   c. Larsen's Manufacturing Company.
   d. Watrous; Div. of American Specialties, Inc.

2. Fire-Protection Cabinets:
   a. J.L. Industries, Inc.
   b. Larsen's Manufacturing Company.
   c. Watrous; Div. of American Specialties, Inc.

2.2 PORTABLE FIRE EXTINGUISHERS

A. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.

2.3 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Cabinet Metal: Enameled-steel sheet.
2. Shelf: Same metal and finish as cabinet.

B. Cabinet Type: Suitable for the following:

1. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions:

1. Recessed: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated. (Install wherever possible)
2. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated. (Install when recessed not possible).
3. Surface Mounted: Cabinet box fully exposed and mounted directly on wall. (Install where semirecessed not possible).

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Trimless with hidden flange of same metal and finish as box that overlaps surrounding wall finish and that is concealed from view by an overlapping door.

E. Door Material: Manufacturer's standard, as follows:

1. Steel sheet.

F. Door Glazing: Manufacturer's standard, as follows:

1. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:

a. Class 1 (clear).

G. Door Style: Manufacturer's standard design, as follows:Fully glazed panel with frame.

H. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Provide minimum 1/2-inch- (13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.

I. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees. Assembly shall comply with ADA standards.

2.4 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.

1. Provide brackets for extinguishers located in cabinets.

B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.

1. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.

a. Application Process: Silk-screened.

2.5 COLORS AND TEXTURES

A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:

1. Exterior of cabinets and doors, except for those surfaces indicated to receive another finish.
2. Interior of cabinets and doors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets are to be installed.

C. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten mounting brackets to structure and cabinets, square and plumb.
3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10520

SECTION 10801

TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED SECTION

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

1.2 SUMMARY

A. This Section includes the following:

1. Toilet and bath accessories.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Products of other manufacturers with equal characteristics, as judged solely by Architect, may be provided.
2. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.
3. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."

4. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:

1. Toilet and Bath Accessories:
   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.
   d. McKinney/Parker Washroom Accessories Corp.

B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Toilet and Bath Accessory Schedule at the end of Part 3.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

G. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

F. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

A. Grab Bar: Where indicated on drawings, provide stainless-steel grab bar complying with the following:

1. Products: Bobrick #6806 series. Provide one 36" long and one 42" long at each accessible toilet.
2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch.
3. Mounting: Concealed with manufacturer's standard flanges and anchors.
4. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
5. Outside Diameter: 1-1/2 inches.

B. Mirror Unit: Where indicated on drawings, provide mirror unit complying with the following:

1. Products: Bobrick #B-165, 18x30 inches.
2. Stainless-Steel, Channel Framed Mirror: 90 degree uniform corners. No. 1 quality ¼" float/plate glass, ASTM C1036. Provide concealed wall hanger for mounting to wall.

C. Paper Towel Dispenser: Owner Provided Contractor Installed (OPCI)

D. Toilet Tissue Dispenser: OPCI

E. Soap Dispenser: OPCI

END OF SECTION 10801

SECTION 10850

BUILDING SPECIALTIES

1.1 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Furnish and install building specialty items.

C. Coordinate solid blocking required to install building specialties with Section 06100.

1.2 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings and product data for all materials. Shop Drawing shall indicate materials, gauges, fabrication details, dimensions and method of attachment.

1.3 Materials

A. Corner Guards: 3-1/2" x 3-1/2" x 16 ga. X 6'-8" high, stainless steel, No. 4 finish, countersunk screw mounting, as manufactured by C/S Group, IPC, or approved equal. Provide blocking as required.

B. Curtain Tracks: Imperial IFC-50 or approved equal. Provide one hook for each 6 inches of track length. Configurations as shown on plans.

C. Curtain Fabric: Med Arc by Arc Com, 100% polyester (Hospital Grade).
   1. Pattern: Tea Garden, No. AC-32624.
   2. Color: Dawn #5.

END OF SECTION 10850

SECTION 12484

FIBERED MODULAR TILE ENTRANCE SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Entrance matting systems, including fibered modular tile entrance systems

B. Related Sections: Section(s) related to this section include:

1. Section 08110 - Steel Doors and Frames.
2. Section 08212 - Stile and Rail Wood Doors.
3. Section 08411 – Aluminum-Framed Entrances & Storefronts
4. Section 08461 – Sliding Automatic Entrance Doors
5. Section 08710 - Door Hardware.

1.02 REFERENCES

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. The Standards listed here are identified with a designation number, title or other designation established by the issuing authority.

B. American Society for Testing and Materials (ASTM):

1. ASTM C1028 Static Coefficient of Friction
2. ASTM D2829 Pill Test
3. ASTM E648 Radiant Panel Test

C. SYSTEM DESCRIPTION

D. Performance Requirements: Provide recessed fibered modular tile entranceway system, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.03 SUBMITTALS

A. General: Submit listed submittals in accordance with the Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product data: Submit product data, including manufacturer's specification sheet and installation instructions for specified products. Include methods of installation and substrate preparation for each type of substrate.

C. Shop drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures.

D. Samples: Submit samples for each type and color of exposed entrance mat, frames and accessories required. Provide 12-inch square samples of mat materials.

E. Quality Assurance Submittals: (1) Certified test reports showing compliance with specified performance characteristics and physical properties, and (2) Manufacturer's Installation Instructions.

F. Closeout Submittals: (1) Cleaning & Maintenance Data (Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance), and (2) Warranty.

1.04 QUALITY ASSURANCE

A. Installer: Installer should be highly experienced in performing work of this section, having previously done work similar to that required for this project.

1.05 SEQUENCING/SCHEDULING

A. Ordering: Comply with Manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Delivery: Deliver materials in Manufacturer's original, unopened, undamaged packaging.

C. Storage: Store materials at temperature and in humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.

D. Installation: Except as otherwise indicated herein, sequencing or scheduling for performance of work of this section in relation with other work is Contractor's option. Delay installation of mats until near time of substantial completion for the project.

1.06 PROJECT CONDITIONS

A. Temperature: Maintain temperature where products will be installed before, during and after installation as recommended by Manufacturer.

B. Field Measurements: Where possible, verify actual measurements by field measuring before fabrication and include measurements in shop drawings. To avoid construction delays, coordinate field measurements and fabrication schedule based upon construction progress.

PART 2 - PRODUCTS

2.01 BASIS OF DESIGN

A. Provide floor mats by Mats, Inc., PO Box 839, 37 Shuman Avenue, Stoughton, MA, 02072; telephone 800-MATS-INC (800-628-7462) or 781-344-1536; fax 781-344-1537; www.matsinc.com, or acceptable product to Architect.

2.02 MATERIALS

A. Polypropylene Modular Matting Tiles: 100 percent heavy denier, solution dyed, needle punched polypropylene with bitumen backing as follows:

1. Diagonal Tile, 19-11/16 by 19-11/16 by 3/8 inch thick, bitumen backing, 131 oz/sq. yd beige color.

B. Options & Accessories

1. Adhesive for Mounting: Mats, Inc. Release-Bond Adhesive as recommended by manufacturer.
2. Vinyl reducer:PVC reducer transition strip as recommended by manufacturer.

D. Product Testing

1. Diagonal Tile: 0.63 wet, 0.65 dry
2. ASTM D2829 Pill Test: Pass
3. ASTM E648 Radiant Panel Test: Passes Federal Flammability Standard

2.03 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted.

PART 3 – EXECUTION

3.01 SUBSTRATE PREPARATION

A. Examine substrates and conditions where floor mats will be installed. Do not proceed with installation until unsatisfactory conditions are corrected. Sub floor shall be clean and dry, and within acceptable tolerances.

3.02 INSTALLATION

A. General: Strictly comply with manufacturer's installation instructions and recommendations. Lay tile from center marks established with principal walls or general entrance area, discounting minor offsets, so that tile at opposite edges of flooring area are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to flooring area axis, quarter-turning tiles using directional arrows as marked on the underside of the tile, unless otherwise directed. Coordinate installation with adjacent work to ensure proper clearances and to prevent tripping hazards.

B. Sizes: Where possible, verify sizes by field measurement before shop fabrication.

C. Accessories: Where indicated for recessed or wall-to-wall applications provide aluminum framework and aluminum ramping or vinyl transition strips as recommended by manufacturer.

3.03 CLEANING AND PROTECTION

A. General Cleaning: Refer to Manufacturer's Cleaning and Maintenance Instructions.
B. Owner's Personnel: Instruct Owner's personnel in proper maintenance procedures.
C. Protection: Protect installed product and finish surfaces from damage during construction and until acceptance.

END OF SECTION 12484

SECTION 12485

FOOT GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes recessed foot grilles and frames.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide foot grilles and frames capable of withstanding and supporting a uniform load of 300 lbf/sq. ft. (14.36 kN/sq. m) without exceeding the allowable design working stress of the materials involved, including anchors and connections.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of foot grille and frame.

B. Shop Drawings: Show fabrication, assembly, joint locations, installation details, layout, plans, elevations, full-scale sections, details of patterns or designs, anchors, and accessories for foot grilles and frames.

C. Samples for Initial Selection: For each product requiring finish and color selections.

D. Samples for Verification: 12-inch- (300-mm-) square assembled sections of foot grille, frame members, and tread rails with the selected tread surface of each type of metal finish and color of exposed grille treads, tread rails, frames, and accessories required.

E. Maintenance Data: For cleaning and maintaining foot grilles. Include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain foot grilles and frames through one source from a single manufacturer.

B. Accessibility Requirements: In addition to requirements of authorities having jurisdiction, provide installed foot grilles that comply with Section 4.5 in the U.S. Architectural &

Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify blocked-out openings in floors by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating foot grilles and frames without field measurements. Coordinate floor construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate size and location of oversized recesses in concrete work to receive foot grilles and frames. Defer frame installations until building enclosure is completed and related interior finish work is in progress.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: The design for foot grilles is based on products manufactured by KADEE Industries. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Arden Architectural Specialties, Inc.
2. Balco, Inc.
3. Construction Specialties, Inc.
4. Crowder, K. N. Mfg. Inc.
5. J. L. Industries.
6. Mats, Inc.
7. Pawling Corporation.
8. Reese Enterprises, Inc.

2.2 MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

B. Stainless-Steel Angles: ASTM A 276 or ASTM A 479/A 479M, corrosion resistant, Type 304.

2.3 FRAMES

A. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

2.4 FOOT GRILLES

A. Furnish and install SSS Clean Tread Model KD98 Stainless Steel Floor Grate as manufactured by KADEE INDUSTRIES, Cleveland, OH (800) 321-3827; Fax (440) 439-6889.

B. Tread Material: Type 304 stainless steel.
1. .071" x .177" wire. Standard slot opening shall be .125".

C. Support Rods: Type 304 stainless steel.
1. 1" rods, spaced 1" o.c.

D. Surface finish will be #4 satin.

E. Frames shall be 304 stainless steel angle.
1. Drainage application: KD98 framing shall consist of intermediate supports spaced no greater than 3' apart. Units shall support a uniform load of 300 lbs. per square foot.

F. Hidden locking devices shall be used to prevent warping and rattling. The number of lockdowns to be used shall be in accordance with the manufacturer's recommendations.

2.5 FABRICATION

A. Shop fabricate foot grilles to greatest extent possible in sizes as indicated. If not otherwise indicated, provide each grille as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.

B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 STAINLESS STEEL FINISHES

A. No. 4, Satin.

B. Bright, Directional Polish: No. 4 finish.

1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine floor conditions and floor recesses for compliance with requirements for location, size, and minimum recess depth affecting installation of foot grilles and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install recessed foot grilles and frames to comply with manufacturer's written instructions at locations indicated and with top of foot grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set foot grille tops at height for most effective cleaning action.

3.3 PROTECTION

A. After completing frame installations, provide temporary filler of plywood or fiberboard in foot grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 12485

SECTION 13090

RADIATION PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Lead sheet, strip, and plate.
2. Lead-lined building materials and products including the following:
   a. Gypsum board.
   b. Steel doors.
   c. Steel door frames.
   d. Wood doors.
   e. Observation-window frames.
3. Informational signs.

B. Related Sections include the following:
1. Division 9 Section "Gypsum Board Assemblies" for metal framing and furring for lead-lined gypsum board and for finishing materials, accessories, and trim applied to lead-lined gypsum board.
2. Division 16 Sections for conduit, wire, and switch boxes for connecting components of neutron-shielding doors, including operators.

1.3 DEFINITIONS

A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.

1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV, unless otherwise indicated.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.

1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.

2. **All lead shielding shall be assumed to be 1/16 inch thick or equivalent.**

B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.

C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in Product Data.

1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection together with details of penetrations.
2. Show details of neutron-shielding doors and frames, including anchorage to and coordination with other work. Show locations of electrical conduit and boxes for connecting door operators, door operator switches, and door interlock switches.

C. Samples for Initial Selection: For each type of prefinished item indicated.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of radiation protection product through one source from a single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to radiation protection including, but not limited to, the following:

1. Sequence and schedule of radiation protection work in relation to other work.
2. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
3. Methods of attaching other construction and equipment to lead-lined finishes.
4. Notification procedures for work that requires modifying radiation protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver materials in original packages, containers, or bundles bearing the brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

C. Lead-Lined Gypsum Panels: Neatly stack panels flat to prevent deformation.

D. Lead-Lined Steel Doors and Frames: Deliver doors and frames cardboard wrapped or crated to provide protection during delivery and storage. Inspect for damage on delivery. Minor damage may be repaired provided the refinished repair matches new work and is approved by Architect; otherwise, remove and replace damaged items as directed.

E. Lead-Lined Wood Doors: Comply with manufacturer's written instructions and requirements in NWWDA I.S.1-A.

1. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
2. Mark each door on top and bottom rail with opening number used on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS

A. Lead Sheet, Strip, and Plate: ASTM B 749, alloy UNS No. L51121 (chemical-copper lead).

B. Lead-Lined Gypsum Board: 1/2-inch-thick gypsum board complying with Division 9 Section "Gypsum Board Assemblies," of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.

1. Provide lead lining full width of board and length necessary to extend from floor to 84 inches above floor.
2. Provide 3-inch-wide lead strips for wrapping metal stud flanges.
3. Provide 2-inch wide lead strips for backing joints.
4. Provide 5/16-inch lead disks for covering screw heads.

C. Accessories and Fasteners: Provide manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.

2.3 MANUFACTURED UNITS

A. Lead-Lined Steel Door Frames: Steel door frames complying with NAAMM HMMA 861, and lined with lead sheet of thickness not less than that required for doors and walls where frames are used.

1. Manufacturers:

   a. American Steel Products Corp.
   b. Pioneer Industries.
   c. Precision Metals, Inc.
   d. Security Metal Products Corp.
   e. A & L Shielding Inc.
   f. Lead Shield, Inc./LSI Sales, Inc.
   g. Mayfield Manufacturing Company.
   h. Radiation Protection Products, Inc.
   i. Ray-Bar Engineering Corp.

2. Provide additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
3. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.

B. Lead-Lined Wood Doors: Flush wood doors with lead lining.

1. Manufacturers:

   a. Algoma Hardwoods, Inc.
   b. Ampco.
   c. Eggers Industries.
   d. A & L Shielding Inc.
   e. Ameray Company.
   f. Atomic International.
   g. Lead Shield, Inc./LSI Sales, Inc.
   h. Radiation Protection Products, Inc.
   i. Ray-Bar Engineering Corp.

2. Door Construction: Veneer face, five ply, bonded particleboard or structural composite lumber core.
3. Lead Lining: One or more continuous sheets of lead extending from top to bottom and edge to edge, constructed either in the core or between the core and faces, at manufacturer's option.
4. Lead Lining: One continuous sheet of lead extending from top to bottom and edge to edge, constructed in the core. Assemble lead lining and core with poured lead fasteners or steel bolts. Space fasteners not more than 1-1/2 inches (38 mm) from door edge and about 8 inches (200 mm) o.c. Countersink bolt heads and cover with lead.
5. Comply with Division 8 Section "Flush Wood Doors" for grade, faces, veneer matching, fabrication, finishing, and other requirements, unless otherwise indicated. Comply with latest edition of AWI, Section 1300, Architectural Flush Doors.

a. Factory fit doors to suit frame openings indicated with 1/16-inch (1.5-mm) clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.
b. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.
c. Prepare doors to receive view windows and louvers as indicated. Provide removable wood stops for glazed openings.
d. Provide lead-lined astragals for pairs of doors.

2.4 INFORMATIONAL SIGNS

A. Informational Signs, General: Fabricate signs by engraving lettering in high-pressure-laminate engraving stock with contrasting face and core. Machine engrave copy using high-speed cutters mechanically positioned by master templates for accurately formed letters, numbers, and symbols.

1. Color: As selected by Architect from manufacturer's full range of colors.
2. Provide copy indicated or as directed. Provide signs of sufficient size to contain required information.
3. Indicate lead equivalence in millimeters and heights of radiation protection in inches.

B. Rooms Where the Level of Protection Is Uniform Throughout: Provide one sign for each room indicating lead equivalence of partitions, ceilings, floors, doors, and other portions of radiation protection enclosure. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height.

C. Rooms Where the Level of Protection Is Not Uniform Throughout: Provide one sign for each room with different lead equivalences in different locations. Indicate, in tabular form, lead equivalence of each wall, partition, ceiling, floor, door, and window. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height. Indicate where lead equivalence changes or is not continuous.

D. Rooms Where Some Partitions Are without Radiation Protection: Provide one sign for each partition that contains radiation protection and indicate its lead equivalence. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height.

E. Rooms Where Only the Door Has Radiation Protection: Provide one sign for each door indicating its lead equivalence.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Concrete Surfaces: Proceed with installation only after surfaces are clean, dry, and free of depressions and sharp projections that could damage or penetrate lead sheet.

3.2 INSTALLATION OF LEAD-LINED GYPSUM BOARD

A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.

B. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum-board manufacturer. Install lead strips covering face of framing and wrap around flange to cover points of screws.

1. Where possible, install lead-lined gypsum board before installing gypsum board on other side of partition, and do not fold lead strips back over inside of flange until after lead-lined gypsum board is applied.
2. Apply lead disks recessed flush with surface of board over heads of screws securing trim.

C. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum-board manufacturer. Apply lead disks over screw heads and recess flush with surface of board.

1. Install lead strips, 1-1/2 inches wide minimum and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at intermediate supports.
2. Apply lead disks recessed flush with surface of board over heads of screws securing trim.

D. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least 1 inch. Arrange board around openings so neither horizontal nor vertical joints occur at corners of openings.

E. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.

3.3 INSTALLATION OF DOORS AND FRAMES

A. Install lead-lined steel doors and door frames according to Division 8 Section "Steel Doors and Frames," unless otherwise indicated.

1. Apply a coat of asphalt mastic or paint to lead lining in door frames where lead will come in contact with masonry or grout.

B. Install lead-lined wood doors according to Division 8 Section "Flush Wood Doors," unless otherwise indicated.

C. Lap lead lining of frames over lining in walls at least 1 inch.

D. Lead Lining of Frames: Line inside of frames with lead of thickness not less than that required in doors and walls where frames are used. Form lead to match frame contour, continuous in

each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Lap lining over lining in walls at least 1 inch.

E. Install doors in frames level and plumb, aligned with frames and with uniform clearance at each edge.

F. Line astragals with lead sheet.

G. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Division 8 Section "Door Hardware" for other installation requirements.

H. Touch up damaged finishes with compatible coating after sanding smooth.

I. Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

3.4 INSTALLATION OF PENETRATING ITEMS

A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.

B. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.

C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners, unless indicated on Drawings.

D. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch. Wrap conduit with lead sheet for 10 inches from box.

E. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three times the largest opening dimension. Lap lead sheet with adjacent lead lining at least 1 inch.

F. Piping: Unless otherwise indicated, wrap piping with lead sheet for 10 inches (250 mm) from point of penetration.

3.5 FIELD QUALITY CONTROL

A. Field Inspection: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.

C. Testing: After radiology equipment has been installed and placed in operating condition, Owner will engage a radiation health physicist to test radiation protection.

D. Correct deficiencies in or remove and replace radiation protection that testing indicates does not comply with specified requirements, including finishes and other work covering defective work.

3.6 PROTECTION

A. Lock radiation-protected rooms once doors and locks are installed and limit access to only those persons performing work in the rooms.

END OF SECTION 13090

SECTION 13900

BASIC FIRE PROTECTION MATERIALS AND METHODS

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 the basic requirements for mechanical installations and includes requirements common to more than one section. It expands and supplements the requirements specified in sections of Division 1.
   1. Mechanical sleeve seals.
   2. Sleeves.
   3. Escutcheons.
   4. Grout.
   5. Demolition of Fire Protection Systems.
   6. Equipment installation requirements.
   7. Painting and finishing.
   8. Concrete bases.
   9. Supports and anchorages.
   10. Access panels and doors.
   11. Seismic Bracing.

B. Related Sections include the following:
   1. Division 3 Section, "Cast-In-Place Concrete."
   2. Division 7 Section, "Firestopping."
   3. Division 8 Section, "Access Panels."
   4. Division 16 Section, "Fire Alarm."
   5. Division 9 Section, "Painting."

1.3 DEFINITIONS

A. Complete and Operational System: A Fire Protection system that has been installed, tested, cleaned, signed-off by appropriate Authority and made operational. Completion of Owner training to be part of this requirement.

B. Fire Protection Contractor: The project Contractor responsible for the installation of the Fire Protection systems and equipment.

C. 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, crawlspaces, and tunnels.

D. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

E. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

F. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

G. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

H. NFPA: National Fire Protection Association.

I. AHJ: Authority Having Jurisdiction, parties responsible for the approval of materials and installations.

1.4 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.
   1. Pre-Construction Submittals: Submit the following items prior to commencing with installations.
      a. Copies of permits required to perform the work.
      b. Copies of certificates of registrations indicating compliance with the "Quality Assurance" paragraph that follows.
      c. Supports and hangers.
      d. Sleeves and sleeve seals.
      e. Escutcheons.
      f. Seismic bracing materials.
   2. Post-Construction Submittals: Submit the following items upon completion of the work.
      a. Copies of final system sign-off and acceptance by the AHJ.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: All work shall be performed by qualified journeymen of their respective trades who are employed by a firm that can demonstrate successful experience with work similar in type, quality and extent to the work required by this project.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. Listing and Approval: Unless otherwise required by the Owner's Insurance Underwriter, components intended for use in fire suppression systems shall be "listed" or "approved."
1. "Listed": UL Listed.
2. "Approved": FMC Approved.

1.6 BASIS OF FIRE PROTECTION DESIGNS

A. General: The following information is intended to provide an overview of the intent and operation of the project fire Protection systems. It is not intended that each and every project Fire Protection scope item be captured herein. The absence of a specific item or system in the descriptions below does not absolve the Fire Protection Contractor from providing the work identified by other Sections and the Drawings.
1. The Fire Protection Contractor shall provide complete and operational systems and installations.

B. Fire Protection Systems Description:
1. Existing Conditions: The area of work is currently fully sprinkled. Currently unfinished spaces are covered with upright heads.
2. Demolition:
   a. Remove existing upright heads and finished area heads within the area of work.
   b. Remove the existing 3-inch sprinkler main and branch piping complete from what will be the new Gym space, (room #219).
   c. Rework sections of main and branch piping as necessary to accommodate new duct work, piping and electrical installations.
   d. Rework sections of main and branch piping as necessary to accommodate proposed new ceiling heights.
3. New Work:
   a. Install new sprinkler heads throughout the space using arm-overs.
   b. Re-install the existing 3-inch sprinkler main around Gym #219. Re-install branch piping within this space tight to steel, above the proposed new 9'-6" ceiling. Reconnect and back-feed existing adjacent branch and main piping.

1.7 CODES, STANDARDS AND AUTHORITIES

A. General: The following listing is intended to identify the major Codes, Standards, and Authorities Having Jurisdiction, (AHJ's) for the project. This information is at least partially provided on the A-000 series Drawings as well. In the event that there is a discrepancy between the information contained herein and that on the A-000 Drawings, the information herein shall govern.

1. In the event that an item is included on the A-000 Drawings and is not listed herein, compliance with the requirements of said item is required.
2. The exclusion of an applicable Code, Standard, or AHJ in the list below does not absolve the Contractor from meeting the requirements of said Code, Standard or AHJ.

B. Codes and Standards: Work performed on the project must comply with the requirements of the following:
1. International Building Code, 2003.
2. NFPA 101, 2003.
3. NFPA 13, 2002.

C. Authorities Having Jurisdiction: Work performed on the project must comply with the requirements of the following AHJ's:
1. State Fire Marshal.
2. Local Fire Department.
3. Building Official.
4. Owner's Insurance Underwriter.

1.8 DRAWINGS AND SPEICIFICATIONS

A. General: The drawings and specifications are complimentary.
1. What is shown or noted on the drawings, but not mentioned in the specifications, automatically becomes a part of the specifications.
2. What is noted in the specifications, but not shown on the drawings, automatically becomes a part of the drawings.
3. Conflicts between the requirements of the drawings and the specifications must be brought to the immediate attention of the Architect/Engineer.
   a. The more stringent requirement will apply, unless ruled otherwise by the Architect/Engineer.
   b. When conflicts or discrepancies are noted, no work shall proceed until the conflict or discrepancy has been resolved by the Architect/Engineer.

B. Drawings and 13900 Series Specification Sections: The Fire Protection Contractor shall bear the responsibility of determining full extent of work required by Contract Documents. The Fire Protection Contractor shall refer to site, architectural, structural, mechanical, electrical and other Drawings and Specification Sections that indicate types of construction with which work of this Section must be coordinated. The Fire Protection Contractor shall review the work with the General Contractor / Construction Manager to establish the extent of work for their trade, and to determine whether there will be any interference with the work of other trades. If the work is later found to include work required to complete and coordinate the work or another trade, or to interfere with the work of another trade then the changes required to complete the work or to eliminate the interference shall be made without additional cost to the Owner.

C. Exact locations of ceiling mounted items shall be as shown and detailed on the Architectural reflected ceiling plans.

D. System components are identified throughout the Drawings for proper system operation. If any component is inadvertently omitted from the drawings, provide that component as per a similar location.

1.9 SUBSTITUTIONS

A. General: See Division 1 for product substitution requirements.
   1. No substitute materials or equipment shall be incorporated in the work without the written approval of the Architect/Engineer.

1.10 FIRE PROTECTION SUBMITTALS

A. General: Refer to Division 1 for submittal definitions, requirements and procedures.

B. Submittal of shop drawings, certified performance data, and samples will be accepted only when submitted per Division 1. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

C. When two or more items of the same material or equipment are required, they shall be products of the same manufacturer insofar as possible.
   1. This does not apply to raw or bulk materials such as pipe and fittings, etc.

1.11 RECORD DOCUMENTS

A. General: Refer to Division 1 for requirements.

B. As work progresses, mark Drawings to indicate revisions to fire protection systems.

C. Mark specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

D. At completion of work and prior to final request for payment, the Fire Protection Subcontractor shall submit a complete set of reproducible record drawings showing all systems as actually installed. Drawings submitted shall be in the following format:
   1. Re-issuances of the project shop drawings.
   2. Re-issuance of the project hydraulic calculations, with revisions as necessary to account for modifications since the time of shop drawing submittal.

1.12 OPERATION AND MAINTENANCE, (O&M) MANUALS

A. General: Refer to Division 1 for procedures and requirements for preparation and submittal of O&M Manuals.

B. Systems Descriptions: Provide description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

C. Operating Procedures: Provide manufacturer's printed data, including start-up, break-in, routine and normal operating instructions; regulation control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.

D. Maintenance Procedures: Provide for routine preventive maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

E. Servicing Instructions: Provide instructions, lubrication charts and schedules.

F. Product Data: Provide copies of all approved submittals.

1.13 OWNER TRAINING

A. General: Refer to Division 1 for general requirements.

1.14 WARRANTIES

A. Refer to Division 1 for project requirements for warranties. Individual warranties are required for each item of power driven or other mechanical equipment having moving parts, and wherever else specified in Division 15.
   1. Submit the warranties specified in Division 15 in a vinyl covered, three ring binder, tabulated and indexed for easy reference.

B. Provide complete warranty information for each item, to include date of commencement; duration; and the names, addresses, and telephone numbers and procedures for filing claims and obtaining warranty services.

C. Duration of warranties shall be not less than one year from the date of substantial completion of the facility unless prior approval has been granted in writing by the Architect/Engineer. If the manufacturer's warranty expires less than one year from the date of substantial completion, that warranty service and replacement of parts shall be provided by the mechanical subcontractor at no cost to the Owner.

1.15 DELIVERY, STORAGE AND HANDLING

A. General: Refer to Division 1 for material procurement requirements.

B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

D. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.16 DIVISION OF FIRE PROTECTION, FIRE ALARM AND ELECTRICAL RESPONSIBILITY

A. General: Line voltage switches, fused switches, outlets, motor starters, power wiring and fuses necessary to connect and operate all electrically powered equipment specified herein will be

furnished and installed as a part of the total project. Coordinate work with Division 16. The intent is to have a complete and operational system. The Fire Protection Contractor shall be responsible for furnishing and installing the equipment necessary to provide for the complete and operational system.

B. Power Wiring: Wiring for equipment shall be furnished and installed as specified under Division 16.

C. Facility Alarm Wiring: Wiring for alarm devices, (between the devices and the fire alarm control panel) shall be furnished and installed as specified under Division 16.

D. System Alarm Wiring: Interconnecting wiring for alarm devices that are part of a packaged fire protection system, (between the devices and the system control panel) shall be furnished and installed by the Fire Protection Contractor per the requirements of Division 16. Examples include; Pre-Action Sprinkler, Clean Agent Gaseous, Wet Chemical.

1.17 SEISMIC REQUIREMENTS

A. General: Provide and install seismic bracing on new sprinkler system piping installations.

1.18 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire protection items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."
   1. The Fire Protection Contractor shall provide access panels per the requirements of Division 8 Sections. Installation of the panels to be as directed by the General Contractor / Construction Manager.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Mechanical Sleeve Seals:
   1. Advance Products & Systems, Inc.
   2. Calpico, Inc.
   3. Metraflex Co.
   4. Pipeline Seal and Insulator, Inc.

5. Thunderline/Link-Seal.

C. Pipe Identification Systems:
1. Seaton Name Plate Co.
2. Brady: Signmark Div.; W.H. Brady Co.
3. Kolbi Industries, Inc.

D. Equipment and System Nameplates:
1. Central Sprinkler Corp.
2. Reliable Automatic Sprinkler Co., Inc.
3. Viking Corp.

E. Supports and Anchors:
1. B-Line Systems, Inc.
2. Carpenter & Patterson, Inc.
3. Grinnell Corp.
4. Fee & Mason Mfg. Co.

F. Seismic Restraints:
1. B-Line Systems, Inc.
2. Loos & Co., Inc.; Cableware Technology Division.
3. Mason Industries, Inc.
4. TOLCO Incorporated.
5. Grinnell Corp.

2.2 JOINING MATERIALS

A. Refer to individual 13900 series Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic, include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with set screws.

2.5 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, and an OD that completely covers opening. Escutcheon finishes to be as follows:
1. Finished area, exposed to view: Polished chrome-plated.
2. Unfinished areas: Galvanized steel.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and non-metallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.7 ACCESS PANELS AND DOORS

A. Panels and doors are to be furnished to provide access to items required in 13900 Series Sections and the Fire Protection Drawings. Panels and doors are to furnished per the requirements of Division 8 Section, "Access Doors."

2.8 PIPE IDENTIFICATION SYSTEMS

A. General: Provide Manufacturer's standard products.
   1. Lettering: Comply with ASME A13.1 for lettering size, colors, and viewing angles.

B. Pipe Markers: Manufacturer's standard preprinted, semi-rigid snap-on, plastic color-coded pipe markers, ASME A13.1.

2.9 NAMEPLATES

A. General: Provide factory pre-printed porcelain enameled, 20 gauge minimum, steel nameplates.

B. Hydraulic Nameplates: Indicate the following:
   1. Area served.
   2. Design area, density, and occupancy classification.
   3. Flow and residual pressure required at the base of the riser.
   4. Inside hose stream demand.
   5. Outside hose stream demand.

C. Ancillary Nameplates: Provide for the following:
   1. Drain locations.
   2. Inspector's Test Stations.
   3. Auxiliary Drains.
   4. Concealed Floor Control and General Sprinkler Zone Valve Assemblies.

2.10 SUPPORTS AND ANCHORS

A. General: Provide Hangers, Supports and Anchors in accordance with NFPA 13, as specified herein, and as per the Manufacturer's Standardization Society Standard Practices, (MSS SP):
   1. MSS SP-58, "Pipe Hanger and Supports – Materials, Design and Manufacture."
   2. MSS SP-69, " Pipe Hanger and Supports – Selection and Application."
   3. MSS SP-89, " Pipe Hanger and Supports – Fabrication and Installation Practices."

B. Miscellaneous Materials:
   1. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
   2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.
   3. Washers: ASTM F 844, steel, plain, flat washers.
   4. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.
   5. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Retaining Straps: Install retaining straps on c-clamp style structure attachments where seismic bracing is a project criteria.

2.11 SEISMIC CONTROLS

A. General: Restraint systems for these items shall consist of tension and compression, (strut) components, or tension only, (cable) components. In either case, provide necessary ancillary appurtenances as required to meet seismic restrain design criteria. Each and every component is not identified herein.
   1. Systems and their components shall be provided by a single manufacturer.
   2. Components shall be intended and listed for use with each other, (do not mix and match components not intended for use with each other).
   3. Systems may include:
      a. Attachments to structure.
      b. Braces and other means of augmenting standard hanger and support assemblies.
   4. Restraint devices constructed of aluminum or cast iron materials are not acceptable.

B. Strut Restraint Systems: Tension and Compression systems consisting of strut manufacturer's standard channel and attachments.

C. Restraining Cable Systems: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.

PART 3 - EXECUTION

3.1 FIRE PROTECTION DEMOLITION

A. Disconnect, demolish, and remove Fire Protection systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

3.2 CUTTING AND PATCHING

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Refer to Division 16 for requirements for cutting and patching electrical equipment, components, and materials.

C. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of fire protection installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of fire protection equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

G. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

H. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. General: Coordinate equipment and materials for installation with other building components.

B. Verify dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for fire protection installations.

D. Sequence, coordinate and integrate installations of fire protection materials and equipment for efficient flow of the work.

E. Coordinate the cutting and patching of building components to accommodate the installation of fire protection equipment and materials. Refer to Division 1.

F. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

G. Install access panels to allow access to equipment and other system components which require servicing or adjustment per the requirements of Division 8.

H. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, lighting fixtures, and other installations.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and other 13900 series Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction

loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following. Use One-piece escutcheons where ever possible in new construction. Split-casting units acceptable for installation on existing piping systems.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

      a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
      b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
      c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
         1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

3.5 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.7 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install fire protection equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.8 CLEAN CONSTRUCTION MEASURES

A. General: Take care during construction to maintain the integrity and cleanliness of pipe and equipment systems.

B. Exposed ends of piping systems and equipment connection ports shall be capped, plugged, or otherwise covered during construction.

3.9 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Sprinkler Heads: Painting of sprinkler heads and their fusible link is prohibited.
1. Provide protective coverings on sprinkler heads where general area painting is taking place.
2. Remove coverings once painting is complete.
3. Replace heads which may have inadvertently been painted.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.12 SUPPORT AND ANCHORAGE INSTALLATION

A. General: Comply with NFPA 13, MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

C. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

D. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

G. Open Web Joist Attachments: Where systems are supported via attachments to open web steel joints, connections to the joists shall be made at joist panel points. Connections and loading shall also be made concentrically.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

I. Support Spacing: Install piping supports at the following maximum spacing intervals using the minimum threaded rod sizes indicated;

Nominal Pipe Size (inches)	Max. Sch. 10, 30 & 40 Steel Pipe Span (feet)	Max. CPVC Pipe Span (feet)	Min. Rod Dia. (inches)
1	12	-	3/8
1-1/4	12	-	3/8
1-1/2	15	-	3/8
2	15	-	3/8
2-1/2	15	-	3/8
3	15	-	3/8
4	15	-	3/8
6	15	-	1/2
8	15	-	1/2

J. Seismic Controls: Install seismic bracing on new installations. Provide retaining straps on c-type beam clamps.

3.13 IDENTIFICATION SYSTEMS INSTALLATION

A. Nameplates: Install nameplates using corrosion resistant fasteners.
   1. Secure hydraulic nameplates directly to the riser valve which they apply.
   2. Install miscellaneous nameplates adjacent to the item being identified.
      a. For identification of items that are concealed, (i.e.; above a ceiling) install the nameplate in a clearly visible location.

B. Pipe Identification: Install pipe identification markers on fire protection system mains only, (not required on branch piping). Markers to be located as follows;
   1. At 50-foot intervals-max., 25-foot in congested areas.
   2. Adjacent to each system valve.
   3. At either side of wall or floor penetration.
   4. Behind access panels.

3.14 START UP AND TESTING

A. General: The Fire Protection Contractor is responsible for startup of all equipment provided in 13900 Series Sections.

3.15 FINAL CLEANING

A. General: Refer to Division 1 for general requirements regarding final cleaning.

END OF SECTION 13900

SECTION 13930

FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 13900, "Basic Fire Protection Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes the following fire-suppression systems inside the building:
1. Sprinkler Systems.

B. Related Sections include the following:
1. Division 16 Section "Fire Alarm" for alarm device wiring.

1.3 DEFINITIONS

A. AHJ: Authorities Having Jurisdiction.

B. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).

B. Fire-suppression system designs and installations shall be approved by Authorities Having Jurisdiction.

C. Water Supply Performance: The Installing Contractor shall conduct a hydrant flow test to serve as the basis for hydraulically calculated systems, (where calculations are necessary).

D. Sprinkler Systems:
1. System pipe-line velocities shall be limited to a maximum of 25 feet per second.
2. Margin of Safety for Available Water Flow and Pressure: System design to include a 10 psig minimum cushion between required supplies and available water performance.
3. Sprinkler Occupancy Hazard Classifications:
a. Building Service Areas and Equipment Rooms: Ordinary Hazard, Group 1.
b. General Storage Areas: Ordinary Hazard, Group 1.
c. Office, Public and Patient Areas: Light Hazard.

4. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m) area.
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (9.5 mL/s over 139-sq. m) area.
5. Maximum Protection Area per Sprinkler:
a. Light-Hazard Occupancy: 225 sf per sprinkler.
1) Exception: Shell spaces being provided with temporary upright head coverage which will ultimately be converted to pendent finished ceiling coverage: 130 sf per sprinkler.
b. Ordinary-Hazard, Group 1 Occupancy: 130 sf per sprinkler.

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:

a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.

1.6 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-Construction Submittals: Submit the following items prior to commencing with installations.
1. Product Data: For the following:
a. Piping materials, including sprinkler specialty fittings.
b. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
c. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
d. Alarm devices, including electrical data.
2. Shop Drawings: At a minimum, (and if acceptable to the Authorities Having Jurisdiction) submit the following; Sprinkler system layout drawings which include information as required by NFPA 13. Drawings shall be approved by the Authorities Having Jurisdiction prior to being submitted to the Architect. Drawings shall be generated at 1/8-inch per foot minimum scale. Information to be shown includes, but is not limited to the following;
a. Proposed new pipe size, location and elevation, (Sizing to be based on existing system pipe schedule).
b. Existing main piping back to the system riser.

c. Proposed new sprinkler head locations and types.
d. Seismic brace details and locations, (where bracing is required by Section 13900).
e. Hanger Details.

3. Full Shop Drawings and Hydraulic Calculations: If required by the Authorities Having Jurisdiction, (or if required due to the extent of necessary system rework) submit the following; Sprinkler system layout drawings which include information as required by NFPA 13. Drawings shall be approved by the Authorities Having Jurisdiction prior to being submitted to the Architect. Drawings shall be generated at 1/8-inch per foot minimum scale. Information to be shown includes, but is not limited to the following;
   a. Existing and proposed new pipe size, location and elevation.
   b. Hydrant flow test data, (and fire pump test data where applicable).
   c. Hydraulic calculations.
   d. Existing and proposed new sprinkler head locations and types.
   e. Seismic brace details and locations, (where bracing is required by Section 13900).
   f. At least one building section which indicates fire suppression pipe and component location.
   g. Hydraulic reference points.
   h. Remote area, including performance data.
   i. Hanger details.

C. Post-Construction Submittals: Submit the following items upon completion of systems installations.
1. NFPA 13 "Contractor's Material and Test Certificate for Aboveground Piping"
2. NFPA 13 "Contractor's Material and Test Certificate for Underground Piping."
3. Operation and Maintenance Data: Include approved product submittals and as-built shop drawings in O&M manuals, (see Section 13900).

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing fire-suppression systems.
1. Contractor to hold a sprinkler installer license in the project State.
2. Contractor's designer to be NICET Level IV Certified or a Registered Professional Fire Protection Engineer.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. Listing and Approval: Unless otherwise required by the Owner's Insurance Underwriter, components intended for use in fire suppression systems shall be "listed" or "approved."
1. "Listed": UL Listed.
2. "Approved": FM Approved.

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Grooved-Joint Piping Systems:
1. Anvil International, Inc.
2. Central Sprinkler Corp.
3. Star Pipe Products; Star Fittings Div.
4. Victaulic Co. of America.

C. Specialty Test and Drain Valves:
1. Central Sprinkler Corp.
2. Fire-End and Croker Corp.
3. Viking Corp.
4. Victaulic Co. of America.

D. Gate Valves with Wall Indicator Posts:
1. Grinnell Fire Protection.
2. McWane, Inc.; Kennedy Valve Div.
3. NIBCO.
4. Stockham.

E. Check and Gate Valves:
1. Clow Valve Co.
2. Crane Co.; Crane Valve Group; Crane Valves.
3. Crane Co.; Crane Valve Group; Jenkins Valves.
4. Hammond Valve.
5. Milwaukee Valve Company.
6. Mueller Company.
7. NIBCO.
8. Red-White Valve Corp.
9. United Brass Works, Inc.

F. Indicating Type Butterfly Valves:
1. Central Sprinkler Corp.
2. Grinnell Fire Protection.

3. McWane, Inc.; Kennedy Valve Div.
4. Milwaukee Valve Company.
5. NIBCO.
6. Victaulic Co. of America.

G. Sprinkler Heads:
1. Central Sprinkler Corp.
2. Globe Fire Sprinkler Corporation.
3. Grinnell Fire Protection.
4. Reliable Automatic Sprinkler Co., Inc.
5. Star Sprinkler Inc.
6. Viking Corp.

H. Electric Bells; Flow, Pressure and Supervisory Switches:
1. ADT Security Services, Inc.
2. Grinnell Fire Protection.
3. ITT McDonnell & Miller.
4. Potter Electric Signal Company.
5. System Sensor.
6. Viking Corp.

I. Pressure Gauges:
1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Brecco Corporation.
4. Dresser Equipment Group; Instrument Div.
5. Marsh Bellofram.
6. WIKA Instrument Corporation.

2.2 STEEL PIPE AND FITTINGS

A. Threaded-End, Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

B. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250); with factory- or field-formed, roll-grooved ends.
1. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
2. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, flexible and rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron

housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

a. Where intended for dry-pipe service, coupling assembly shall be UL listed for such service.

2.3 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping.

B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

2.4 LISTED FIRE-PROTECTION VALVES

A. General: Valves shall be UL listed or FMG approved, with 175-psig (1200 kPa) minimum pressure rating.

B. Gate Valves with Wall Indicator Posts:

1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with hand wheel, extension rod, locking device, and cast-iron barrel.

C. Check Valves NPS 2 (DN 50) and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Valve body to include a ball drip port where automatic upstream drainage is required.

D. Gate Valves: UL 262, OS&Y type.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 (DN 65) and Larger: Cast-iron body with flanged ends.

E. Indicating Type Butterfly Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch] [Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
2. NPS 2 (DN 50) and Smaller: Ball or butterfly valve with bronze body and threaded ends.
3. NPS 2-1/2 (DN 65) and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

2.5 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 (DN 50) and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig (4140-kPa) minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.6 SPECIALTY VALVES

A. Automatic Drain Valves: UL 1726, NPS 3/4 (DN 20), ball-check device with threaded ends.

2.7 SPRINKLERS

A. General: Sprinklers shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum pressure rating.
   1. Sprinklers shall be quick response type, K=5.6, 155°F rated, nominal ½-inch orifice, unless otherwise stated.
      a. Option: Contractor may propose the use of sprinkler heads with alternate K factor and orifice sizes, pending available project flow and pressure requirements can satisfy their requirements.
   2. Not Allowed: Sprinklers which employ O-ring seals and sprinklers recently involved in the recent Central Sprinkler recall.

B. Heat Responsive Elements shall comply with the following:
   1. UL 199, for nonresidential applications.
   2. UL 1626, for residential applications.
   3. UL 1767, for early-suppression, fast-response applications.

C. Recessed pendent type with matching push-on escutcheon plate:
   1. Finish: Match existing.
   2. Escutcheon: Match existing.
   3. Fusible Link: Glass bulb type, temperature rated for the specific hazard.

D. Concealed pendent type with matching push-on cover plate:
   1. Finish: Rough bronze.
   2. Cover: Match existing.
   3. Fusible Link: Glass bulb type, temperature rated for the specific hazard.

E. Standard upright type.
   1. Finish: Rough bronze.
   2. Fusible Link: Glass bulb type, temperature rated for the specific hazard.

F. Recessed horizontal sidewall type with matching push-on escutcheon plate.
   1. Finish: Match existing.
   2. Escutcheon: Match existing.
   3. Fusible Link: Glass bulb type, temperature rated for the specific hazard.

G. Dry Barrel Type, recessed pendent or horizontal type with matching push-on escutcheon plate. Dry barrel to be a minimum of 24-inches long. Coordinate exact length with construction requirements.
   1. Finish: Match existing.
   2. Escutcheon: Match existing.
   3. Fusible Link: Solder type, temperature rated for the specific hazard.

H. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

I. Sprinkler Cabinets: As furnished by the same manufacturer as the heads.

2.8 ALARM DEVICES

A. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig (1725-kPa) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

B. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.

C. Valve Supervisory, (Tamper) Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

2.9 PRESSURE GAGES

A. Description: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter, dial pressure gage with range of 0 to 250 psig (0 to 1725 kPa) minimum.
   1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
   2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Where hydraulic calculations are required, perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
   1. The Architect can provide a standard report form if requested.
   2. Report test results promptly and in writing.

3.2 EXAMINATION

A. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

D. Standard-Pressure, Wet-Pipe Systems, 175-psig (1200-kPa) Maximum Working Pressure:

1. NPS 2 and Smaller: Threaded-end, black, schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
2. NPS 2-1/2 and Larger: Grooved-end, black, schedule 10 steel pipe with roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
   a. Threadable Light wall piping systems not allowed.

3.4 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA Standards.
   a. Shutoff Duty: Use butterfly, or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA Standards.
   a. Shutoff Duty: Use ball, butterfly, or gate valves.
   b. Throttling Duty: Use ball or globe valves.

3.5 JOINT CONSTRUCTION

A. Refer to Section 13900, "Basic Fire Protection Materials and Methods" for basic piping joint construction.

B. Threaded Joints: Do not thread pipe with wall thickness less than Schedule 40.

C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
2. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

1. NPS 2 (DN 50) and Smaller: Use dielectric unions, couplings, or nipples.
2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
3. NPS 5 (DN 125) and Larger: Use dielectric flange insulation kits.

3.6 PIPING INSTALLATION

A. Refer to Section 13900, "Basic Fire Protection Materials and Methods" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.

F. Install "Inspector's Test Stations" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13, the local Fire Department, and the Drawings.

G. Install sprinkler piping with drains for complete system drainage.

H. Install alarm devices in piping systems.

I. Hangers and Supports: Comply with NFPA 13 for hanger materials.
1. Install sprinkler system piping according to NFPA 13.
2. Seismic Restraints: Install piping according to NFPA 13 to protect from earthquake damage. Include retaining straps on c-type beam clamps.

J. Install pressure gages on riser or feed main, at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

K. Fill wet-pipe systems with water.

3.7 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA Standards and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

3.8 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without Ceilings: Upright sprinklers.
   a. Install guards on heads located in Mechanical and storage rooms as well as in gymnasium and other athletic activity spaces.
2. Rooms with Suspended Ceilings: Recessed pendent sprinklers.
3. Rooms with Hard Drywall, (or similar) Ceilings: Concealed sprinklers.
4. Wall Mounting: Sidewall sprinklers. Use recessed sidewalls in finished spaces.
5. Spaces Subject to Freezing: Dry-barrel type heads, (sidewall or pendent).

3.9 SPRINKLER INSTALLATION

A. General: Install sprinklers in obvious patterns with other ceiling mounted devices, (lights, diffusers, etc.). Do not "randomly" install sprinkler heads in hard ceilings.
   1. Refer to the Drawings for other sprinkler placement requirements, (Fire Protection and/or Architectural reflected ceiling plans).
   2. Install sprinklers centered in suspended ceiling tiles.

B. Upright Heads: Install heads using a 1x1/2-inch reducer, 1-inch nipple and 1-inch tee. Do not use a branch size x ½-inch tee to supply heads.

C. Pendent Heads: Install pendent heads using 1-inch arm overs, or return bends. Directly dropping off branch lines is unacceptable.
   1. Option: Where allowed by AHJ's, pendent heads may be supplied using 1-inch flexible hose and mounting assemblies in lieu of arm overs.

D. Dry Heads: Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
   1. Dry pendent heads to be "tee'ed" directly into a drainable branch line such that a column of water is not stagnant on top of the dry barrel.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect to existing sprinkler system supplies.

D. Electrical Connections: Power wiring, bonding and grounding to be performed per Division 16 Sections.

E. Alarm Connections: Facility Fire Alarm wiring to be performed per Division 16 Sections.

3.11 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Energize circuits to electrical equipment and devices.
4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
5. Coordinate with fire alarm tests. Operate as required.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.12 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

END OF SECTION 13930

SECTION 15000

BASIC MECHANICAL REQUIREMENTS

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 the basic requirements for mechanical installations and includes requirements common to more than one section. It expands and supplements the requirements specified in sections of Division 1.

B. Related Sections include the following:
   1. Section 13900, "Basic Fire Protection Materials and Methods" for Fire Protection Contractor coordination drawing requirements.
   2. Section 15075, "Mechanical Identification" for valve tag schedules.

1.3 DEFINITIONS

A. Complete and Operational System: A Mechanical system that has been installed, tested, cleaned, signed-off by appropriate Authority and made operational. Completion of Owner training to be part of this requirement.

B. Mechanical Contractor: The project Contractor responsible for the installation of the Mechanical systems and equipment. This designation refers to the a Contractor who performs HVAC and/or Plumbing work.

1.4 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-Construction Submittals: Submit the following items prior to commencing with installations.
   1. Coordination Drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: All work shall be performed by qualified journeymen of their respective trades who are employed by a firm that can demonstrate successful experience with work similar in type, quality and extent to the work required by this project.

1.6 BASIS OF MECHANICAL DESIGNS

A. General: The following information is intended to provide an overview of the intent and operation of the project Mechanical systems. It is not intended that each and every project Mechanical scope item be captured herein. The absence of a specific item or system in the descriptions below does not absolve the Mechanical Contractor(s) from providing the work identified by other Sections and the Drawings.
   1. The Mechanical Contractor(s) shall provide a complete and operational systems and installations.

B. Mechanical Design Criteria

   1. Existing Systems:

      a. Existing Air Handling System

         1) The existing Air Handling Unit (AHU-3) located in the Second Floor Mechanical Room serves the existing First Floor ED and the existing Second Floor SCU. The ED will be taken off this system as part of the proposed 2004 ED renovation project. Portions of the ED will continue to be served by AHU-3 during construction / phasing. The ED to be served by a new dedicated Rooftop air handling unit.

         2) Removal of the existing zones and associated ductwork to be phased within the area of work.

         3) Remove the existing air system and associated piping and components currently serving the entrance.

         4) Remove the existing Fan Coil Units and associated piping within the area of work. Intent is not to reuse this unit for this project. Salvage for Owner.

         5) Remove existing wall hung Sanyo split system air conditioner, associated piping, and roof mounted condensing unit. Intent is not to reuse this unit for this project. Salvage for Owner.

      b. Existing Exhaust Systems

         1) Toilet Exhaust:

            a) Remove the existing roof mounted exhaust fan (EF-7) serving the Emergency Department Toilet Rooms. The existing duct riser and associated branch ducts to remain. Provide new exhaust fan, (EF-7). Refer to Proposed New Systems description.

         2) Isolation Room Exhaust:

            a) The existing Isolation room is planned to be renovated back to a Treatment Room use. The isolation Room is planned to move to the room across the corridor from its current location. The existing.

Isolation Room exhaust system including roof mounted exhaust fan, filter housing, associated ductwork drop to the First Floor to remain. The existing TSI controls to be removed. Contractor to carry allowance to replace the TSI controller. The existing system exceeds the current AIA Guidelines for exhaust air change rate and pressure differential. System balancing will be required and filter condition checked. Contractor to carry allowance to change the existing HEPA filter.

2. Proposed New Mechanical Systems

a. Scope of new systems to bring existing and renovated spaces up to current AIA Guidelines to include the following:

b. Waiting Room Exhaust System:

1) Provide exhaust system including roof mounted packaged skid system including, pre-filter, bag-in bag-out HEPA filter section, utility set upblast centrifugal exhaust fan. System size based on 12 air changes per hour of the volume of the existing Emergency Department Waiting area and the existing Radiology Waiting area. Single common exhaust system proposed to serve both waiting areas, as both areas are required to be exhausted continuously.

2) Basis of Design: As scheduled on the Drawings.

3) Proposed location of exhaust system to be on higher roof, not the canopy. Doors and control of waiting area "envelope" to be reviewed.

c. Toilet Exhaust System:

1) Replace the existing roof mounted exhaust fan with new exhaust fan (EF-7R) in same location. New exhaust fan sized for existing and renovated toilet and utility spaces within the area of work and including several existing spaces on the second floor.

2) Basis of Design: As scheduled on the Drawings:

d. Roof Mounted Air Handler:

1) Provide new constant volume roof mounted air handler to serve the Emergency Department. The new RTU capacity to be sized for the proposed 2004 ED Renovation area of work, including the existing Treatment Rooms, and Lobby Area. No allowance to be included in the RTU capacity for Future ED expansion into adjacent space across the main corridor.

2) Basis of Design: As Scheduled on the Drawings: York International Curbmaster size 215.

3) Roof mounted air handler to be located on Roof area (above second floor). Structural support frame required. Supply and return duct path across the

roof and drop to low canopy roof at Main Entrance to feed the Emergency Department.

4) Provide hot water supply and return piping heating coil located in the supply duct near the existing Women's Toilet room. Connection to exiting distribution piping and capacity to be reviewed and determined.

e. Roof Mounted Condensing Unit:

1) Provide air-cooled condensing unit on roof and associated refrigerant piping.

2) Basis of Design: As Scheduled on the Drawings: York International YCUL0040.

f. Air Distribution:

1) Spaces with similar occupancy and load to be common zones. Critical spaces to be independently zoned. System to be constant volume to ensure air movement from "clean" to "less clean" areas. Provide constant volume hot water reheat coils for each zone. Airflows to be designed as required space temperature, pressure relationships, and air change requirements in accordance with Table 7.2 of the 2001 AIA Edition of the "Guidelines for Design and Construction of Hospital and Healthcare Facilities", and ASHRAE Standards.

2) Return to be ducted to each zone.

g. Humidification:

1) Steam supply is not available in the Basement Mechanical room. Provide electric clean steam humidifier. Dispersion tube assembly to be located in the supply duct main near the existing Women's Toilet Room. Humidifier basin to be located in the Basement. Piping connection to existing utilities and routing to be as indicated on the Drawings.

2) Basis of Design: As Scheduled on the Drawings.

h. Controls

1) Provide allowance for DDC Controls off the existing Siemens central system for the new exhaust systems equipment and new air handling system.

i. Testing, Adjusting, and Balancing (TAB)

1) Provide allowance for TAB of the Existing Systems within the Area of Work.

2) Provide allowance for TAB of the New Systems within the Area of Work.

3. Medical Gas and Vacuum Systems

   a. The existing source equipment to remain. Piping, zone valve boxes, outlets, and alarm system to be reviewed and modified as required to suit the new space layout. Existing medical gas outlets to remain.

   b. The existing medical vacuum and oxygen outlets within the area of work are all served by one zone valve box located in a wall indicated to be removed. The existing zone, which is a critical care area, does not have an Area Alarm as required by NFPA 99.

   c. Provide medical gas outlets, type and qty per AIA Guidelines. Medical gas outlet type, quantity, and location to be reviewed and coordinated with the Owner.

   d. Provide (1) new triple zone valve box to serve the all existing and new medical vacuum inlets, oxygen and medical air outlets within the area of work.

   e. Provide (1) new Area Alarm panel, proposed location above zone valve box.

   f. All medical gas system work to be furnished, installed, tested, and certified in accordance with NFPA 99.

   g. The existing medical vacuum, oxygen, and medical air piping mains feeding the existing zone valve box do not appear to have isolation valves within the area of work downstream of tie-in points. Intent is to make connections to the existing systems without shutting down. Refer to the Drawings for connection to existing and suggested phasing.

   h. The medical gas systems within the area of work and associated alarm system to be reviewed with the Medical Gas Certifier for the Hospital.

4. Plumbing Systems

   a. The existing plumbing systems are to be utilized within the area of work. Plumbing piping system to be reviewed and modified as required to suit the new space layout. Existing plumbing fixtures within the area of work to remain or be removed as indicated on the Architectural Plans.

   b. All plumbing system work to be furnished, installed, tested in accordance with The State of Maine Internal Plumbing Rules.

   c. Provide new plumbing fixtures as indicated on the Architectural Drawings. Sinks located in new casework to be furnished by the casework vendor, refer to Architectural Drawings.

   d. Provide plumbing utilities to serve equipment in Nourishment Room, including ice machine, soda machine, and coffee maker.

   e. Provide eyewash stations including tempering valves.

f. Provide plaster trap for Ortho room sink as Scheduled on the Drawings.

g. Plumbing rough-in and hook up for all fixtures to be by the Contractor. Connect to the existing plumbing piping systems as indicated on the Drawings to serve new fixtures.

1.7 CODES, STANDARDS AND AUTHORITIES

A. General: The following listing is intended to identify the major Codes, Standards, and Authorities Having Jurisdiction, (AHJ's) for the project. This information is at least partially provided on the G-000 series Drawings as well. In the event that there is a discrepancy between the information contained herein and that on the G-000 Drawings, the information herein shall govern.
1. In the event that an item is included on the G-000 Drawings and is not listed herein, compliance with the requirements of said item is required.
2. The exclusion of an applicable Code, Standard, or AHJ in the list below does not absolve the Contractor from meeting the requirements of said Code, Standard or AHJ.

B. Codes: Work performed on the project must comply with the requirements of the following:
1. BOCA Building Code, 1999 Edition.
2. BOCA Mechanical Code, 1993 Edition.
3. State of Maine Internal Plumbing Rules, Latest Edition.

C. Standards: Work performed on the project must comply with the requirements of the following Industry Standards:
1. ASHRAE Standard 62-2001 Ventilation for Acceptable Indoor Air Quality
2. ASHRAE Standard 90.1-2001 Energy Standard for Buildings Except Low-Rise Residential Buildings.
3. NPFA 99 – Health Care Facilities, 2002 Edition.
4. NFPA 90A – Installation of Air-Conditioning and Ventilating Systems
5. Guidelines for Design and Construction of Hospital and Healthcare Facilities, 2001 Edition

1.8 DRAWINGS AND SPECIFICATIONS

A. General: The drawings and specifications are complimentary.
1. What is shown or noted on the drawings, but not mentioned in the specifications, automatically becomes a part of the specifications.
2. What is noted in the specifications, but not shown on the drawings, automatically becomes a part of the drawings.
3. Conflicts between the requirements of the drawings and the specifications must be brought to the immediate attention of the Architect/Engineer.
   a. The more stringent requirement will apply, unless ruled otherwise by the Architect/Engineer.
   b. When conflicts or discrepancies are noted, no work shall proceed until the conflict or discrepancy has been resolved by the Architect/Engineer.

B. Mechanical Drawings and Division 15 Specification Sections: The Mechanical Contractor shall bear the responsibility of determining full extent of work required by Contract Documents. The

Mechanical Contractor shall refer to site, architectural, structural, electrical and other Drawings and Specification Sections that indicate types of construction with which work of this Section must be coordinated. The Mechanical Contractor shall review the work with the General Contractor / Construction Manager to establish the extent of work for their trade, and to determine whether there will be any interference with the work of other trades. If the work is later found to include work required to complete and coordinate the work or another trade, or to interfere with the work of another trade then the changes required to complete the work or to eliminate the interference shall be made without additional cost to the Owner.

1. The Drawings schematically indicate the order of connection of the various system components. Each and every nuance and detail in not indicated. Whether specifically shown or not, all items shall be connected in accordance with Code, the details provided, accepted trade practices, and the intent of the Contract Documents. Coordinate with the other trades.

C. Exact locations of ceiling mounted items shall be as shown and detailed on the Architectural reflected ceiling plans.

D. System components (thermostats, sensors, volume dampers, access doors, etc.) are identified throughout the Drawings for proper system operation. If any component is inadvertently omitted from the drawings, provide that component as per a similar location.

1.9 COORDINATION DRAWINGS

A. General: Mechanical Contractor(s) to generate coordination drawings for the following portions of the facility:
1. Mechanical Systems at the Lobby Area.

B. Prepare a set of drawings in conjunction with the Fire Protection Contractor. In the event that Plumbing and HVAC work is performed by separate Contractors, the HVAC Contractor shall take the lead and initiate the generation of the drawings. Plumbing and Fire Protection work shall be subsequently applied to the drawings.
1. Drawings are intended to prevent installation conflicts.
2. Drawings to indicate piping, ductwork, equipment and other system components in relation to each other, along with electrical fixtures, conduits, busses, cable trays, supports and structural members.

C. Drawing Requirements: Drawings to be generated at 3/8-inch = 1-foot minimum scale and shall be ultimately delivered on reproducible media. Drawing size to be consistent with the SMRT design drawings.
1. Drawings to be CADD generated or manually drafted.

1.10 SUBSTITUTIONS

A. General: See Division 1 for product substitution requirements.
1. No substitute materials or equipment shall be incorporated in the work without the written approval of the Architect/Engineer.

B. Substitute materials and equipment submitted for approval must fit within the spaces available with neither substantial alteration nor increased pressure drops or friction losses.

C. Approval of substitute materials or equipment by the Architect/Engineer shall not relieve the contractor from his responsibility to provide a complete and operational mechanical system.

D. The Architect/Engineer's decision as to the equality or acceptability of proposed substitutions for the materials and equipment specified shall be final.
   1. Any additional costs incurred by such substitutions, including additional costs to other trades, or engineering design costs, shall be borne by the Contractor. This includes costs associated with the design and installation of infrastructure and support systems to facilitate a proposed substitution. This cost will be borne by the Mechanical Contractor.

1.11 MECHANICAL SUBMITTALS

A. General: Refer to Division 1 for submittal definitions, requirements and procedures.

B. Submittal of shop drawings. certified performance data, and samples will be accepted only when submitted per Division 1. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

C. Submittals for each mechanical trade shall be complete, including all items for which submission and approval is required, and each sheet containing performance data shall be clearly highlighted and marked for the appropriate model or type of equipment to be reviewed. Intended use shall be written on each submittal sheet for each different type of equipment or material to be reviewed (i.e. valves for domestic water or heating hot water, etc.). Incomplete or unmarked submittals WILL BE RETURNED to the Contractor without action.

D. Submittals shall be organized by specification Section and shall be clearly labeled. Submittals for HVAC and Plumbing items covered by a "shared" Mechanical specification Section, (i.e., hangers and supports, insulation) shall be separate and clearly labeled as to the trade intended.
   1. Unclear and/or mixed submittals will not be processed.

E. When two or more items of the same material or equipment are required, (i.e., plumbing fixtures, pumps, valves, air handling units, fans, diffusers, registers and grilles.) they shall be products of the same manufacturer insofar as possible.
   1. This does not apply to raw or bulk materials such as pipe and fittings, sheet metal, etc.

1.12 RECORD DOCUMENTS

A. General: Refer to Division 1 for requirements.

B. As work progresses, mark Drawings to indicate revisions to piping and ductwork, size and location including locations dampers and other control devices, filters, boxes and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; mains and branches of piping systems, with valves and control devices located and numbered; Change Orders; concealed control system devices.

C. Mark specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

D. At completion of work and prior to final request for payment, the Mechanical Subcontractor(s) shall submit a complete set of reproducible record drawings showing all systems as actually installed. Drawings submitted shall be in the following format:
   1. Neatly hand marked up copies of SMRT design drawings.
   2. CADD generated.
      a. SMRT design Drawing files may be available as a starting point for CADD generated drawings. A release form will need to be signed to facilitate this.
      b. CADD generated drawings shall be ultimately delivered in AutoCAD 2000 format on CD.
   3. Valve Tags: Record drawings to include valve tag markers which correspond to the valve tag chart provided under the O&M Manual Section.

1.13 OPERATION AND MAINTENANCE, (O&M) MANUALS

A. General: Refer to Division 1 for procedures and requirements for preparation and submittal of O&M Manuals.

B. Systems Descriptions: Provide description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

C. Operating Procedures: Provide manufacturer's printed data, including start-up, break-in, routine and normal operating instructions; regulation control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.

D. Maintenance Procedures: Provide for routine preventive maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

E. Servicing Instructions: Provide instructions, lubrication charts and schedules.

F. Product Data: Provide copies of all approved submittals.

G. Valve Schedules: Include valve tag charts in the O&M Manuals. Valve tag charts are as per Section 15075, "Mechanical Identification."

1.14 OWNER TRAINING

A. General: Refer to Division 1 for general requirements.

1.15 WARRANTIES

A. Refer to Division 1 for project requirements for warranties. Individual warranties are required for each item of power driven or other mechanical equipment having moving parts, and wherever else specified in Division 15.
   1. Submit the warranties specified in Division 15 in a vinyl covered, three ring binder, tabulated and indexed for easy reference.

B. Provide complete warranty information for each item, to include date of commencement; duration; and the names, addresses, and telephone numbers and procedures for filing claims and obtaining warranty services.

C. Duration of warranties shall be not less than one year from the date of substantial completion of the facility unless prior approval has been granted in writing by the Architect/Engineer. If the manufacturer's warranty expires less than one year from the date of substantial completion, that warranty service and replacement of parts shall be provided by the mechanical subcontractor at no cost to the Owner.

1.16 DELIVERY, STORAGE AND HANDLING

A. General: Refer to Division 1 for material procurement requirements.

B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

D. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.17 ENERGY EFFICIENCY

A. All equipment shall have minimum efficiency as described in ASHRAE Standard 90.1-2001 requirements. All equipment suppliers must be aware of the requirements and submitted equipment shall meet these minimum requirements.

1.18 REFRIGERANTS AND OTHER HAZARDOUS MATERIALS

A. The Mechanical Contractor shall be responsible for the capture, removal, and disposal of materials resulting from the Work.
   1. Comply with the requirements of applicable Codes, Standards and Authorities.

1.19 DIVISION OF MECHANICAL AND ELECTRICAL RESPONSIBILITY

A. General: Line voltage switches, fused switches, outlets, motor starters, power wiring and fuses necessary to connect and operate all electrically powered equipment specified herein will be furnished and installed as a part of the total project. Coordinate work with Division 16. The intent is to have a complete and operational system. The Mechanical Contractor shall be responsible for furnishing and installing the equipment necessary to provide for the complete and operational system.

B. Motor Starters: Where not specified in Division 15, shall be furnished and installed under Division 16.

C. Power Wiring: Wiring for equipment shall be furnished and installed as specified under Division 16.

D. Temperature Control Wiring: Wiring and interlocks shall be furnished and installed under Division 15.

E. Disconnect Switches: Where not specified in Division 15, shall be furnished and installed under Division 16.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 START UP AND TESTING

A. General: Contractor shall provide all fuel for startup and testing of all equipment provided in this section. Refer to Division 1 for responsibility of electrical power.

B. The Mechanical Contractor is responsible for startup of all equipment provided in Division 15 Sections.

C. The Mechanical Contractor shall verify that systems are complete and operational before commencing with balancing work.

D. Prior to balancing, ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place.
5. Duct systems are clean of debris.
6. Fans and pumps are rotating correctly.
7. Air outlets are installed and connected.
8. Duct system leakage is minimized.
9. Hydronic systems are flushed, filled and vented.
10. Proper strainer baskets are cleaned and in place.
11. Service and balance valves are open.

3.2 FUNCTIONAL TESTING

A. General: The entirety of the Mechanical Equipment and Controls System shall be tested for functional performance for specified operation and control sequences.

3.3 FINAL CLEANING

A. General: Refer to Division 1 for general requirements regarding final cleaning.

B. Refer to Section 15940, "Testing, Adjusting and Balancing" for requirements of cleaning filters, strainers, and other mechanical systems prior to final acceptance.

END OF SECTION

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Escutcheons.
6. Mechanical demolition.
7. Equipment installation requirements common to equipment sections.
8. Painting and finishing.
9. Supports and anchorages.
10. Access panels and doors.
11. Motors for Mechanical Equipment

B. Related Sections include the following:
1. Division 7 Section, "Firestopping."
2. Division 8 Section, "Access Panels."
3. Division 9 Section, "Painting."

1.3 DEFINITIONS

A. 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, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-Construction Submittals: Submit the following items prior to commencing with installations.
1. Product Data: For dielectic fittings, escutcheons.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."
   1. Provide access panels per the requirements of Division 8 Sections. Installation of the panels to be as directed by the General Contractor / Construction Manager.

D. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:

   1. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Dielectric Unions:
   1. Capitol Manufacturing Co.
   2. Central Plastics Company.
   3. Eclipse, Inc.
   4. Epco Sales, Inc.
   5. Hart Industries, International, Inc.
   6. Watts Industries, Inc.; Water Products Div.
   7. Zurn Industries, Inc.; Wilkins Div.

C. Dielectric Nipples:
   1. Perfection Corp.
   2. Precision Plumbing Products, Inc.
   3. Sioux Chief Manufacturing Co., Inc.
   4. Victaulic Co. of America.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

D. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening. Escutcheon finishes to be as follows:
   1. Finished area, exposed to view: Polished chrome-plated.
   2. Unfinished areas: Rough brass or similar finish.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass.

C. One-Piece, Cast-Brass Type: With set screw.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 ACCESS PANELS AND DOORS

A. Panels and doors are to be furnished to provide access to items required in Division 15 Sections and the Mechanical Drawings. Panels and doors are to furnished per the requirements of Division 8 Section, "Access Doors."

2.8 MOTORS FOR MECHANICAL EQUIPMENT

A. Motor Characteristics:
   1. Single phase or three phase as scheduled on the drawings.
   2. Frequency Rating: 60 Hz.
   3. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
   4. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
   5. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
   6. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

7. Enclosure: Open dripproof.

B. Polyphase Motors:

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: [Standard efficiency according to NEMA MG 1, Para. 12.59 and Table 12-10] [Premium efficiency] <Insert minimum motor efficiency acceptable>.
3. Stator: Copper windings, unless otherwise indicated.
   a. Multispeed motors shall have separate winding for each speed.
4. Rotor: Squirrel cage, unless otherwise indicated.
5. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
6. Temperature Rise: Match insulation rating, unless otherwise indicated.
7. Insulation: Class F, unless otherwise indicated.
8. Code Letter Designation:
   a. Motors 15 HP and Larger: NEMA starting Code F or G.
   b. Motors Smaller Than 15HP: Manufacturer's standard starting characteristic.
9. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
   a. Finish: Gray enamel.

C. Polyphase Motors with Additional Requirements:
1. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   a. Designed with critical vibration frequencies outside operating range of controller output.
   b. Temperature Rise: Matched to rating for Class B insulation.
   c. Insulation: Class H.
   d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

D. Single-Phase Motors:
1. Type: One of the following, to suit starting torque and requirements of specific motor application:
   a. Permanent-split capacitor.
   b. Split-phase start, capacitor run.
   c. Capacitor start, capacitor run.
2. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
3. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
4. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.
5. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
   a. Measure winding resistance.

b. Read no-load current and speed at rated voltage and frequency.
c. Measure locked rotor current at rated frequency.
d. Perform high-potential test.

2.12 PIPE EXPANSION FITTINGS AND LOOPS

A. Application: When the length of a piping run and the temperature range that the piping will experience will require expansion compensation refer to the ASHRAE 2000 Handbook – HVAC Systems and Equipment and ASME B31.9 for the proper application of expansion compensation.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

A. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 CUTTING AND PATCHING

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Refer to Division 16 for requirements for cutting and patching electrical equipment, components, and materials.

C. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

G. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

H. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.3 ROUGH-IN

A. General: Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment and fixtures to be connected. Refer to equipment and fixture specifications in Divisions 2 through 16, and to approved shop drawings, for rough-in requirements.

3.4 GENERAL INSTALLATION REQUIREMENTS

A. General: Coordinate equipment and materials for installation with other building components.

B. Verify dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

D. Coordinate the installation of required supporting devices.
1. Support suspended equipment from walls or from structural frames. Do not support equipment from metal roof deck.

E. Sequence, coordinate and integrate installations of mechanical materials and equipment for efficient flow of the work.

F. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Refer to Division 1.

G. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

H. Install access panels to allow access to equipment and other system components which require servicing or adjustment per the requirements of Division 8.

I. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, lighting fixtures, and other installations.

3.5 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following. Use One-piece escutcheons where ever possible in new construction. Split-casting units acceptable for installation on existing piping systems.
   1. Piping with Fitting or Sleeve Protruding from Wall: Deep-pattern type.
   2. Chrome-Plated Piping: Cast-brass type with polished chrome-plated finish.
   3. Insulated Piping: Stamped-steel type with spring clips.
   4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Cast-brass type with polished chrome-plated finish.
   5. Bare Piping at Ceiling Penetrations in Finished Spaces: Cast-brass type with polished chrome-plated finish.
   6. Bare Piping in Unfinished Service Spaces and Equipment Rooms: Cast-brass type with rough-brass finish.

7. Bare Piping at Floor Penetrations in Equipment Rooms: Floor-plate type.

M. Sleeves are not required for core-drilled holes. When installing a pipe thru a core-drilled hole core drill the hole to provide for the 1" annular space around the pipe and use a mechanical sleeve seal as indicated in paragraphs O and P below.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
   b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
      1) Seal space outside of sleeve fittings with grout.
4. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

3.6 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.8 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.9 CLEAN CONSTRUCTION MEASURES

A. General: Take care during construction to maintain the integrity and cleanliness of duct, pipe and equipment systems.

B. Ductwork must be capped during construction, dust and debris in ductwork is not acceptable. Interior of ductwork and air systems must be completely cleaned.

C. Exposed ends of piping systems and equipment/fixture connection ports shall be capped, plugged, or otherwise covered during construction.

3.10 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.12 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 15060

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

B. Related Sections include the following:
1. Section 15140 "Plumbing Piping".
2. Section 15213 "Medical Gas Piping".
3. Section 15181 "Hydronic Piping".

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

1.6 QUALITY ASSURANCE

A. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:
   a. B-Line Systems, Inc.
   b. Carpenter & Patterson, Inc.
   c. Grinnell Corp.

2. Channel Support Systems:

   a. B-Line Systems, Inc.
   b. Grinnell Corp.; Power-Strut Unit.
   c. Unistrut Corp.

3. Thermal-Hanger Shield Inserts:

   a. Carpenter & Patterson, Inc.
   b. Pipe Shields, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
5. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

C. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements, including spacing, are specified in Sections specifying equipment and Piping Systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in Piping System Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in Piping System Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

3. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
4. Adjustable Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
5. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
6. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2 .
7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. C-Clamps (MSS Type 23): For structural shapes.
4. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
5. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
6. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.

E. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

J. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4 to 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15071

MECHANICAL VIBRATION AND SEISMIC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by the Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes the following:
1. Vibration Isolators.
2. Duct and Pipe Isolators.
3. Vibration Isolation Equipment Bases.
4. Seismic Restraint Devices.

B. Related Sections include the following:
1. Section 15050, "Basic Mechanical Materials and Methods" for thermal expansion compensation in piping systems.
2. Section 15060, "Hangers and Supports" for piping, duct, and equipment hangers and supports as well as requirements for strut components.

1.3 DEFINITIONS

A. A_v: Effective peak velocity related acceleration coefficient.

B. OSHPD: Office of Statewide Health Planning & Development for the State of California. OSHPD assigns a unique anchorage preapproval "R" number to each seismic restraint it tests. The number describes a specific device applied as tested.

C. Withstand: The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the systems will be fully operational after the seismic event."

1.4 INTENT

A. Mechanical equipment, piping and ductwork shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure.

B. Mechanical systems shall remain in place without separation of any part when subjected to the seismic forces specified and the systems will be fully operational after the seismic event. Mechanical systems include all equipment, ductwork, and piping.

1.5 PERFORMANCE REQUIREMENTS

A. Applicable Code: BOCA Building Code, 1999 Edition.

B. General: Performance requirements to be used in the design of seismic controls shall use design forces calculated as follows:
   1. Seismic Use Group: III
   2. Seismic Design Category: C
   3. Component Importance Factor: 1.5

C. Applicability: Seismic control and vibration isolation is required on new mechanical systems.

1.6 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-Construction Submittals: Submit the following items prior to commencing with installations.
   1. Product Data: Include load deflection curves for each vibration isolation device.
      a. Provide Project specific catalog cuts and/or data sheets on the vibration isolators and restraints proposed for inclusion on this Project. Reference each and every "TYPE" and detail each compliance with this specification.
      b. Provide an itemized list of all isolated and non-isolated equipment. Provide detailed schedules showing isolator and seismic restraints proposed for each piece of equipment, referencing material and seismic calculation drawing numbers.
      c. Show base construction for equipment; include dimensions, structural member sizes and support point locations.
      d. Indicate isolation devices selected with complete dimensional and deflection data before condition is accepted for installation.
      e. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
      f. For ceiling suspended equipment provide minimum/maximum installation angle allowed for restraint system as well as braced and unbraced rod lengths at each allowable installation condition.
      g. For pad type isolators serving floor-mounted equipment provide layout of pad location for each individual unit.

   2. Shop Drawings and Calculations: Signed and sealed by a qualified professional engineer registered to practice in the State of Maine, with at least five years of seismic design experience. Include the following:

a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases. Calculations must indicate specific code paragraph references for each acceleration criteria. Seismic calculations shall indicate the component values required to determine the force to be restrained. Seismic restraint calculations must be provided for all connections of equipment to structure. Performance of all products (such as: strut, cable, anchors, clips, etc.) associated with restraints must be supported with manufacturer's data sheets or certified calculations.
b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
c. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
d. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
e. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch (13-mm) deflection in x, y, and z planes.
f. Piping and Ductwork Spacing Tables: Submit spacing and other installation specific requirements or submit copies of the Construction Documents clearly marked with brace types and locations.

3. Welding certificates.

4. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
   d. An in-force, $1,000,000.00 coverage limit Seismic Design Errors and Omissions insurance certificate must accompany submittals. Manufacturer's product liability insurance certificates are not an acceptable substitution.

C. Post Construction: Submit the following at least fifteen (15) days before requesting site review for Substantial Completion.
   1. A letter report signed and sealed by the Professional Engineer who designed the components, stating that the system components have been installed to their satisfaction.

1.7 QUALITY ASSURANCE

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage pre-approval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Vibration Isolators:
1. Ace Mounting Co., Inc.
2. Amber/Booth Company, Inc.
3. B-Line Systems, Inc.
4. Isolation Technology, Inc.
5. Kinetics Noise Control, Inc.
6. Mason Industries, Inc.
7. Vibration Mountings & Controls/Korfund.

C. Duct and Pipe Vibration Isolators
1. Mason Industries, Inc.
2. Mason-Mercer, (Mason Industries, Inc. – Mercer Rubber Co.)
3. The Metraflex Co.
4. Amber/Booth Company, Inc.

D. Vibration Isolation Equipment Bases:
1. Amber/Booth Company, Inc.
2. Isolation Technology, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.
5. Vibration Mountings & Controls/Korfund.

E. Seismic Restraint Devices:
1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. Kinetics Noise Control, Inc.
4. Loos & Co., Inc.; Cableware Technology Division.
5. Mason Industries, Inc.
6. TOLCO Incorporated.
7. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
8. Vibration Mountings & Controls/Korfund.

2.2 VIBRATION ISOLATORS

A. General: Floor span distance for use in Minimum Static Deflection calculations:

B. Elastomeric Grommet, (Bushing): Oil- and water-resistant elastomer, bolt-isolating bushing.
1. Material: Bridge Bearing Neoprene.
2. Basis of Design: Mason Industries, Inc. Type HG.

C. Elastomeric Isolator Pads: Oil- and water-resistant elastomer, arranged in single or multiple layers, molded with a non-slip pattern, factory cut to sizes that match requirements of supported equipment.
1. Material: Standard neoprene.
2. Shims, (between multiple layers): 16 ga. Steel.
3. Basis of Design: Mason Industries, Inc. Types W, SW & layered combinations thereof.

D. Fiberglass Isolator Pads: High density precompressed molded glass fibers, individually coated with a flexible, moisture-impervious elastomeric membrane. The media shall be non-corrosive, non-combustible, non-absorbent, and shall resist rust, ozone, mildew and fungus.
1. Basis of Design: Kinetics Noise Control, Model KIP.

E. Elastomeric Isolator Pads & Plates: Oil- and water-resistant elastomer, arranged in single or multiple layers, molded with a non-slip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene or bridge-bearing neoprene, complying with AASHTO M 251.
2. Shims, (between multiple layers): 16 ga. Steel.
3. Basis of Design: Mason Industries, Inc. Type SWM & layered combinations thereof.

F. Elastomeric Mounts (Mason Spec. A): Double-deflection type, with molded, oil-resistant neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
1. Vibration Isolating Material: Neoprene.
2. Basis of Design: Mason Industries, Inc. Type ND.

G. Restrained Elastomeric Mounts: All-directional elastomeric mountings with seismic restraint.

1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
2. Shock-absorbing materials: Neoprene.
3. Basis of Design: Mason Industries, Inc. Type BR.

H. Spring Isolators (Mason Spec. B): Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig (690 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
7. Basis of Design: Mason Industries, Inc. Type SLF and SLFH.

I. Restrained Spring Isolators (Mason Spec. D): Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Basis of Design: Mason Industries, Inc. Type SLR.

J. Housed Spring Isolators: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel before contacting a resilient collar.
4. Basis of Design: Mason Industries, Inc. Type SSLFH.

K. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
1. Basis of Design: Mason Industries, Inc. Type HD & WHD.

L. Spring Hangers (Mason Spec. F): Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Basis of Design: Mason Industries, Inc. Type 30N.

M. Spring Hangers with Vertical-Limit Stop (Mason Specs. G & H): Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Basis of Design: Mason Industries, Inc. Type PC30N.

2.3 DUCT AND PIPE ISOLATORS

A. General: Hanger isolators listed in above are applicable to duct and piping applications as well as suspended equipment. Additionally, items identified below are specific to duct and piping installations.

B. Thrust Limits (Mason Spec. I): Combination coil spring and elastomeric insert with spring and insert in tension, and with a load stop. Include rod and angle-iron brackets for attaching to equipment.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.
8. Basis of Design: Mason Industries, Inc. Types WBD.

C. Acoustical Wall, Ceiling or Floor Seal (Mason Spec Q): Split steel sleeve held in place by stainless steel band clamps. Isolating material between sleeve and service pipe to be closed cell neoprene sponge.
1. Basis of Design: Mason Industries, Inc. Type SWS.
2. Acceptable Option: Field fabricated seals consisting of sheet metal sleeve, stainless steel band clamps, and mineral wool or fiberglass isolating packing.
a. Seal ends of wool with silicone sealant.

D. Molded Rubber Pipe Expansion Joint (Mason Spec. O): Double sphere shaped with steel flanged end connections; peroxide or sulfur cured EPDM cover, reinforced with multiple layers of Kevlar or nylon cord; molded reinforcing ring. Unit to be designed to allow for tensile, compressive, angular and transverse movement. Units to be rated for minimum continuing operating pressures of 250psig at 170°F and 215 psig at 250°F.
1. Control Rods: Rods or cables and associated hardware as recommended by unit manufacturer.
2. Basis of Design: Mason Industries, Inc. – Mercer Rubber Co. Type SFDEJ.

E. Stainless Steel Hose (Mason Spec. P): Type 321 corrugated stainless steel hose with overbraid; Male NPT ends for 2-inch and smaller, 150# flanged for 2-1/2-inch and larger.
1. Basis of Design: Mercer Rubber Co. Type BSS-GU-MN & BSS-GU-RF-150.
2. Acceptable Option: Bronze corrugated hose with overbraid; for use with copper piping systems; soldered ends.
a. Basis of Design: Mercer Rubber Co. Type BBF.

F. Molded Rubber Duct Expansion Joint: Flexible duct connectors constructed of natural rubber or synthetic liner, nylon or steel reinforced as necessary to meet operating pressures and/or vacuum conditions; 304 stainless steel bands or flanged end connections.
1. Basis of Design: Mercer Rubber Co. Duct Type Expansion Joints.
2. Acceptable Option: Expansion Joints fabricated by the ductwork supplier as acceptable pending performance standards are equal to Basis of Design.

2.4 VIBRATION ISOLATION EQUIPMENT BASES

A. Steel Base (Mason Specs. J & K): Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Basis of Design: Mason Industries, Inc. Types WF, (base) & ICS, (rails).

B. Inertia Base (Mason Spec. L): Factory-fabricated, welded, structural-steel bases ready for field-applied, cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
   a. Bolted modular type assembly.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.
5. Basis of Design: Mason Industries, Inc. Type BMK.

2.5 SEISMIC-RESTRAINT DEVICES

A. General: Certain items identified in paragraphs above have seismic control capabilities in addition to vibration isolation, (duct thrust restraints, restrained mounts and springs, etc.). The items identified in the following paragraphs are components specific to seismic control.
   1. Base Mounted Equipment: Items identified above and herein comprise restraint systems for base mounted equipment.
   2. Suspended Equipment, Piping and Ductwork Restraint Systems: Restraint systems for these items shall consist of tension and compression, (strut) components, or tension only, (cable) components. In either case, provide necessary ancillary appurtenances as required to meet seismic restrain design criteria. Each and every component is not identified herein.
      a. Systems and their components shall be provided by a single manufacturer.
      b. Components shall be intended and listed for use with each other, (do not mix and match components not intended for use with each other).
      c. Systems may include:
         1) Attachments to structure.
         2) Braces and other means of augmenting standard hanger and support assemblies.
         3) Threaded rod stiffeners.
      d. Restraint devices constructed of aluminum or cast iron materials are not acceptable.

B. Strut Restraint Systems: Strut components, (channel support systems) are as identified in Section 15060, "Hangers and Supports."
   1. Basis of Design: As manufactured by B-Line Systems, Inc.

C. Restraining Cable Systems: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.
   1. Basis of Design: As manufactured by Mason Industries, Inc.

D. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251, with a flat washer face.
   1. Basis of Design: Mason Industries, Inc. Types PB & HG.

E. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
   1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
   2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251.
   3. Basis of Design: Mason Industries, Inc. Types Z-1225 & Z-1011.

F. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.
   1. Basis of Design: Mason Industries, Inc. Types SAS & SAB.

2.6 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
   1. Powder coating on springs and housings.
   2. All hardware shall be electro-galvanized. Hot-dip galvanize metal components for exterior use.
   3. Baked enamel for metal components on isolators for interior use.
   4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT VIBRATION ISOLATOR APPLICATION

A. General: Provide isolators of sufficient size, arrangement and configuration to support the weight and forces generated by the equipment, per isolator manufacturer Requirements. Provide isolation for support equipment, piping and ductwork associated with these "isolated systems" per the requirements of the paragraphs that follow. Coordinate isolation with seismic requirements.

B. Applications: Provide vibration isolation for the following pieces of equipment.
   1. Roof Mounted Condensing Units: Section 15671, "Condensing Units."
      a. Restrained spring furnished with equipment.

   2. Roof Mounted Air Handling Units: Section 15726, "Modular Outdoor Air Handling Units."
      a. Fan Sections, restrained springs furnished with equipment.

   3. Roof mounted Fans: Section 15837, "Centrifugal Fans."
      a. Restrained springs furnished with equipment.

3.3 EQUIPMENT VIBRATION ISOLATOR INSTALLATION, GENERAL

A. Install roof equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."

B. Base mounted equipment / isolation assemblies to be secured to structure. "Free floating" equipment is not acceptable.
   1. Install resilient bolt isolation washers on equipment anchor bolts.

C. Support Equipment: Install isolators on support equipment that is part of an isolated system. "Isolated systems" are identified by whether or not a major piece of system equipment is isolated.
   1. Base Mounted Support Equipment: Types W, SW & SWM, (match major equipment type).
   2. Suspended Support Equipment: Types HD & WHD.

3.4 DUCT AND PIPING SYSTEMS VIBRATION ISOLATION INSTALLATION

A. General: Piping systems shall be supported in accordance with their respective Sections as well as the requirements of Section 15060, "Hangers and Supports." In addition to those requirements, described herein are requirements to address vibration forces. Coordinate these installations with seismic controls.

B. Connections to Equipment, General: Piping connections to isolated pieces of Mechanical equipment shall include the following means of limiting vibration transmissions to the piping.
   1. Equipment Connections: Install pipe isolators at the inlet and outlet connections to each piece of isolated equipment. Exact locations of isolators as detailed on the Drawings.
      a. Types SFDEJ, BSS-GU-MN, BSS-GU-RF-150, BBF.
   2. Suspended Piping and Ductwork Either Side: Isolate pipe runs leading to and/or away from each piece of isolated equipment for a distance of 50 feet. Pipe support isolator types to match those used on the isolated equipment. Minimum static deflection to be one-half that of the equipment isolator.
      a. Pipes serving equipment isolated by elastomeric pads or mounts;
         1) Seismic & Non Seismic Applications: Types HD & WHD.
      b. Pipes serving equipment isolated by springs;
         1) Seismic Application: Type PC30N.

3. Wall, Floor and Hard Ceiling Penetrations: Where services leading to and/or away from isolated equipment penetrate walls, floors and/or hard ceilings within 50 feet of the equipment, the wall and/or floor penetrations shall be acoustically isolated.
   a. Type SWS.
      1) Exception: Where walls and/or floors penetrated are fire rated, provide a sleeve and appropriate fire stopping in lieu of this acoustical isolator. Fire Stopping is specified in Division 7.
4. Riser Isolation: Isolation of vertical riser-through-floor penetrations within 50 feet of isolated equipment shall be accomplished via using pairs of isolators which transmit riser load from a heavy duty riser clamp, (welded to the pipe) or welded attachments.
   a. Risers servicing equipment isolated by elastomeric pads or mounts;
      1) Types W & SW with a steel plate between the isolator and riser clamp.
   b. Risers servicing equipment isolated by springs;
      1) Type SLR.
5. Base of Riser and Horizontal Floor Supported Services: Isolation of floor supported piping and ductwork within 50 feet of isolated equipment shall be accomplished via using pairs of isolators which transmit load from a service –supporting cross member. Pipe support isolator types to match those used on the isolated equipment. Minimum static deflection to also match that of the equipment isolator.
   a. Pipes serving equipment isolated by elastomeric pads or mounts;
      1) Types HD & WHD.
   b. Pipes serving equipment isolated by springs;
      1) Type SLR.

C. Common Support Requirements: Where piping is intended to be installed on a common, (trapeze) rack, the following shall apply;
   1. Do not install isolated and non-isolated services on the same rack.
   2. Rack isolation shall be of a type and meet the requirements of the most stringent isolation
   3. Services shall be clipped on to the rack, (or attached via guides if the plans specifically call for this). Neoprene isolators shall be installed between the pipe and the rack/clip.

3.5 SEISMIC CONTROLS INSTALLATION

A. General: Seismic controls for equipment and distribution systems shall be as per the requirements of approved Seismic Controls Submittals.

3.6 FIELD QUALITY CONTROL

A. Vibration Isolator Testing: Perform the following field quality-control testing:
   1. Isolator seismic-restraint clearance.
   2. Isolator deflection.
   3. Snubber minimum clearances.

B. Seismic Controls Verifications: The Professional Engineer who designed the seismic controls shall review on-site installations as necessary to certify the successful completion of installations.
   1. Submit verification per the requirements of Section 1, "Submittals."

3.7 ADJUSTING

A. Adjust isolators after piping systems have been filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop.

D. Adjust active height of spring isolators.

E. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

G. CLEANING
1. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION 15071

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:
1. Equipment markers.
2. Access panel and door markers.
3. Pipe markers.
4. Stencils.
5. Valve tags.
6. Valve schedules.

B. Related Sections include the following:
1. Section 15140 "Plumbing Piping".
2. Section 15213 "Medical Gas Piping".
3. Section 15181 "Hydronic Piping".
4. Section 15815 "Metal Ducts".
5. Section 15838 "Power Ventilators".
6. Section 15761 "Air Terminal Units".
7. Section 15183 "Refrigerant Piping".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Valve numbering scheme (for Owner review).

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Identification Systems:
1. Seaton Name Plate Co.
2. Brady: Signmark Div.; W.H. Brady Co.
3. Marking Services Inc.

2.2 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match Drawing equipment Schedule Tags.

2. Size: 2-1/2 by 4 inches for control devices, dampers, and valves and equipment.

3. Color: Black background with white lettering.

B. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.3 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated on Drawing Legend Sheet M-001 and abbreviate only as necessary for each application length.
3. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive. Basis of Design: Seton Setmark.

C. Plastic Tape Pipe Markers: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back. Basis of Design: Seton Opti-Code.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts.

1. Stencil Material: Metal or fiberboard.
2. Stencil Paint: Exterior, gloss, acrylic enamel. Paint color for each duct system stencil to be coordinated with the Owner.

2.5 VALVE TAGS

A. Valve Tags: Numbering scheme shall be approved by the Owner.

1. Material: 19 gauge brass. Provide hole for fastener.
2. Size: 1-1/2 inch diameter round, octagon, or square.
3. Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
4. Valve-Tag Fasteners: Brass wire-link jack chain, or meter seal with stainless steel wire and aluminum crimp.

2.6 VALVE SCHEDULES

A. Valve schedule numbering scheme shall be approved by the Owner prior to generating final schedule.

B. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-Schedule Frames: Standard 8-1/2 x 11" document size, extruded aluminum.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

B. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
2. Medical Gas Piping: Self-adhesive plastic tape pipe markers in accordance with the requirements of NFPA 99.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near all penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings.

3.4 DUCT IDENTIFICATION

A. Stenciled Duct Marker: Install stenciled duct markers, showing service and direction of flow.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 VALVE-SCHEDULE INSTALLATION

A. Coordinate valve schedule mounting location with the Owner.

3.7 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 15075

SECTION 15081

DUCT INSULATION AND JACKETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes semi-rigid and flexible duct; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
2. Section 15815 "Metal Ducts."

1.3 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-construction Shop Drawings: Show fabrication and installation details for metal ducts as follows prior to commencing with fabrication and installation:
1. Product Data: Identify thermal conductivity, thickness, and field applied jackets for each type of product indicated.
2. Shop Drawings: Show fabrication and installation details for the following:
   a. Application of field-applied jackets.
   b. Applications at linkages for control devices.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with duct installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Fiber Glass Insulation:
1. CertainTeed.
2. Knauf FiberGlass.
3. Owens-Corning Fiberglas Corp.
4. Schuller International, Inc. / Johns Manville Insulations

2.2 INSULATION MATERIALS

A. Fiber Glass Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket (FSK) manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film. 'K' value: 0.24 Btu*in/(hr*sqft*degree F) at 75 degree F. Based on Johns Manville 800 Series Spin-Glas.

B. Fiberglass Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket (FSK) manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film. 'K' value: 0.29 Btu*in/(hr*sqft*degree F) at 75 degree F. Based on Johns Manville Microlite.

C. Calcium Silicate Insulation: Flat, curved, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a nonasbestos fibrous reinforcement. Comply with ASTM E 814, Type I. Insulation used for grease duct enclosure shall be UL listed for that application. Based on Johns Manville Firetemp L.

D. Flexible blanket grease duct insulation: Ceramic fiber inorganic blanket encapsulated in scrim reinforced foil, UL 1978, ASTM E 814. Two layers suitable for grease duct installation and zero clearance to combustibles. Thermal conductivity 1.69 Btu*in /(hr*sqft*degreeF) at 1500 degrees F. Based on 3M Fire Barrier Duct Wrap 15A.

2.3 FIELD-APPLIED JACKETS

A. Metal Jacket:
   1. Available Products:
      a. Childers Products, Division of ITW: Metal Jacketing Systems.
      b. PABCO Metals Corporation; Surefit.
      c. RPR Products, Inc.; Insul-Mate.

   2. Painted Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

      a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Aluminum jacket paint color to be selected by Architect.
      d. Moisture Barrier for Outdoor Application: 2.5-mil thick Polysurlyn.
      e. Factory-Fabricated Fitting Covers:
         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radium elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Field fabricate fitting covers only if factory fabricated fitting covers are not available.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

   1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
3. Aluminum: 0.007 inch (0.18 mm) thick.
4. Brass: 0.010 inch (0.25 mm) thick.
5. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.

C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

D. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

1. Welded Pin Holding Capacity: 100 lb (45 kg) for direct pull perpendicular to the attached surface.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 FIBER GLASS INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

1. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions larger than 24 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
   b. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   c. Do not overcompress insulation during installation.
2. Impale insulation over anchors and attach speed washers.
3. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.
6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.
9. Terminate insulation around duct access doors and seal insulation edges.

B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Space anchor pins as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
   c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.

4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.
9. Terminate insulation around duct access doors and seal insulation edges.

3.5 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Supply ductwork except where located in conditioned space.

2. Exhaust ductwork within 10 feet of exterior opening.
3. Outdoor exposed supply and return ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Metal ducts with duct liner.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
4. Flexible connectors.
5. Vibration-control devices.
6. Testing agency labels and stamps.
7. Nameplates and data plates.
8. Access panels and doors in air-distribution systems.
9. Cooking hood exhaust ducts installed in rated chase in accordance with applicable code.

3.6 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Rectangular and round, supply-air ducts, above ceilings, concealed, in mechanical rooms, and in unconditioned space.

1. Material: Fiberglass blanket or fiberglass board.
2. Thickness: 1 ½ inches.
3. Number of Layers: one.
4. Factory-Applied Jacket: FSK or vinyl-film. Vapor retarder required on ducts conveying air below ambient temperature.

B. Service: Exhaust ducts within 10' of exterior opening.

1. Material: Fiberglass blanket or fiberglass board.
2. Thickness: 1 inch.
3. Number of Layers: one.
4. Factory-Applied Jacket: FSK or vinyl-film.

3.7 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Possible variations of jackets by location are endless. This Article specifies locations in two broad categories: concealed and exposed.

B. 30-mil (0.8-mm) or heavier PVC is recommended for outdoor applications. 40-mil (1.0-mm) PVC does not meet a flame-spread index of 25 and a smoke-developed index of 50; however, a flame-spread or smoke-developed index is not a requirement for outdoor applications.

C. 0.024-inch (0.61-mm) or heavier aluminum is recommended for outdoor applications.

D. Painted aluminum increases surface emissivity and provides added chemical resistance.

E. 0.016-inch (0.41-mm) or heavier stainless steel is recommended for outdoor applications.

F. Z-shaped locking seam is recommended for metal jackets located in unprotected applications that are exposed to severe weather.

G. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

H. Ducts and Plenums, exposed, up to 48-inches in diameter or with flat surfaces up to 72-inches:

3.8 Painted aluminum, smooth, 0.024-inch thick.

END OF SECTION

SECTION 15083

PIPE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 7, Section 07270 "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
2. Section 15081 "Duct Insulation" for insulation for ducts and plenums.
3. Pipe insulation shields and protection saddles, see appropriate Piping sections.

1.3 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-Construction Submittals: Submit the following items prior to commencing with installations.

1. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
2. Shop Drawings: Show fabrication and installation details for the following:
   a. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
   b. Attachment and covering of heat trace inside insulation.
   c. Insulation application at pipe expansion joints for each type of insulation.
   d. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   e. Removable insulation at piping specialties and equipment connections.
   f. Application of field-applied jackets.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in the appropriate piping section.

B. Coordinate clearance requirements with piping Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Fiber Glass Insulation:
1. CertainTeed Manson.
2. Knauf FiberGlass GmbH.
3. Owens-Corning Fiberglas Corp.
4. Schuller International, Inc. / Johns Manville Insulations

C. Flexible Elastomeric Thermal Insulation:
1. Armstrong World Industries, Inc.
2. Rubatex Corp.

D. Calcium Silicate Insulation:
1. Owens-Corning Fiberglas Corp.
2. Pabco.
3. Schuller International, Inc. / Johns Manville Insulations

2.2 INSULATION MATERIALS

A. Fiber Glass Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Thermal conductivity: 0.23 Btu*in/(hr*sq ft*degree F) at 75 degrees F.

2. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket complying with ASTM C 1136. Based on Johns Manville Micro-Lok.

3. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.

4. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:

a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.

b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

5. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.

B. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.

1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class 1.
2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.
3. Thermal conductivity: 0.32 Btu*in/(hr*sq ft*degree F) at 75 degrees F.
4. Based on Pittsburgh Corning Foamglas.

C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Thermal conductivity: 0.27 Btu*in/(hr*sq ft*degree F) at 75 degrees F.
2. Adhesive: As recommended by insulation material manufacturer.
3. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
4. Based on Armstrong AP Armaflex.

D. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-(0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
3. Aluminum: 0.007 inch (0.18 mm) thick.
4. Brass: 0.010 inch (0.25 mm) thick.
5. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.

C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section 07270 "Firestopping."

T. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 FIBER GLASS INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.

4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
5. surface.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
2. Apply lap or joint strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

3.8 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.
4. Drainage piping located in crawl spaces, unless otherwise indicated.
5. Below-grade piping, unless otherwise indicated.
6. Chrome-plated pipes and fittings, unless potential for personnel injury.
7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.
8. Flanges and unions at equipment on hot piping systems conveying fluids 140 degrees F or less. Bevel and seal ends of insulation.

3.9 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.10 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot and recirculated hot water.

1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
2. Insulation Material: Fiber glass with jacket.
3. Insulation Thickness: Apply the following insulation thicknesses:

   a. Piping up to 1 1/4": 0.5" thickness.
   b. Piping 1-1/4" and greater: 1" thickness.
4. Vapor Retarder Required: No.
5. Finish: None.

B. Service: Domestic cold water.

1. Operating Temperature: 35 to 60 deg F (2 to 15 deg C).
2. Insulation Material: Fiber glass with jacket.
3. Insulation Thickness: Apply the following insulation thicknesses:

   a. Piping up to 1 1/4": 0.5" thickness.
   b. Piping 1-1/4" and greater: 1" thickness.
4. Vapor Retarder Required: Yes.
5. Finish: None.

C. Service: Refrigerant suction and hot-gas piping.

1. Operating Temperature: 40 to 60 deg F (2 to 10 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses:

   a. All piping: 1" thickness.
4. Finish:
   a. Indoors: none.
   b. Outdoors: weather-resistant protective finish equal to field applied, vinyl/acrylic water based, Rubatex Protective Coating.

D. Service: Heating hot-water supply and return.

1. Operating Temperature: 100 to 200 deg F (38 to 93 deg C).
2. Insulation Material: Fiberglass with jacket.
3. Insulation Thickness: Apply the following insulation thicknesses:

   a. Piping up to 4": 1.0" thickness.
   b. Piping 4"and greater: 1.5" thickness.
   c. Piping insulation is not required between the control valve and coil on run-outs when the control valve is located within 4 feet of the coil and the pipe size is 1 inch or less.
4. Vapor Retarder Required: No.
5. Finish: none.

E. Service: Clean Steam (Humidification).

1. Operating Temperature: 212 to 250 deg F (232 deg C).
2. Insulation Material: Fiberglass with jacket.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Piping 1.25" and greater: 2.0" thickness.
4. Vapor Retarder Required: No.
5. Finish: None.

END OF SECTION

SECTION 15122

METERS AND GAGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes the following meters and gages for mechanical systems:

1. Thermometers.
2. Gages.
3. Test plugs.

B. Related Sections include the following:
1. Section 15140 "Plumbing Piping and Specialties".
2. Section 15181 "Hydronic Piping and Specialties".

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Product Data: For each type of product indicated; include performance curves.

C. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

D. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Termometers:

1. Palmer - Wahl Instruments Inc.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

C. Thermowells

1. Palmer - Wahl Instruments Inc.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

D. Pressure gages

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Palmer - Wahl Instruments Inc.
3. Trerice, H. O. Co.
4. Weiss Instruments, Inc.
5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

E. Test plugs

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

2.2 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Stem type complying with ASTM E1.
1. Case: Die-cast aluminum, 9 inches long.
2. Tube: Blue reading, organic-liquid filled, with magnifying lens.
3. Tube Background: Satin-faced, non-reflective aluminum with permanently etched scale markings.
4. Window: Glass or plastic.
5. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

6. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
7. Accuracy: Plus or minus 1 scale division to maximum of 1.5 percent of range.
8. Basis of Design: Trerice Model BX914-SPB

2.3 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used or see list of acceptable manufacturers above.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

A. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, cast aluminum, 3-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Black metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Accuracy: Grade 1A, plus or minus 1 percent of whole scale.
10. Basis of Design: Trerice Model 600CB35

B. Pressure-Gage Fittings:

1. Valves: NPS 1/4 (DN 8) brass or stainless-steel needle type.
2. Syphons: NPS 1/4 (DN 8) coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

B. Minimum Pressure and Temperature Rating: 500 psig at 350 deg F (3450 kPa at 177 deg C).

C. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air or water service at minus 30 to plus 350 deg F (minus 35 to plus 177 deg C) shall be Nordel.

PART 3 - EXECUTION

3.4 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:

1. Inlet and outlet of each hydronic boiler.

B. Provide the following dual temperature scale ranges for thermometers:

1. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions (Minus 1 to plus 115 deg C, with 1-degree scale divisions).
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions (Minus 18 to plus 38 deg C, with 1-degree scale divisions).
3. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions (Minus 1 to plus 115 deg C, with 1-degree scale divisions).

3.5 GAGE APPLICATIONS

A. Provide the following dual pressure scale range for fluids under pressure:
1. Two times operating pressure.

B. Install pressure gages for discharge of each pressure-reducing valve.

C. Install pressure gages at suction and discharge of each pump.

3.6 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids.

E. Install test plugs in tees in piping.

3.7 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

B. Connect wiring and ground equipment in accordance with Division 16.

3.8 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.9 MERCURY

A. Equipment shall not contain mercury or mercury containing products.

END OF SECTION

SECTION 15140

PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes the following piping systems to a point 10-feet outside the building wall, unless otherwise noted;
   1. Water Supply Piping.
      a. Domestic Cold, Hot and Recirculated Hot Water.
      b. Non-potable Water.
      c. Tempered Water.
   2. Drainage, Waste and Vent, (DWV).
      a. Sanitary Waste and Vent.
      b. Indirect Waste.

B. Related Sections include the following:

   1. Division 7, Section 07270 "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.

   2. Division 7, Section 07900 "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.

   3. Section 15083, "Pipe Insulation" for system insulation requirements.
   4. Section 15122, "Meters and Gauges" for thermometers, pressure gages, and fittings.
   5. Section 15430, "Plumbing Specialties" for water distribution piping specialties.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. EPDM: Ethylene-propylene-diene terpolymer.

C. DWV: Drainage, Waste and Vent piping systems.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installations capable of producing piping systems with the following minimum working pressure ratings, unless otherwise noted.
1. Water Supply Systems, Above Ground: 125 psig.
2. DWV, (Gravity) Systems: 10 foot of head of water.

1.5 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-Construction Submittals: Submit the following items prior to commencing with installations.
1. Product Data: For pipe, tube, fittings, valves and couplings.
2. Product Data: For pipe, tube, fittings, couplings, valves and water meters.

C. Submittals During Construction: Submit the following items at the intervals indicated.
1. Pressure test results after system rough-ins.
a. Test results to include Plumbing Inspector sign-off.
b. If systems are tested in portions, submit results as each portion is tested.

D. Post Construction Submittals: Submit the following items upon completion of system installations.
1. Water Disinfection statement and final water quality test results.
2. Final Plumbing Inspector Sign-off.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. No-hub Couplings:
1. Husky Technologies.
2. Ideal; A Gates Group Company.
3. Tyler Pipe Co.
4. Charlotte Pipe and Foundry.

C. Ball Valves:
1. Conbraco Industries, Inc.; Apollo Div.
2. Crane Co.; Crane Valve Group; Jenkins Valves.
3. Crane Co.; Crane Valve Group; Stockham Div.
4. NIBCO INC.
5. Watts Industries, Inc.; Water Products Div.
6. Hammond Valve.
7. Milwaukee Valve Company.

D. Gate Valves:
1. Crane Co.; Crane Valve Group; Stockham Div.
2. Grinnell Corporation.
3. Hammond Valve.
4. Milwaukee Valve Company.
5. NIBCO INC.
6. Watts Industries, Inc.; Water Products Div.

E. Globe Valves:
1. Crane Co.; Crane Valve Group; Stockham Div.
2. Grinnell Corporation.
3. Hammond Valve.
4. Milwaukee Valve Company.
5. NIBCO INC.

F. Swing Check Valves:
1. Crane Co.; Crane Valve Group; Stockham Div.
2. Grinnell Corporation.
3. Hammond Valve.
4. Milwaukee Valve Company.
5. NIBCO INC.
6. Watts Industries, Inc.; Water Products Div.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

2.4 CAST-IRON SOIL PIPE AND FITTINGS

A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.

B. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.

1) NPS 1-1/2 to NPS 4: 3-inch wide shield with 4 bands.
2) NPS 5 to NPS 10: 4-inch wide shield with 6 bands.

2.5 VALVES

A. Balancing and drain valves are specified in Section 15430 "Plumbing Specialties."

B. Refer to Part 3 "Valve Applications" Article for applications of valve types.

C. General Requirements:
1. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
2. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller.
5. Extended Valve Stems: On insulated valves.
6. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
7. Valve Grooved Ends: AWWA C606, NPS 2-1/2 (DN 65) and larger.
8. Solder Joint: With sockets according to ASME B16.18.
a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.
9. Threaded: With threads according to ASME B1.20.1.
10. Valve Bypass and Drain Connections: MSS SP-45.

D. Ball Valves:
1. MSS SP-110, 600# W.O.G., forged brass, two piece body, hard chrome plated forged brass ball, standard or full port, true adjustable packing nut, (O-ring only type stem seal not acceptable) blow-out proof stem.
2. Acceptable end connections;
a. Threaded for NPS 4 and smaller.
b. Soldered for NPS 3 and smaller.
c. Flanged or grooved for NPS 4 and larger.
3. Basis of Design: Apollo 70 Series.

E. Gate Valves:

1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, hand wheel, inside screw, solid wedge disc.
2. Acceptable end connections;
   a. Soldered for NPS 3 and smaller.

F. Globe Valves:
1. MSS SP-80, Class 125, bronze body, bronze trim, bronze disc.
2. Acceptable end connections;
   a. Soldered for NPS 3 and smaller.

G. Swing Check Valves:
1. Up to NPS 3: MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat.
2. NPS 4 and larger: MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat.
3. Acceptable end connections;
   a. Soldered for NPS 3 and smaller.
   b. Flanged or grooved for NPS 4 and larger.

PART 3 - EXECUTION

3.1 EXCAVATION AND PREPARATION

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

B. Prepare pipe bedding to receive buried piping.
1. Grade the bottom of the trench smooth. Provide a stable, rock free base.
2. Remove any unstable materials from the base of the trench. Provide sand or pea stone as required to grade the trench bottom.
3. Remove base materials at each piping joint to relieve undo stresses at the fittings and couplings.

3.2 PIPE AND FITTING APPLICATIONS

A. Water Supply Piping, Aboveground:
1. Hard copper tube, Type L; copper pressure fittings; lead-free soldered joints.
   a. Option for NPS 2-1/2 and larger: Hard copper tube, Type L with grooved ends; copper grooved-end fittings and couplings; and grooved joints.

B. DWV Gravity Piping, Below Building Slab and to 10-feet outside the building wall:
1. Service weight cast iron soil pipe; hub and spigot fittings; gasket or lead and oakum joints.

C. DWV Gravity Piping, Aboveground:
1. Service weight cast iron soil pipe; hubless cast iron fittings; no-hub coupled joints.
2. Option: 2-inch and smaller drain and vent lines may be installed using Copper tube, Type L; copper drainage fittings, soldered joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller.
3. Directional Duty: Use swing check valves.
4. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
5. Drain Duty: Hose-end drain valves.

B. Cast-iron, grooved-end valves may be used with grooved-end piping.

C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

E. Install balancing valve in each hot-water circulation return branch. Set balancing valves partly open to restrict but not stop flow. Balancing valves are specified in Section 15430 "Plumbing Specialties."

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Install copper tubing according to CDA's "Copper Tube Handbook."

C. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

E. Make changes in direction for DWV piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Lay buried building DWV piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

G. Install DWV piping at the following minimum slopes, unless otherwise indicated:

1. Horizontal drainage piping, NPS 3-inch and smaller: ¼-inch per foot downward in direction of flow.

2. Horizontal drainage piping, NPS 4-inch and larger: 1/8-inch per foot downward in direction of flow.

3. Vent Piping: 1/8-inch per foot down toward vertical fixture vent or toward vent stack.

H. Install PVC DWV piping according to ASTM D 2665.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

3.6 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Section 15071 "Mechanical Vibration and Seismic Controls."

B. Pipe hanger and support devices are specified in Section 15060 "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. MSS Type 1, adjustable, steel clevis hangers.

C. Install supports according to Section 15060 "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.

G. Install supports for vertical copper tubing every 10 feet (3 m).

H. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to the following:
1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
2. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

D. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

E. Connect storm drainage piping to roof drains and storm drainage specialties.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

C. Inspect DWV piping as follows:

1. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
2. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test DWV piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. General: Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

B. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
3. Prepare and submit reports of purging and disinfecting activities.

C. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

D. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 15181

HYDRONIC PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes piping, general-duty valves, special-duty valves, and hydronic specialties for heating water systems.

B. Related Sections include the following:

1. Section 07841 "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
2. Section 07920 "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
3. Section 15050 "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
4. Section 15122 "Meters and Gages" for thermometers and pressure gages.
5. Section 15075 "Mechanical Identification" for labeling and identifying hydronic piping.
6. Section 15900 "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene rubber.

D. PTFE: Polytetrafluoroethylene plastic.

E. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of general-duty valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories

B. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.

C. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

F. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

C. ASME Compliance: ASME B31.9 for building services piping valves.

D. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

1.6 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7, Section 07841 "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General-Duty Valves:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Div.
   d. Hammond Valve.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Red-White Valve Corp.

2. Calibrated Balancing Valves:
   a. Flow Design, Inc.
   b. Griswold Controls.
   c. ITT Bell & Gossett; ITT Fluid Technology Corp.
   d. Taco, Inc.

2.2 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.4 SPECIAL-DUTY VALVES

A. Refer to Part 3 "Valve Applications" Article for applications of each valve.

B. Calibrated Balancing Valves, NPS 2 (DN 50) and Smaller: Bronze body, ball type, 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

2.5 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig (1035-kPa) working pressure; 225 deg F (107 deg C) operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 (DN 6) discharge connection and NPS 1/2 (DN 15) inlet connection.

B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig (1035-kPa) working pressure; 240 deg F (116 deg C) operating temperature; with NPS 1/4 (DN 8) discharge connection and NPS 1/2 (DN 15) inlet connection.

C. Y-Pattern Strainers: 125-psig (860-kPa) working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 (DN 65) and larger, threaded connections for NPS 2 (DN 50) and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.

2.6 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

E. Valve Actuators:
1. Handwheel: For valves other than quarter-turn types.
2. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller.

F. Extended Valve Stems: On insulated valves.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.7 COPPER-ALLOY BALL VALVES

A. MSS SP-110, Two-Piece, Copper-Alloy Ball Valves: Bronze body with large-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem. O-ring only stem seals shall not be acceptable.
1. Basis of Design: Hammond 8501/8511.

2.8 BRONZE CHECK VALVES

A. MSS SP-80 Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.
1. Basis of Design: Hammond IB 940/945.

2.9 BRONZE GATE VALVES

A. MSS SP-80 Type 2, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge union-ring bonnet, and ferrous-alloy handwheel.
1. Basis of Design: Hammond IB 617/635.

2.10 BRONZE GLOBE VALVES

A. MSS SP-80, Type 2, Class 125, Bronze Globe Valves: Bronze body with PTFE or TFE disc union-ring bonnet and ferrous-alloy handwheel.
1. Basis of Design: Hammond IB 416T/423.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Heating Water, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints.

3.2 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Gate or ball valves.
2. Throttling Duty: Globe or ball valves.

B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

C. Install calibrated balancing valves in the return water line of each heating element and elsewhere as required to facilitate system balancing.

D. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

E. Heating Water Piping: Use the following types of valves:
1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 125, bronze.
3. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 125 minimum.
4. Gate Valves, NPS 2 and Smaller: Type 2, Class 125, bronze.
5. Globe Valves, NPS 2 and Smaller: Type 2, Class 125, bronze.

3.3 PIPING INSTALLATIONS

A. Refer to Section 15050, "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

G. Install strainers on supply side of each control valve and elsewhere as indicated. Match size of strainer blowoff connection for strainers smaller than NPS 2.

H. Anchor piping for proper direction of expansion and contraction.

3.4 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Section 15060 "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS ¾: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.6 JOINT CONSTRUCTION

A. Refer to Section 15050 "Basic Mechanical Materials and Methods" for joint construction requirements for soldered joints in copper tubing.

B. Valve Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.7 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.

3.8 TERMINAL EQUIPMENT CONNECTIONS

A. Install control valves in accessible locations close to connected equipment.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.10 ADJUSTING

A. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
3. Set temperature controls so all coils are calling for full flow.
4. Check and set operating temperatures of existing system equipment.
5. Lubricate motors and bearings.

B. Refer to Section 15950 Testing, Adjusting, and Balancing.

3.11 CLEANING

A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION

SECTION 15183

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

B. Related Sections include the following:

1. Division 7 Section "Roof Accessories" for roof curbs, piping supports, and roof penetration boots.
2. Division 7, Section 07270 "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
3. Division 7, Section 07900 "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
4. Section 15060 "Hangers and Supports" for pipe supports and installation requirements.
5. Section 15075 "Mechanical Identification" for labeling and identifying refrigerant piping.
6. Section 15122 "Meters and Gages" for thermometers and pressure gages.
7. Section 15900 "HVAC Instrumentation and Controls" for thermostats, controllers, automatic-control valves, and sensors.

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.

1. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

B. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."

C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.5 COORDINATION

A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

D. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.

E. Coordinate pipe fitting pressure classes with products specified in related Sections.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Refrigeration Oil Test Kits: One each, containing everything required to conduct one test.
2. Refrigerant: One container each, with 20 lb of refrigerant.
3. Filter-Dryer Cartridges: One of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Refrigerants:

a. Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.
b. DuPont Company; Fluorochemicals Div.
c. Elf Atochem North America, Inc.; Fluorocarbon Div.
d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.

2. Refrigerant Valves and Specialties:

a. Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
b. Danfoss Electronics, Inc.
c. Emerson Electric Company; Alco Controls Div.
d. Henry Valve Company.
e. Sporlan Valve Company.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8, Classification Bag-1 (silver)

E. Flexible Connectors: 500-psig minimum operating pressure; seamless tin-bronze core, high-tensile bronze-braid covering, and solder-joint end connections; dehydrated, pressure tested, minimum 7 inches long

2.3 VALVES

A. Coordinate with valves furnished with equipment.

B. Diaphragm Packless Valves: 500-psig working pressure and 275 deg F working temperature; globe design with straight-through or angle pattern; forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, and with solder-end connections.

C. Packed-Angle Valves: 500-psig working pressure and 275 deg F working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.

D. Check Valves Smaller Than NPS 1: 400-psig operating pressure and 285 deg F operating temperature; cast-brass body, with removable piston, polytetrafluoroethylene seat, and stainless-steel spring; globe design. Valve shall be straight-through pattern, with solder-end connections.

E. Check Valves, NPS 1 and Larger: 400-psig operating pressure and 285 deg F operating temperature; cast-bronze body, with cast-bronze or forged-brass bolted bonnet; floating piston with mechanically retained polytetrafluoroethylene seat disc. Valve shall be straight-through or angle pattern, with solder-end connections.

F. Service Valves: 500-psig pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.

G. Solenoid Valves: Comply with ARI 760; 250 deg F temperature rating and 400-psig working pressure; forged brass, with polytetrafluoroethylene valve seat, 2-way, straight-through pattern, and solder-end connections; manual operator; fitted with suitable NEMA 250 enclosure of type required by location, with 1/2-inch conduit adapter and 120-V, normally closed holding coil.

H. Pressure-Regulating Valves: Comply with ARI 770; pilot operated, forged brass or cast bronze, stainless-steel bottom spring, pressure-gage tappings, 24-V dc standard coil, and wrought-copper fittings for solder-end connections; suitable for refrigerant specified.

I. Pressure-Regulating Valves: Comply with ARI 770; direct acting, brass; with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connection; suitable for refrigerant specified.

J. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.

K. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

L. Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.

2.4 REFRIGERANT PIPING SPECIALITIES

A. Coordinate with specialties furnished with equipement.

B. Straight- or Angle-Type Strainers: 500-psig working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 1-1/8 inches, 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.

C. Moisture/Liquid Indicators: 500-psig maximum working pressure and 200 deg F operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

D. Replaceable-Core Filter-Dryers: 500-psig (3450-kPa) maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:

1. Filter Cartridge: Pleated media with integral end rings, stainless-steel support, ARI 730 rated for capacity.
2. Filter-Dryer Cartridge: Pleated media with solid-core sieve with activated alumina, ARI 730 rated for capacity.
3. Wax Removal Cartridge: Molded, bonded core of activated charcoal and desiccant with integral gaskets.

2.5 REFRIGERANTS

A. Basis of Design: ASHRAE 34, R-407C (Blend of R-125, R134a, R-32).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Aboveground, within Building: type ACR drawn-copper tubing.

3.2 VALVE APPLICATIONS

A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor, for gage taps at hot-gas bypass regulators, on each side of strainers.

B. Install check valves in compressor discharge lines and in condenser liquid lines on multiple condenser systems.

C. Install packed-angle valve in liquid line between receiver shutoff valve and thermostatic expansion valve for system charging.

D. Install diaphragm packless or packed-angle valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.

E. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve.

1. Install solenoid valves in horizontal lines with coil at top.
2. Electrical wiring for solenoid valves is specified in Division 16 Sections. Coordinate electrical requirements and connections.

F. Install thermostatic expansion valves as close as possible to evaporator.

1. If refrigerant distributors are used, install them directly on expansion-valve outlet.
2. Install valve so diaphragm case is warmer than bulb.
3. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.

4. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

G. Install pressure-regulating and pressure relief valves as required by ASHRAE 15. Pipe pressure relief valve discharge to outside.

3.3 SPECIALTY APPLICATIONS

A. Coordinate with specialties furnished with equipment.

B. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.

C. Install strainers immediately upstream from each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.

D. Install strainers in main liquid line where multiple expansion valves with integral strainers are used.

E. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

F. Install pressure relief valves on ASME receivers; pipe discharge to outdoors.

G. Install replaceable-core filter-dryers in vertical liquid line adjacent to receivers and before each solenoid valve.

H. Install solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

I. Install flexible connectors at or near compressors.

3.4 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

F. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

G. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

H. Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.

I. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

J. Hanger, support, and anchor products are specified in Division 15 Section "Hangers and Supports."

K. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6.0 m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6.0 m) or longer.
3. Pipe rollers for multiple horizontal runs 20 feet (6.0 m) or longer, supported by a trapeze.
4. Spring hangers to support vertical runs.

L. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
7. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).

M. Support vertical runs at each floor.

3.5 PIPE JOINT CONSTRUCTION

A. Braze joints according to Division 15 Section "Basic Mechanical Materials and Methods."

B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

3.6 FIELD QUALITY CONTROL

A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.

1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.

    a. System shall maintain test pressure at the manifold gage throughout duration of test.
    b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
    c. Fill system with nitrogen to raise a test pressure of 150 psig (1035 kPa) or higher as required by authorities having jurisdiction.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of the conditioned air or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Check compressor oil level above center of sight glass.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves, except bypass valves that are used for other purposes.
5. Check compressor-motor alignment, and lubricate motors and bearings.

3.8 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter-dryer after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometer. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION

SECTION 15213

MEDICAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes medical gas piping and related specialties for the following medical gas systems:

1. Medical gas pressure systems:

   a. Oxygen piping, designated "O2 - Oxygen."
   b. Medical compressed-air piping, designated "MA - Medical Air."

2. Medical gas suction systems:

   a. Medical-surgical vacuum piping, designated "MV - Medical Vacuum."

B. Related Sections include the following:

1. Section 15075 "Mechanical Identification"

2. Section 07270 "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.

3. Section 07900 "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
4. Section 15122 "Meters and Gages" for thermometers and pressure gages.

1.3 DEFINITIONS

A. ACR: Air conditioning and refrigeration.

B. CR: Chlorosulfonated polyethylene synthetic rubber.

C. D.I.S.S.: Diameter-index safety system.

D. NPS: Nominal pipe size.

E. PTFE: Polytetrafluoroethylene plastic.

F. TFE: Tetrafluoroethylene plastic.

G. WAGD: Waste anesthetic gas disposal.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide medical gas and vacuum piping systems that comply with the following NFPA 99 level categories:

1. Level 1: For entire facility with systems where failure of medical gas supply would be immediate and direct life-safety threat to patients. Air and vacuum equipment arrangement must be duplex or redundant.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Medical gas tubes and fittings.
2. Medical gas valves and valve boxes.
3. Medical gas service connections.
4. Alarm system components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Coordination Drawings: For medical gas systems. Include relationship to other services that serve same work area.

D. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.

E. Piping Material Certification: Signed by Installer certifying that medical gas piping materials comply with NFPA 99 requirements.

F. Qualification Data: For testing agency.

G. Field quality-control Test and Certification Reports.

H. Operation and Maintenance Data: For medical gas piping and specialties to include in emergency, operation, and maintenance manuals. Include data for the following:
1. Medical gas service connections.
2. Alarm system.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the Medical Gas Professional Healthcare Organization or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Fabricate and label bulk medical gas storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels."

E. Comply with NFPA 70, "National Electrical Code."

F. Comply with NFPA 99-2002 edition, "Health Care Facilities," for materials, installation, testing and certification.

G. Comply with UL 498, "Attachment Plugs and Receptacles," for electrical service connections.

H. Contamination of existing piping systems caused be faulty workmanship or procedures shall be corrected to the Owner's satisfaction at he Contractor's expense and at no additional cost to the owner.

1.7 COORDINATION

A. Coordinate size and location of concrete bases with concrete work.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quick-Connect Service Connections: Furnish complete noninterchangeable medical gas pressure outlets and suction inlets.

a. Oxygen Service Connections: Equal to 10 percent of amount installed, but no fewer than one unit.
b. Medical Air Service Connections: Equal to 10 percent of amount installed, but no fewer than one unit.
c. Medical Vacuum Service Connections: Equal to 10 percent of amount installed, but no fewer than one unit.
d. Medical Vacuum Slide Brackets: Equal to 10 percent of amount installed, but no fewer than one unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Healthcare Products, Inc.; Chemetron Div.
2. Amico Corporation.
3. BeaconMedaes.
4. Squire-Cogswell/Aeros Instruments.

2.2 PIPES, TUBES, AND FITTINGS

A. General: Sizes indicated on the drawings are nominal pipe/tube size, (NPS).

Nominal Pipe/Tube Size, (NPS)	Actual O.D. / ACR Designation (inches)
1/2	5/8
3/4	7/8
1	1-1/8
1-1/4	1-3/8
1-1/2	1-5/8
2	2-1/8
2-1/2	2-5/8
3	3-1/8

B. Hard Copper Tube: ASTM B 819, Type K or L, seamless, drawn-temper, medical gas tube that has been factory cleaned, purged, and sealed for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.

1. Fittings: Factory cleaned, purged, and bagged for oxygen service according to ASTM B 819 or field cleaned, purged, and bagged as specified in "Preparation" Article in Part 3.

a. Copper Pressure Fittings: ASME B16.22, wrought-copper solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
b. Cast-Copper-Alloy Flanges: ASME B16.24, Class 300.
c. Copper Unions: ASME B16.22 or MSS SP-123.

C. Memory-Metal Couplings: Nickel-titanium, shape-memory-alloy, cryogenic compression fitting for joining copper tube without heat.

1. Cleaning: Factory cleaned, purged, and bagged for oxygen service according to ASTM B 819 or field cleaned, purged, and sealed or bagged as specified in "Preparation" Article in Part 3.

D. Flexible Pipe Connectors: Corrugated-bronze inner tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Cleaning: Factory cleaned, purged, and sealed or bagged for oxygen service according to ASTM B 819 or field cleaned, purged, and sealed or bagged as specified in "Preparation" Article in Part 3.
2. Working-Pressure Rating: 200 psig minimum.
3. End Connections NPS 2 (2-1/8" O.D.) and Smaller: Threaded copper pipe or plain-end copper tube.
4. End Connections NPS 2-1/2 (2-5/8" O.D.) and Larger: Flanged copper alloy.

2.3 JOINING MATERIALS

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

B. Brazing Filler Metals: AWS A5.8, BCuP series alloys. Flux is prohibited unless used with bronze fittings.

C. Threaded-Joint Tape: PTFE.

D. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos free, and suitable for oxygen service.

2.4 MEDICAL GAS VALVES

A. Valves, General: Factory cleaned for oxygen service and bagged. Color-coded handles and identification labels shall be provided with each valve.

1. Exception: Factory cleaning and bagging are not required for valves for WAGD service.

B. Copper-Alloy Ball Valves: MSS SP-110, 3-piece-body, full-port ball valve rated for 300-psig minimum working pressure; with chrome-plated brass ball, PTFE or TFE seats, blowout-proof stem, threaded or solder-joint ends, and locking-type handle designed for quarter turn between opened and closed positions.

C. Bronze Check Valves: Straight-through-pattern, spring-loaded ball check valve; designed for 300-psig minimum working pressure.

D. Zone Valves: MSS SP-110, 3-piece-body, full-port copper-alloy ball valve rated for 300-psig minimum working pressure; with chrome-plated brass ball, PTFE or TFE seats, blowout-proof stem, threaded or solder-joint ends, and handle designed for quarter turn between opened and closed positions.

1. Include union-type body with bolted swing-away center section.

2. Include factory-installed ASTM B 819, Type K or L, copper-tube extensions with pressure gage for pressure systems and vacuum gage for vacuum systems.

E. Zone Valve Boxes: Formed steel for recessed mounting, with holes for medical gas piping and anchors. Include boxes for single- or multiple-valve installation with pressure gage and in sizes to permit manual operation of valves.

1. Interior Finish: Factory-applied white enamel.
2. Cover Plate: Anodized aluminum with frangible or removable windows.
3. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

F. Safety Valves: Bronze body with settings to match system requirements.

1. Pressure Relief Valves: ASME construction, poppet type.
2. Vacuum Relief Valves: Specialty manufacturer's option.

G. Pressure Regulators: Bronze body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig minimum inlet pressure; and capable of controlling delivered air pressure within 0.5 psig for each 10-psig inlet pressure.

H. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, 200-psig minimum working-pressure rating, and capable of automatic discharge of collected condensate.

2.5 MEDICAL GAS SERVICE CONNECTIONS

A. Connection Devices: For specific medical gas pressure and vacuum services listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping, unless otherwise indicated.

1. Roughing-in Assembly:

a. Steel outlet box for recessed mounting and concealed piping.
b. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed.
c. Double seals that will prevent gas leakage.
d. ASTM B 819, Type K, NPS 3/8 (1/2" O.D.) copper inlet or outlet tube brazed to valve with gas-service marking and tube-end dust cap.

2. Finishing Assembly:

a. Brass housing with primary check valve.
b. Double seals that will prevent gas leakage.
c. Cover plate with gas-service label.

3. Quick-Connect Service Connections: With keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use. Include the following:

a. Oxygen Service Connections: Keyed oxygen outlet.
b. Medical Air Service Connections: Keyed medical air outlet.
c. Medical Vacuum Service Connections: Keyed medical vacuum suction inlet.
d. Medical Vacuum Slide Brackets: With pattern matching medical vacuum service connection.

2.6 MEDICAL GAS ALARM SYSTEM

A. Medical Gas Alarm System, General: Compatible alarm panels, remote sensing devices, and other related components as required by NFPA 99 for Level [**1**] medical gas alarm systems. Refer to Division 15 Section "Medical Air and Vacuum Equipment" for air compressors and vacuum pumps. Power wiring is specified in Division 16 Sections.

B. Components: Designed for continuous service and to operate on power supplied from 120-V ac power source to alarm panels and with connections for 24- or 12-V ac low-voltage wiring to remote sensing devices. Include step-down transformers if required.

C. Pressure and Vacuum Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.

1. Low-Pressure Switches: 0- to 100-psig operating range.
2. High-Pressure Switches: Up to 250-psig operating range.
3. Vacuum Switches: 0- to 30-in. Hg range.

D. Medical Gas Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.

1. Mounting: Recessed installation.
2. Enclosures: Fabricated from minimum 0.047-inch- thick steel or minimum 0.05-inch-(1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.

3. Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gages; and indicators for oxygen, medical air, and medical vacuum. Alarms signal when the following conditions exist:

a. Oxygen: Pressure drops below 40 psig or rises above 60 psig.
b. Medical Air: Pressure drops below 40 psig or rises above 60 psig.
c. Medical Vacuum: Vacuum drops below 12 in. Hg.

2.7 TEST GAS

A. Description: Oil-free dry nitrogen complying with CGA P-9, for purging and testing of piping.

2.8 IDENTIFICATION

A. Refer to Division 15 Section "Mechanical Identification" for identification of piping, valves, gages, alarms, and specialties and for labels for bulk medical gas storage tanks.

PART 3 - EXECUTION

3.1 PREPARATION

A. Interruption of Existing Medical Gas Service:

1. Contractor shall not interrupt medical gas service to occupied facilities. Under no conditions shall medical gas service valves (existing or new) be closed by the Contractor.
2. Owner shall be responsible for isolating portions of existing systems and closing service valves as required; including verifying proper service valve or zone valve labeling, and exact areas and rooms controlled.

B. Medical Gas System Isolation:

1. Total isolation between new systems and existing systems shall be maintained until all new piping is tested for leaks and tested for cross connections per NFPA 99 by the Contractor.

C. Cleaning of Piping: If precleaned piping must be recleaned because of exposure, perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
2. Wash medical gas piping and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.

    a. Scrub to ensure complete cleaning.
    b. Rinse with clean, hot water to remove cleaning solution.

3.2 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 PIPING APPLICATIONS

A. General: Use pipe, tube, fittings, and joining methods for medical gas piping systems according to the following applications:

B. Joining New to Existing Copper Tubes NPS 2 (2-1/8" O.D.) and Smaller: Use memory-metal couplings.

C. Joining of Dissimilar Metal Piping: Use dielectric fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for dielectric fitting types.

1. NPS 2 (2-1/8" O.D.) and Smaller: Use dielectric unions.
2. NPS 2-1/2 to NPS 4 (2-5/8" to 4-1/8" O.D.): Use dielectric flanges.

3. NPS 5 (5-1/8" O.D.) and Larger: Use dielectric flange kits.

D. Specialty and Equipment Flanged Connections: Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube.

E. Interior Medical Gas Pressure Piping: Use hard copper tube, copper pressure fittings, and brazed joints.

F. Interior Medical Vacuum Piping: Use hard copper tube, copper pressure fittings, and brazed joints.

3.4 MEDICAL GAS VALVE APPLICATIONS

A. Drawings indicate medical gas valve types to be used. If specific valve types are not indicated, the following requirements apply:

1. Medical Gas Pressure Piping:

a. Shutoff Valves NPS 3 (3-1/8" O.D.) and Smaller: Copper-alloy ball valve.
b. Check Valves NPS 3 (3-1/8" O.D.) and Smaller: Bronze.

2. Medical Vacuum Piping:

a. Shutoff Valves NPS 3 (3-1/8" O.D.) and Smaller: Copper-alloy ball valve.
b. Check Valves NPS 3 (3-1/8" O.D.) and Smaller: Bronze.

3. Zone Valves: With copper-tube extensions and gage.

3.5 PIPING INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Install supports and anchors according to Division 15 Section "Hangers and Supports" with spacing according to NFPA 99.

C. Install thermometers and pressure gages according to Division 15 Section "Meters and Gages."

D. Install flexible pipe connector at each connection to medical air and vacuum equipment.

E. Install exterior, buried medical gas piping in protective conduit fabricated with PVC pipe and fittings. Do not extend conduit through foundation wall.

F. Purge medical gas piping, using oil-free dry nitrogen, after installing piping but before connecting to service connections, alarms, and gages.

3.6 MEDICAL GAS VALVE INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping and valve installation.

B. Install valves in locations required by and according to NFPA 99.

C. Install valves as required for phasing, purging, and testing. Remove handles or lock open as required.

D. Install shutoff valve at each connection to and from medical gas specialties and equipment.

E. Install check valves to maintain correct direction of fluid flow to and from medical gas specialties and equipment.

F. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.

G. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

1. Pressure System Valves: Install pressure gage downstream from valve.
2. Suction System Valves: Install vacuum gage upstream from valve.

H. Install pressure safety and vacuum relief valves where recommended by specialty manufacturers.

I. Install pressure regulators in piping to reduce pressure.

3.7 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Brazed Joints: Use silver- or copper-phosphorus-composition filler metal and comply with CDA's "Copper Tube Handbook," Section VII, "Brazed Joints"; or AWS D10.13, "Recommended Practices for the Brazing of Copper Pipe and Tubing for Medical Gas Systems."

C. Arrange for coupling manufacturer's authorized representative to join new copper tube to existing copper tube with memory-metal couplings.

D. Join new copper tube to existing copper tube with memory-metal couplings. Follow coupling manufacturer's product-specific procedure.

3.8 MEDICAL GAS SERVICE CONNECTION INSTALLATION

A. Install medical gas service connections, of types indicated, in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

B. Install medical gas service connections, of types indicated, in medical gas service units.

3.9 MEDICAL GAS ALARM SYSTEM INSTALLATION

A. Install medical gas alarm system components in locations required by and according to NFPA 99 and manufacturer's written instructions.

B. Install medical gas area alarm panels where indicated.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to specialties and equipment to allow service and maintenance.

C. Connect medical gas piping to specialties, equipment, and accessories.

1. Connection NPS 2 (2-1/8" O.D.) and Smaller: With shutoff valve and copper union.
2. Connection NPS 2-1/2 (2-5/8" O.D.) and Larger: With shutoff valve and cast-copper-alloy flange.

D. Ground specialties and equipment according to Division 16 Section "Grounding and Bonding."

E. Connect wiring according to Division 16 Section "Conductors and Cables."

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.11 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for medical gas piping systems according to NFPA 99. Refer to Section 15075 "Mechanical Identification" for labeling and identification materials.

B. Captions and Color-Coding: Use the following or similar medical gas captions and color-coding for medical gas piping products where required by NFPA 99:

1. Oxygen: White letters on green background or green letters on white background.
2. Medical Air: Black letters on yellow background.
3. Medical Vacuum: Black letters on white background.

C. Label medical gas systems operating at other-than-standard pressure with system operating pressure.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to perform the following field tests and inspections and prepare test reports. The Testing Agency shall be approved by the Owner.

1. Inspect, test, and certify completed medical gas systems according to requirements in NFPA 99. Inspect, test, and certify each medical gas piping system, including specialties, service connections, alarm system, safety devices, and source equipment.

2. Inspect, test, and Re-Certify zones or portions of the existing medical gas and vacuum systems downstream of where connections or modifications to the existing systems are made.

3. Provide oil-free dry nitrogen, medical gases, materials, and equipment required for testing.

4. Level 1 Pressure Medical Gas Testing: Use oil-free dry nitrogen, unless otherwise indicated, and perform procedures and tests as indicated in NFPA 99 performance and testing paragraphs for piped gas systems. Include the following:

   a. Performance Testing:

      1) Blow Down: Clear piping before connecting service connections or outlets.
      2) Initial Pressure Tests: Subject each piping section to test pressure of 1.5 times system working pressure, but not less than 150 psig, before attaching system components, after installing station outlets with test caps (if supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water. Repair leaks with new materials and retest systems.
      3) Cross-Connection Tests: Determine that no cross connections of piping systems exist. Disconnect all systems except system to be checked. Pressurize system to 50 psig. Verify that gas flow from service connections and outlets is only from system being checked. Repeat for each system. Verify correct labeling.
      4) Purge Tests: Perform heavy intermittent purging of piping and full-flow purging of service connections.
      5) Standing-Pressure Tests: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test at 20 percent above normal line pressure. Verify that pressure differences comply with required calibration. Repair leaks with new materials and retest systems.

   b. System Verification:

      1) Cross-Connection Tests: Repeat cross-connection test above or perform alternate tests with each gas at different pressure.
      2) Flow Tests: Perform flow test at each outlet.
      3) Valve Tests: Verify proper valve operation.
      4) Alarm Tests: Operate systems and verify proper warning indication of each medical gas piping system function.

5) Piping Purity Tests: Test for dew point and hydrocarbons as compared to source gas.
6) Final Tie-End Tests: Verify that above tests have been successfully performed.
7) Operational Pressure Tests: Use designated system gases and test for pressure and flow.
8) Medical Gas Concentration Tests: Test each gas for required concentration.
9) Labeling: Verify correct labeling.

5. Level 1 Vacuum System Testing: Use oil-free dry nitrogen, unless otherwise indicated, and perform procedures and tests as indicated in NFPA 99 performance and testing paragraphs for piped vacuum systems. Include the following:

a. Blow Down: Clear piping before connecting service connections or inlets.
b. Initial Pressure Tests: Subject each piping section to test pressure not less than 150 psig before attaching system components, after installing station outlets with test caps (if supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water. Repair leaks with new materials and retest systems.
c. Initial Cross-Connection Tests: Determine that no cross connections of piping systems exist. Disconnect all systems except system to be checked. Pressurize system to 50 psig. Verify that gas flow from service connections and outlets is only from system being checked. Repeat for each system. Verify correct labeling.
d. Standing-Pressure Tests: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test at not less than 60 psig.
e. Final Cross-Connection Tests: Repeat cross-connection test above or perform alternate tests with each system at different pressure.
f. Vacuum Tests: Verify functional operation of components.
g. Valve Tests: Verify proper valve operation.
h. Alarm Tests: Operate systems and verify proper warning indication of each medical gas piping system function.
i. Labeling: Verify correct labeling.

B. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

1. Inspections performed.
2. Procedures, materials, and gases used.
3. Test methods used.
4. Results of tests.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain medical gas alarm system. Refer to Division 1 Section 01770 "Closeout Procedures."

END OF SECTION

SECTION 15410

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes plumbing fixtures and related components.

B. Related Sections include the following:
   1. Section 15430, "Plumbing Specialties" for water distribution piping specialties.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

C. ADA: Americans with Disabilities Act.

1.4 SUBMITTALS

A. Pre-Construction Submittals: Submit the following items prior to commencing with the installations.
   1. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
   2. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

B. Post Construction Submittals: Submit the following items upon completion of system installations.
   1. Maintenance Data: For plumbing fixtures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

   1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
   1. Hand Sinks: NSF 2 construction.
   2. Plastic Mop-Service Basins: ANSI Z124.6.
   3. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
   4. Vitreous-China Fixtures: ASME A112.19.2M.
   5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

   1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
   2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
   3. Faucet Hose: ASTM D 3901.
   4. Faucets: ASME A112.18.1M.

5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply and Drain Fittings: ASME A112.18.1M.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
5. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Floor Drains: ASME A112.21.1M.
2. Hose-Coupling Threads: ASME B1.20.7.
3. Off-Floor Fixture Supports: ASME A112.6.1M.
4. Pipe Threads: ASME B1.20.1.
5. Plastic Toilet Seats: ANSI Z124.5.
6. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Faucet, Laminar-Flow Fittings: Equal to 10 percent of amount of each type and size installed, but not less than 2 of each type and size.
4. Faucet, Flow-Control Fittings: Equal to 10 percent of amount of each type and size installed.
5. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but not less than 12 of each type.

6. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
7. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Commercial Cast Brass Faucets:
1. Sloan (to match faucets provided by others).

C. Flush Valves:
1. Sloan Valve Co.
2. Zurn Industries, Inc.
3. Toto, USA.

D. Toilet Seats:
1. Church Seat Co.
2. Bemis Mfg. Co.
3. Beneke.
4. Kohler Co.

E. Protective Shielding Guards, (Under counter Insulation Kits):
1. Truebro, Inc.
2. McGuire/Pro Wrap.
3. Plumberex Specialty Products, Inc.

F. Fixture Carriers and Supports:
1. Zurn Industries, Inc.
2. J.R. Smith Mfg. Co.
3. Josam Co.
4. Watts Drainage.
5. Mifab.

G. Supply Stops:
1. Chicago Faucet Co.
2. McGuire Mfg. Co.

H. Vitreous China Fixtures:
1. American Standard, Inc.
2. Crane Plumbing/Fiat Products.
3. Kohler Co.
4. Eljer Mfg. Co.

I. Stainless Steel Sinks:
1. Just Mfg. Co.

2. Elkay Mfg. Co.
3. Kindred.

J. Molded Stone and Plastic Basins:
1. Fiat Products.
2. Swan.

2.2 FIXTURES, GENERAL

A. General fixture, faucet and related item requirements are listed below. Refer to the "Plumbing Fixture Schedule" on the Drawings for the basis o f design for each item.

B. Accessibility: Fixtures and items that are required to be accessible are tagged as such in the Plumbing Fixture Schedule on the Drawings.

2.3 FAUCETS

A. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Maximum Flow Rate, (unless otherwise indicated):
   a. Sinks: 2.5 gpm.
   b. Lavatories: 0.5 gpm
2. Body Material: Cast brass
3. Finish: Polished chrome plate
4. Vacuum Breaker: Required for service sinks, basins, science and laboratory sinks.
   a. Required at any sink faucet which has exposed hose thread end(s).
5. Operation Mechanism: Self closing push-button handle(s), lever handles, electric-sensor, battery-operated sensor, as scheduled on the drawings.

2.4 FLUSHOMETERS

A. General: Cast-brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, and copper or brass tubing, and polished chrome-plated finish on exposed parts.

1. Internal Design: Diaphragm operation.
2. Style: Exposed, unless noted otherwise.
3. Inlet Size: NPS 1.
   a. NPS ¾ acceptable for urinals if scheduled as such.
4. Trip Mechanism: Oscillating, lever-handle, hard-wired, electric-sensor, battery-operated sensor.
5. Consumption:
   a. Water Closets: 1.6 gal./flush.
   b. Urinals: 1.0 gal./flush.
6. Tailpiece Size: Diameter scheduled, length to top of bowl.
7. Bedpan Washer: Refer to the schedule for applicability.

2.5 TOILET SEATS

A. General: Solid plastic, open front, without cover, self sustaining check hinges.
   1. Color: White.
   2. Size: Elongated, unless otherwise noted.

2.6 PROTECTIVE SHIELDING GUARDS

A. General: Manufactured insulation and plastic covering for water supply, trap and drain piping and complying with ADA requirements.

2.7 FIXTURE SUPPORTS

A. Water-Closet Support: Water-closet combination carrier designed for accessible and standard mounting heights, (see schedule). Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

B. Urinal Support: Urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include steel uprights with feet.

C. Lavatory and Sink Supports: Lavatory carrier with concealed arms and tie rod. Include steel uprights with feet.

2.8 SUPPLY STOPS

A. General: Cast brass or copper, chrome plated angle style with chrome plated escutchon and loose key operator.
   1. Lavatory Supplies: NPS 3/8.
   2. Sink and Tank Style Water Closet Supplies: NPS ½.

2.9 WATER CLOSETS

A. General: Commercial, vitreous-china fixture, siphon jet design, 1.6 gal./flush.
   1. Mounting: Wall hung and floor mounted.
   2. Outlet: Back or floor.
   3. Flush style: Flush valve or tank.
      a. Pressure assist: Tank to be equipped with pressurized tank.
   4. Color: White.

2.10 LAVATORIES

A. General: Wall hung or self rimming counter mount vitreous-china fixture.
   1. Color: White.

2.11 GENERAL USE SINKS

A. General: Commercial, counter mount, self rimming, sound deadening fixture.
   1. Material: 18 gauge, type 304 stainless steel.

2.12 SERVICE FIXTURES

A. Mop Service Basins: Flush-to-wall, floor-mounting precast terrazzo or plastic basin with rim guards.
   1. Drain: NPS 3. grid.
   2. Accessories: Mop hanger, splash guards, faucet hose attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture.

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install protective shielding guards on exposed under counter supply and waste piping at fixtures identified as accessible and at other locations scheduled.

M. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

N. Install toilet seats on water closets.

O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

Q. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

R. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

S. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Section 15050 "Basic Mechanical Materials and Methods" for escutcheons.

T. Set bathtubs, shower receptors, and service basins in leveling bed of cement grout. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for grout.

U. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 15430

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by this Section.

1.2 SUMMARY

A. This Section includes the following plumbing specialties:

1. Backflow preventers.
2. Thermostatic water mixing valves.
3. Strainers.
4. Trap seal primer valves.
5. Drain valves.
6. Miscellaneous piping specialties.
7. Cleanouts.
8. Floor drains.
9. Interceptors.
10. Emergency Equipment.

B. Related Sections include the following:

1. Section 15122, "Meters and Gages" for water meters, (other than at municipal entrances), thermometers, and pressure gages.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. PE: Polyethylene plastic.

C. PUR: Polyurethane plastic.

D. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
1. Water Supply Systems, Above Ground: 125 psig.
2. DWV, (Gravity) Systems: 10 foot of head of water.

1.5 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-Construction Submittals: Submit the following items prior to commencing with installations.
1. Product Data, including wiring diagrams for electrically and battery powered items.
a. Backflow preventers.
b. Balancing valves and strainers.
c. Thermostatic water mixing valves.
d. Water hammer arresters, air vents, and trap seal primer valves and systems.
e. Drain valves.
f. Cleanouts, floor drains, open receptors and trench drains.
g. Interceptors.
h. Emergency equipment.

C. Post Construction Submittals: Submit the following items upon completion of system installations.
1. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
a. Backflow preventers.
b. Thermostatic water mixing valves.
c. Trap seal primer valves and systems.
d. Interceptors.
e. Emergency equipment.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Water Filter Cartridges: Equal to 200 percent of amount installed for each type and size indicated.
2. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed below.

B. Backflow Preventers:
1. Ames Co., Inc.
2. CMB Industries, Inc.; Febco Backflow Preventers.
3. Conbraco Industries, Inc.
4. Watts Industries, Inc.; Water Products Div.
5. Zurn Industries, Inc.; Wilkins Div.

C. Thermostatic Water Mixing Valves:

1. Lawler Manufacturing Company, Inc.
2. Leonard Valve Company.
3. Mark Controls Corp.; Powers Process Controls.
4. Symmons Industries, Inc.
5. Armstrong-Lynnwood, Inc.; Rada.

D. Trap Seal Primer Valves:
1. Precision Plumbing Products, Inc.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Industries, Inc.
5. Zurn Industries, Inc.

E. Water Hammer Arresters:
1. Josam Co.
2. Precision Plumbing Products, Inc.
3. Sioux Chief Manufacturing Co., Inc.
4. Watts Industries, Inc.
5. Smith, Jay R. Mfg. Co.

6. Zurn Industries, Inc.; Wilkins Div.

F. Cleanouts and Floor Drains:
1. Watts Industries, Inc.
2. Smith, Jay R. Mfg. Co.
3. Zurn Industries, Inc.; Wilkins Div.
4. Josam Co.
5. Tyler Pipe; Wade Div.

G. Interceptors:
1. Josam Co.
2. MIFAB Manufacturing, Inc.
3. Rockford Sanitary Systems, Inc.
4. Smith, Jay R. Mfg. Co.
5. Tyler Pipe, Wade Div.
6. Watts Industries, Inc., Drainage Products Div.
7. Zurn Industries, Inc.

H. Emergency Equipment:
1. Encon Safety Products.
2. Guardian Equipment Co. / Leonard Water Temperature Controls.
3. Haws Corporation.

2.2 BACKFLOW PREVENTERS

A. General: ASSE standard, backflow preventers.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.

2. Interior Components: Corrosion-resistant materials.
3. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
4. Strainer: Provide strainer on inlet. Include draw off valve with cap and chain.
   a. Exception: Where backflow preventers are located immediately downstream of a water meter and strainer, a strainer is not required at the backflow preventer, unless specifically required by the applicable water authority.

B. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.

2.3 THERMOSTATIC WATER MIXING VALVES

A. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer.

1. Type: Bimetal thermostat, operation and pressure rating 125 psig (860 kPa) minimum.

B. Manifolded (High-Low), Thermostatic Water Mixing-Valve Assemblies: Factory-fabricated unit consisting of parallel arrangement of thermostatic water mixing valves.

1. Arrangement: One large-flow, thermostatic water mixing valve with flow-control valve, pressure regulator, inlet and outlet pressure gages, and one small-flow, thermostatic water mixing valve with flow-control valve. Include outlet thermometer, factory- or field-installed inlet and outlet valves, and other indicated options.
   a. Acceptable Alternate: Assemblies which meet scheduled flow range and pressure drop requirements need not be high-low style. The intent of the units is to meet the entire flow range and pressure constraints.
2. Basis of Design: As scheduled on the drawings.

2.4 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
2. NPS 2 (DN 50) and Smaller: Bronze body, with female threaded ends.
3. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
   a. Drain: Pipe plug.

2.5 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

1. 125-psig (860-kPa) minimum working pressure.
2. Bronze body with atmospheric-vented drain chamber.
3. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
4. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
5. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.6 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 (DN 20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig (1380-kPa) minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 (DN 6) side drain outlet and cap.

2.7 WATER HAMMER ARRESTERS

A. General: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.8 MISCELLANEOUS PIPING SPECIALTIES

A. Open End Drains, (or "Stand Drains"): Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, backwater valve, hub-and-spigot riser section; and increaser fitting, joined with ASTM C 564, rubber gaskets.

B. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.

1. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
2. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

C. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

D. Wall Accessible Cleanouts: Line type with lacquered cast iron body, gas and water tight tapered thread plug, and round stainless steel access cover secured with machine screw.
1. Basis of Design: Zurn #Z-1441.

E. Finished Floor Cleanouts: Lacquered cast iron body with anchor flange, reversible clamping collar, adjustable threaded top assembly, and round, gasketed cover.
1. Cover to be scored in unfinished and service areas.
2. Cover to be depressed to receive floor finish material in finished spaces.
3. Basis of Design: Zurn #Z-1400.

2.9 FLOOR DRAINS

A. General: ASME A112.21.2M; Provide trap primer inlet connections on drain bodies unless otherwise scheduled.
1. Where drains do not require trap primers, install a threaded plug in the primer inlet port. Plug to be of a dielectrically compatible material.
2. Basis of Design: As scheduled on the Drawings.

B. Floor Drains:
1. Body Material: Cast Iron.
2. Seepage Flange and Clamping Device: Required for interior application.

3. Anchor Flange: Required for exterior application.
4. Exposed Surfaces and Interior Lining: As scheduled.
5. Outlet Style: Hub and Spigot for slab-on-grade applications. No-hub for above grade applications.
6. Sediment Bucket and Grate Variations: As scheduled.

2.10 EMERGENCY EQUIPMENT

A. General: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment." In as much as possible, provide water tempering equipment and fixtures as supplied by the same manufacture or pair of manufacturers as listed in paragraph 2.01.

B. Water Tempering Equipment: Thermostatic mixing valve assembly with fail-cold bypass. Valves shall be specifically manufactured for use with emergency fixtures.
1. Water supplied to plumbed emergency Fixtures to be 85°F, +/- 5°F.
2. Minimum flow range for valves serving showers: 20-30 gpm.
3. Minimum flow range for valves serving eye/face washes: 3-5 gpm.
4. Basis of Design: As scheduled on the Drawings.

C. Emergency Fixtures: Fixtures may include; Showers, combination shower & eye/fash wash units, and eye/face wash units. Units shall be barrier free and shall include stay open style activation.
1. Basis of Design: As scheduled on the Drawings.

D. Drain Piping: Provide drain piping for eye/face wash units as well as the eye/face wash portion of combination units, where drain ports are supplied as part of the fixture.
1. Exposed Piping Application: Steel pipe and fittings, schedule 40, galvanized. Include galvanized steel escutcheons where piping penetrates finished walls.
2. Concealed Piping Applications: Copper tube and fittings, type DWV.

E. Signage: Provide signage for each unit, as supplied by the same manufacturer as the fixtures. Signage to be as per ANSI Z358.1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe

diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

C. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

D. Drain Valve Application: Install hose end drain valves at the base of system risers.

1. Acceptable Alternate: For ¾-inch supply risers which serve only one story above, stop-and-waste shut-off valves may be used in lieu of shut-off valves and separate drain valves.

E. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

F. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

G. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

H. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

I. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

J. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

K. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

L. Fasten recessed-type plumbing specialties to reinforcement built into walls.

M. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

N. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

O. Install air vents at piping high points. Include ball, gate, or globe valve in inlet and drain piping from outlet to floor drain.

P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Interceptor Connections: Connect piping, flow-control fittings, and accessories.
1. Solids Interceptors: Connect inlet and outlet.

D. Emergency Fixture Drains: Unless otherwise indicated on the plans, connect to fixture drain ports and spill drain piping to nearest drain. Where local drains do not exist, terminate drain piping at 18-inches above the finished floor with a down turned elbow.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 15671

CONDENSING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes air-cooled condensing units.

1.3 SUBMITTALS

A. Product Data: For each condensing unit, include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which condensing units will be attached.
2. Liquid and vapor pipe sizes.
3. Refrigerant specialties.
4. Piping including connections, oil traps, and double risers.
5. Evaporators.

D. Manufacturer Seismic Qualification Certification: Submit certification that condensing units, accessories, and components will withstand seismic forces defined in Section 15071 "Mechanical Vibration and Seismic Controls." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For condensing units to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of condensing units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."

D. Factory Test: Condensing Unit shall be pressure-tested, evacuated, and given a holding charge of refrigerant and a full oil charge, and shall be factory operational run tested to assure each control device operates properly.

1.5 DELIVERY AND HANDLING

A. Unit shall be delivered to job site fully assembled, and given nitrogen holding charge and a full oil charge by the manufacturer. Refrigerant supplied by Contractor.

B. Unit shall be stored and handled per Manufacturer's instructions.

1.6 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

B. Coordinate location of piping and electrical rough-ins.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
   1. Manufacturer shall Warrant all equipment and material of its manufacture against defects in workmanship and material for a period of one year from date of initial start-up or eighteen (18) months from date of shipment, whichever occurs first. Manufacturer's full unit warranty shall cover both parts and labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Condensing Units, Air Cooled, 6 to 120 Tons
      a. Carrier Corporation.
      b. McQuay International.
      c. Trane Co.
      d. York International Corp. (Basis of Design).

2.2 CONDENSING UNITS, AIR COOLED, 6 TO 120 TONS

A. GENERAL
   1. Condensing Unit shall be designed, selected, and constructed using a refrigerant with Flammability rating of "1", as defined by ANSI/ASHRAE STANDARD - 34 Number Designation and Safety Classification of Refrigerants. (Basis of Design HFC-407C).

   2. Condensing Unit shall include, but is not limited to: a system with a single refrigerant circuit, scroll compressors, air-cooled condenser, refrigerant, lubrication system, interconnecting wiring, safety and operating controls including capacity controller, control center, motor starting components, and special features as specified herein or required for safe, automatic operation.

B. CABINET

1. External structural members shall be constructed of heavy gauge, galvanized steel coated with paint which, shall be capable of withstanding ASTM B117, 500 hour, 5% salt spray test.

C. COMPRESSORS
1. Compressors: Shall be hermetic, scroll-type, including:
   a. Refrigerant flow through the compressor with100% suction cooled motor.
   b. Large suction-side free volume and oil sump to provide liquid handling capability.
   c. Annular discharge check valve and reverse vent assembly to provide low pressure drop, silent shutdown, and reverse rotation protection.
   d. Initial Oil charge.
   e. Oil Level sightglass.
   f. Vibration isolator mounts for compressors.
   g. Brazed-type connections for fully hermetic refrigerant circuits.

D. REFRIGERANT CIRCUIT
1. All piping shall be copper, with brazed joints. The liquid line shall include a field connection shutoff valve with charging port located on each condenser circuit. Suction line connections shall be provided on each refrigeration circuit at the suction valve. Filter drier and sight glass shall be shipped loose for field installation on each refrigerant circuit. Field refrigerant piping shall be connected to the condensing unit without loss of charge in the unit.

E. AIR COOLED CONDENSER
1. Coils: Internally enhanced, seamless copper tubes, expanded into aluminum alloy fins with full height collars. Subcooling coil shall be an integral part of condenser.

2. Fans: Shall be dynamically and statically balanced, direct drive, corrosion resistant blades, providing vertical air discharge. Each fan shall have its own compartment to prevent cross flow during fan cycling. Guards of heavy gauge, PVC (polyvinyl chloride) coated or galvanized steel shall be provided.

3. Fan Motors: High efficiency, direct drive, insulation class "F", current protected, Totally Enclosed Air-Over (TEAO).

F. CONTROLS
1. General: Automatic start, stop, operating, and protection sequences across the range of scheduled conditions.

2. Microprocessor Enclosure: Rain and dust tight NEMA 3R/12 (IP55) powder painted steel cabinet with hinged, latched, and gasket sealed door.

3. Microprocessor Control Center: Manufacturer shall provide microprocessor based, minimum 40 character, alphanumeric control panel with all controls necessary for automatic condensing unit operation. Mechanical Contractor shall provide field control wiring necessary to interface sensors to the condensing unit control system.

G. POWER CONNECTION AND DISTRIBUTION

1. Power Panels: NEMA 3R/12 (IP55) rain/dust tight, powder painted, steel cabinets with hinged, latched, and gasket sealed outer doors. Provide main power connection(s), control power connections, compressor and fan motor start contactors, current overloads, and factory wiring.

2. Exposed compressor, control, and fan motor power wiring shall be routed through liquid tight conduit.

H. ACCESSORIES AND OPTIONS – As Scheduled on the Drawings.

1. Provide Microprocessor controlled, factory installed Across-the-Line type compressor motor starters.

2. Outdoor Ambient Temperature Control (Factory installed)
   a. Unit controls shall permit operation from 25°F to 115°F ambient.
   b. Low Ambient Control: Additional controls shall permit unit operation to 0°F ambient.

3. Power Supply Connections:
   a. Single Point Terminal Block with individual System circuit breakers to isolate the unit power for servicing.

4. Pressure & Temperature Transducers and Sensors (Factory installed):
   a. Discharge Pressure Transducers: Shall permit unit to sense and display discharge pressure.
   b. Suction Pressure Transducers: Shall permit unit to sense and display suction pressure.

5. Control Power Transformer (Factory installed): Shall be provided to convert unit power voltage to 120/1/60. Factory mounting shall include primary and secondary wiring between the transformer and the control panel.

6. Service Isolation Valves (Factory-mounted): Provide service suction and discharge (ball type) isolation valves for each refrigeration circuit. Include a system high-pressure relief valve in compliance with ASHRAE 15.

7. Compressor Crankcase Heaters (Factory-mounted): Provide for extra protection against liquid refrigerant migration.

8. Protective Condensing Unit Panels (Factory Mounted):

   a. Louvered/Wire Panels: Louvered steel panels on external condenser coil faces, painted as per remainder of unit cabinet. Heavy gauge, welded wire-mesh, coated to resist corrosion, around base of machine to restrict unauthorized access.

9. Hot Gas By-Pass (Factory installed): Shall permit continuous, stable operation at capacities below the minimum step of unloading by introducing an artificial load.

10. Building Automation System (EMS) Reset Interface (Factory installed): Condensing Unit shall accept 4 to 20mA, 0 to 10 VDC, or discrete contact closure input to reset the discharge air temperature.

11. Sound Reduction (Factory Mounted):

    a. Unit sound power level shall not exceed 90 dBA. Provide sound attenuation options as required.

12. Vibration Isolation (Field Mounted):
    a. 2 Inch Deflection Seismic Isolators: Level adjustable, restrained mounts in rugged welded steel housing with vertical and horizontal limit stops. Housings shall be designed to withstand a minimum 1.0g accelerated force in all directions to 2 inches.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate condensing units according to [**ARI 340/360**].

1. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

B. Test and inspect shell and tube condensers according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of condensing units.

B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine roofs for suitable conditions where condensing units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Vibration Isolation: Mount condensing units on restrained spring isolators. Vibration isolation devices and installation requirements are specified in Section 15071 "Mechanical Vibration and Seismic Controls."

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Section 15183 "Refrigerant Piping."

D. Connect wiring and ground equipment according to Division 16.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

C. Remove and replace malfunctioning condensing units and retest as specified above.

D. Contractor shall paint damaged and abraded factory finish with touch-up paint matching factory finish.

3.5 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casing.

2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Lubricate bearings on fans.

C. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

D. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

E. Measure and record airflow over coils.

F. Verify proper operation of condenser capacity control device.

G. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

H. After startup and performance test, lubricate bearings.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 15726

MODULAR OUTDOOR AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes constant-volume and variable air volume, modular air-handling units with coils for outdoor installations.

B. Related Sections include the following:Section 15071 "Mechanical Vibration and Seismic Controls".

1.3 SUBMITTALS

A. Product Data: For each type of modular outdoor air-handling unit indicated. Include the following:

1. Certified fan-performance curves with system operating conditions indicated.
2. Certified fan-sound power ratings.
3. Certified coil-performance ratings with system operating conditions indicated.
4. Motor ratings, electrical characteristics, and motor and fan accessories.
5. Material gages and finishes.
6. Filters with performance characteristics.
7. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Submit with Shop Drawings. Show mechanical-room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

D. Manufacturer Seismic Qualification Certification: Submit certification that modular outdoor air-handling units, accessories, and components will withstand seismic forces defined in Section 15071 "Mechanical Vibration and Seismic Controls." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field Quality-Control Test Reports: From manufacturer.

1.4 REFERENCES

A. ARI 430 - Standard for Central Station Air Handling Units.

B. ARI 410 - Standard for Forced Circulation Air-Cooling and Air-Heating Coils.

C. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

D. UL 1995 - Heating and Cooling Equipment

E. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

F. SMACNA - HVAC Duct Construction Standards.

G. ANSI/UL 900 - Test Performance of Air Filter Units.

H. AMCA 300 - Reverberant Method for Sound Testing of Fans.

I. ARI 260 - Standard for Sound Rating of Ducted Air Moving and Conditioning Equipment

J. AMCA 301 - Method for Publishing Sound Ratings for Air Moving Devices.

K. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain modular outdoor air-handling units through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of modular outdoor air-handling units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. NFPA Compliance: Modular outdoor air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

E. ARI Certification: Modular outdoor air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

F. Comply with NFPA 70.

G. ISO 9001 Certification. The air handling manufacturer shall be ISO 9001 Certified by a third party registrar.

H. Constant Volume Air Handling Units: Certify air volume, static pressure, fan speed, brake horsepower and selection procedures in accordance with ARI 430. If air handling units are not certified in accordance with ARI 430, contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.

I. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with ARI 410-91.

1.6 COORDINATION

A. Coordinate installation of equipment supports.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each modular outdoor air-handling unit.
2. Fan Belts: One set for each modular outdoor air-handling unit fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier; Div. of United Technologies Corp.
2. McQuay International.
3. Trane Company (The); Worldwide Applied Systems Group.
4. York International Corporation. (Basis of Design)

2.2 MANUFACTURED UNITS

A. Modular outdoor air-handling units shall be factory assembled and consist of fans, motor(s) and drive assembly, coils, dampers, plenums, filters, condensate pans, mixing dampers, control devices, and accessories.

B. Outdoor Air Handling Unit configuration shall be as detailed and scheduled on the Drawings.

2.3 CABINET

A. Materials: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

1. Outside Casing: Galvanized steel, minimum 18-gauge.
2. Inside Casing: Galvanized steel, minimum 20-gauge, solid.
3. Floor Casing: Galvanized steel, minimum 18-gauge walking surface with minimum 20-gauge sub-floor panel.

B. Cabinet Insulation: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071 with coated surface exposed to air stream to prevent erosion of glass fibers.
2. Thickness: 2 inches.
3. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature. Minimum R-value of 8.0.
4. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50, when tested according to ASTM C 411.
5. Location and Application: Factory applied with adhesive and mechanical fasteners between the sheet metal panels. Factory applied injected foam is also a suitable alternative.

C. Access Panels and Doors: Same materials and finishes as cabinet, complete with hinges, latches, handles, and gaskets. Access panels and doors shall be easily operable without the use of tools. Inspection and access panels and doors shall be sized and located to allow periodic maintenance and inspections. Access doors shall be constructed with a double-wall of solid

G90 galvanized steel interior panel. Gasketing around the full perimeter of the access door shall be used to prevent air and water leakage. Provide access panels and doors in the following locations:

1. Fan Section: Doors.
2. Access Section: Doors.
3. Coil Section: Inspection panel.
4. Damper Section: Doors.
5. Filter Section: Doors to allow periodic removal and installation of filters.

D. Condensate Drain Pans: Formed sections of stainless-steel sheet complying with requirements in ASHRAE 62. Fabricate pans with slopes in two planes to collect condensate from cooling coils (including coil piping connections and return bends) when units are operating at maximum catalogued face velocity across cooling coil.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Both ends of pan.
3. Pan-Top Surface Coating: Elastomeric compound.
4. Units with stacked coils shall have an intermediate drain pan or drain trough to collect condensate from top coil.

E. Exterior Paint Finish: External surface of unit casing shall be prepared and factory coated with a minimum 1.5 mil enamel finish or equal. Unit casing exterior with factory coating shall be able to withstand a salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours. Unit casing will be provided with manufacturer's standard color.

F. Sloped Roof Construction: Unit roof shall be sloped a minimum 0.25 inch per foot either from one side of unit to other or from center to sides of the unit. Roof assembly shall overhang all walls of units by 2 inches minimum.

G. Outside Air Intake Hoods: Hoods shall be sized for 100% economizer cycle.

2.4 FAN SECTION

A. Fan-Section Construction: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure and equipped with formed-steel channel base for integral mounting of fan, motor, and casing panels. Mount fan with restrained vibration isolation.

B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to make curved scroll housings with shaped cutoff, spun-metal inlet bell, and access doors or panels to allow entry to internal parts and components.

1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Performance Class: AMCA 99-2408, Class I, II or III as scheduled or required by the design operating conditions.
3. Horizontal Flanged Split Housing: Bolted construction.
4. Plug Fans: With steel cabinet. Fabricate without fan scroll and volute housing.

C. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower. Variable frequency drive controlled blowers shall be dynamically balanced throughout the entire blower speed range.

D. Airfoil-Fan Wheels: Steel construction with smooth-curved inlet flange, heavy back plate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and back plate; cast-iron or cast-steel hub riveted to back plate and fastened to shaft with set screws.

E. Coatings: Powder-baked enamel.

F. Shafts: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed for constant speed blowers or throughout the fan operating range for a variable speed blower at the rated motor horsepower, with final alignment and belt adjustment made after installation. Fan shafts shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
3. Key fan wheels to fan shaft to prevent slipping and to permit removal or the fan wheel.

G. Pre-lubricated and Sealed Shaft Bearings: Provide self-aligning, grease lubricated pillow-block ball bearings selected for L-50 200,000 hour average life per ANSI/AFBMA 9. Extend both grease lubrication fittings to drive side of unit with plastic tubes and zerk fittings rigidly attached to drive side bearing support.

H. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation and with 1.5 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
2. Motor Pulleys: Adjustable pitch for constant speed blowers; fixed pitch for use with motors controlled by variable frequency drives. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
3. Belts: Oil resistant, non-sparking, and non-static; matched for multiple belt drives.

I. Motor Mount: Adjustable for belt tensioning.

J. Vibration Control: Fans and motor assembly shall be internally mounted and isolated on a full width support channel with restrained spring vibration isolators having a minimum of 2-inch static deflection suitable for Seismic Zone 4 requirements.

K. Fan-Section Source Quality Control:

1. Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

2. Factory test fan performance for flow rate, pressure, power, air density, rotation speed, and efficiency. Establish ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

L. Grating: Provide minimum 6"x6" welded wire grating at the floor of the unit suitable to prevent maintenance/installation workers from falling into the duct connections.

2.5 MOTORS

A. Comply with requirements in Division 15, Section 15050 Basic Mechanical Materials and Methods, "Motors for Mechanical Equipment."

B. Noise Rating: Quiet.

C. Motors controlled by variable frequency drives shall be rated for inverter duty service.

2.6 COILS

A. Coil Sections: Common or individual, insulated, galvanized-steel casings. Design and construct to facilitate removal and replacement of coil for maintenance and to ensure full airflow through coils.

B. Refrigerant Coils: Coil designed for use with R-407C refrigerant, fabricated according to ARI 410, connected with brazed fittings.

1. Capacity Reduction: Circuit for interwoven control.
2. Tubes: Copper.
3. Fins: Aluminum, with spacing to match the scheduled performance.
4. Fin and Tube Joint: Mechanical bond.
5. Suction and Distributor: Seamless copper tube with brazed joints.
6. Frames: Galvanized-steel channel frame.
7. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.

    a. Working-Pressure Rating: 300 psig (2070 kPa).

8. Source Quality Control: Test to 450 psig (3105 kPa) and to 300 psig (2070 kPa) underwater.

9. Performance: As Scheduled on the Drawings.

2.7 DAMPERS

A. Damper Operators: Electric as specified in Division 15 Section "HVAC Instrumentation and Controls."

B. Low-Leakage, Outside-Air Dampers: Double-skin, airfoil-blade aluminum dampers with compressible jamb seals and extruded-vinyl blade edge seals, in opposed blade for modulating applications or parallel-blade for two position applications with aluminum or steel operating

rods rotating in sintered bronze or nylon bearings mounted in a single aluminum frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. (0.22 L/s per sq. m) at 1-inch wg (250 Pa) and 8 cfm/sq. ft. (0.4 L/s per sq. m) at 4-inch wg (1.0 MPa).

C. Mixing Boxes: Opposed-blade galvanized-steel dampers mechanically fastened to steel operating rod in reinforced, galvanized-steel cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

D. Airflow Monitoring Station: Provide a factory-mounted damper/airflow monitoring station in the outdoor air damper opening of the mixing box as scheduled on the drawings. Damper blades shall be galvanized steel, housed in a galvanized steel frame and mechanically fastened to an axle rod rotating on bearings. The dampers shall be rated for a maximum leakage rate of less than 1 percent of nominal cfm (L/s) at 1 in. wg (249 Pa). The airflow measurement station shall measure up to 100 percent of airflow. The airflow monitoring station shall output a 2-10 VDC signal representing velocity and shall have a total accuracy of +/-5 percent of actual flow down to 15 percent of nominal flow between -40 F (-40.0 C) and +158 F (70.0 C).

2.8 FILTER SECTIONS

A. Filters: Comply with NFPA 90A.

B. Filters and filter segments shall be provided as scheduled. Filter frames shall be constructed of galvanized steel and be built as an integral part of the unit. Filter media shall be listed Class 1 under U.L. Standard 900.

C. Pre-Filter / Angle Filter Section:
1. Media: pleated, 2 " deep, 30% efficiency.

D. HEPA (High Efficiency Particulate Air) Filter Section:
1. Media: 12" deep, 99.97% efficiency at 0.3 micron particles, ASHRAE Standard 52-76.

E. Each filter section shall include a factory installed flush mounted magnahelic differential pressure gauge to measure the pressure drop across the filter bank.

2.9 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Fan motors shall be NEMA design ball bearing type with electrical characteristics and horsepower as specified on the schedule. Motors shall be 1750 RPM, open drip proof type. All motors shall be high efficiency. The motor shall be mounted on the same isolation base as the fan. The motor shall be on an adjustable base.

B. Units shall be equipped with motor starter panel(s) serving supply and return/exhaust fan motor(s).
1. The panel(s) and all associated components shall be U.L. listed.
2. The motor starter panel shall be protected by a NEMA 3R enclosure.
3. Panel shall include an integral non-fused main power disconnect.

4. The panel shall contain a main power block, single speed fan motor contactor(s) with overload device(s), three phase ambient compensated overload heater elements, two primary control fuses, one secondary control line size fuse, terminal strip, and a door-mounted on/off auto switch.
5. Power wiring from the starter panel to the fan motor shall be factory installed.
6. Power wiring for the entire unit shall be tied together for single point power connection at the supply fan segment fuse block point.
7. The motor control panel shall be supplied with an independent disconnect for the 115 Volt circuit and a 115 Volt transformer for the lights, receptacles, and control devices to allow operation of 1-phase devices when 3 phase power is disconnected.A marine-type, vapor proof service light shall be provided in segments as indicated on the schedule. Each light will be 100 watt service and shall be wired to one common switch for the entire unit. A duplex 115 volt convenience outlet shall also be provided on the supply fan segment.

C. Factory Commissioning: Trained factory personnel shall ensure proper operation of the starter by a thorough factory test. Fuses and overload heaters shall be selected individually for the voltage, horsepower, and full load amps of the actual motor being supplied. Testing shall include a "Hypot" test of unit wiring to insure that no weaknesses exist in starter, wiring, or motor. "Hand" and "Auto" positions shall be verified to insure starter is operational.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install modular outdoor air-handling units with vibration and seismic control devices as specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

B. Arrange installation of units to provide access space around modular outdoor air-handling units for service and maintenance.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to externally isolated modular outdoor air-handling units with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4 (DN 32), Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Refrigerant Piping: Comply with applicable requirements in Section 15183 "Refrigerant Piping." Connect to supply and return coil tappings with shutoff valve and union or flange at each connection.

F. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.

G. Electrical: Comply with applicable requirements in Division 16.

H. Ground equipment according to Division 16.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
2. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
4. HEPA Filter Operational Test: Pressurize housing to a minimum of 3-inch wg (750 Pa) or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter with soapy water to check for air leaks.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Final Checks before Startup: Perform the following:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Perform cleaning and adjusting specified in this Section.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Lubricate bearings, pulleys, and other moving parts with factory-recommended lubricants.
6. Set outside- and return-air mixing dampers to minimum outside-air setting.
7. Comb coil fins for parallel airflow orientation.
8. Install clean filters.

C. Starting procedures for modular outdoor air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

D. Refer to Section 15950 "Testing, Adjusting, and Balancing" for modular outdoor air-handling system testing, adjusting, and balancing.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

3.7 CLEANING

A. Clean modular outdoor air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting, and balancing modular outdoor air-handling and air-distribution systems, clean filter housings and install new filters.

3.8 PAINT TOUCH-UP

A. Touch up damage to the external paint system with factory matched color paint.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular outdoor air-handling units. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 15726

SECTION 15815

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round spiral-seam ducts and formed fittings.

B. Related Sections include the following:

1. Division 7, Section 07270 "Through-Penetration Firestop Systems" for materials and methods for sealing duct penetrations through fire and smoke barriers.
2. Division 7, Section 07900 "Joint Sealants" for materials and methods for sealing duct penetrations through exterior walls.
3. Section 15071 "Mechanical Vibration and Seismic Controls."
4. Section 15820 "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. NUSIG: National Uniform Seismic Installation Guidelines.

B. SMACNA – Sheet Metal and Air Conditioning Contractors' National Association, Inc. – latest edition.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and - distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. General: See Division 1 for general submittal and product substitution requirements.

B. Pre-construction Shop Drawings: Show fabrication and installation details for metal ducts as follows prior to commencing with fabrication and installation:

1. Emergency Department Entrance Area – CAD generated or hand drafted and drawn to ¼ inch equals 1 foot). Include the following information:
   a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   b. Duct layout indicating sizes and pressure classes.
   c. Elevations of top and bottom of ducts.
   d. Dimensions of main duct runs from building grid lines.
2. Metal gages.
3. Fittings.
4. Reinforcement and spacing.
5. Seam and joint construction.
6. Penetrations through fire-rated and other partitions.
7. Equipment installation based on equipment being used on Project.
8. Duct accessories, including access doors and panels.
9. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

C. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Transverse joints
   a. Ductmate Industries, Inc.
   b. Nexus Inc.
   c. Ward Industries, Inc.

2. Round duct and fittings
   a. McGill AirFlow Corporation.
   b. SEMCO Incorporated.
   c. Monroe Metal Mfg. Co.

3. Duct joints – round ducts
   a. Ductmate Industries, Inc.
   b. Lindab Inc.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having **G90 (Z275)** coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

2.3 SEALANT MATERIALS

A. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

B. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

C. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Refer to Section 15071 "Mechanical Vibration and Seismic Controls."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

C. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.5 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of nonbraced panel area unless ducts are lined.

2.6 ROUND DUCT AND FITTING FABRICATION

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards and as indicated. Provide duct material, gauges, reinforcement, and sealing for operating pressures indicated.

B. All duct and fittings shall be manufactured by a company whose primary business is the manufacture of spiral duct and fittings and who has been in business for at least 10 years. All spiral duct and fittings shall be manufactured by the same firm and shall be as shown on the contract drawings.

C. Round, Spriral Lock - Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

D. Duct Joints:

1. Ducts up to 20 Inches (500 mm) in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches (535 to 1830 mm) in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches (1830 mm) in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of two roll-formed galvanized steel mating flanges with an integral sealant, galvanized steel closure ring, and neoprene gasket. Manufacture ducts according to connection system manufacturer's tolerances.

E. Branch connections shall be made with 90 degree conical and 45 degree straight taps. All branch connections shall be made as separate fittings. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):

    a. Ducts 3 to 36 Inches (75 to 915 mm) in Diameter: 0.034 inch (0.85 mm).
    b. Ducts 37 to 50 Inches (940 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
    c. Ducts 52 to 60 Inches (1320 to 1525 mm) in Diameter: 0.052 inch (1.3 mm).
    d. Ducts 62 to 84 Inches (1575 to 2130 mm) in Diameter: 0.064 inch (1.6 mm).

3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg (500 to 2500 Pa):

    a. Ducts 3 to 26 Inches (75 to 660 mm) in Diameter: 0.034 inch (0.85 mm).
    b. Ducts 27 to 50 Inches (685 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
    c. Ducts 52 to 60 Inches (1320 to 1525 mm) in Diameter: 0.052 inch (1.3 mm).
    d. Ducts 62 to 84 Inches (1575 to 2130 mm) in Diameter: 0.064 inch (1.6 mm).

4. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
5. Round Elbows 12 Inches (200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 Inches (225 through 355 mm) in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows Larger Than 14 Inches (355 mm) in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
8. Die-Formed Elbows for Sizes through 12 Inches (200 mm) in Diameter and pressures through 10 inch wg: 24 gauge with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
10. Pleated Elbows for Sizes through 14 Inches (355 mm) in Diameter and Pressures through 10-Inch wg (2500 Pa): 0.022 inch (0.55 mm).

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts: 2-inch wg.
2. Return Ducts (Negative Pressure): 2-inch wg .
3. Toilet Exhaust Ducts (Negative Pressure): 1-inch wg.
4. Isolation/Waiting Area Exhaust Ducts (Negative Pressure): 2-inch wg.

B. All ducts shall be galvanized steel.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

H. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

J. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

K. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches (38 mm).

M. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."

N. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

O. Protect duct interiors from the elements and foreign materials until building is enclosed. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Follow SMACNA's "Duct Cleanliness for New Construction."

P. Paint interiors of metal ducts that do not have duct liner, for 24 inches (600 mm) upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated, as required to meet requirements of the applicable energy code, and as outlined below.
   1. Supply Ducts – pressure classes equal to or lower than 2-inch wg:
      a. For ducts located in conditioned spaces: seal transverse joints.
      b. For ducts located in unconditioned spaces: seal all transverse joints and longitudinal seams.

c. For ducts located outdoors: seal all transverse joints, longitudinal seams and duct wall penetrations.

2. Return Ducts, all pressure classes:
   a. For ducts located in conditioned spaces: seal transverse joints.
   b. For ducts located in unconditioned spaces: seal all transverse joints and longitudinal seams.
   c. For ducts located outdoors: seal all transverse joints, longitudinal seams and duct wall penetrations.
3. Exhaust ducts:
   a. For ducts located in conditioned spaces: seal all transverse joints and longitudinal seams.
   b. For ducts located in unconditioned spaces: seal all transverse joints only.

B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

END OF SECTION

SECTION 15820

DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Turning vanes.
7. Duct-mounting access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

B. Related Sections include the following:

1. Division 15, Section 15900 "HVAC Instrumentation and Controls" for electric and pneumatic damper actuators.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Smoke dampers.

6. Turning vanes.
7. Duct-mounting access doors.
8. Flexible connectors.
9. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.
4. Fire-damper, smoke-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Backdraft dampers
   a. Air Balance, Inc.
   b. American Warming and Ventilating.
   c. CESCO Products.
   d. Duro Dyne Corp.

e. Greenheck.
f. Penn Ventilation Company, Inc.
g. Prefco Products, Inc.
h. Ruskin Company.
i. Vent Products Company, Inc.

2. Volume dampers
a. Air Balance, Inc.
b. American Warming and Ventilating.
c. Flexmaster U.S.A., Inc.
d. McGill AirFlow Corporation.
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Penn Ventilation Company, Inc.
h. Ruskin Company.
i. Vent Products Company, Inc.

3. Motorized control dampers
a. Air Balance, Inc.
b. American Warming and Ventilating.
c. CESCO Products.
d. Duro Dyne Corp.
e. Greenheck.
f. McGill AirFlow Corporation.
g. METALAIRE, Inc.
h. Nailor Industries Inc.
i. Penn Ventilation Company, Inc.
j. Ruskin Company.
k. Vent Products Company, Inc.

4. Fire dampers
a. Air Balance, Inc.
b. CESCO Products.
c. Greenheck.
d. McGill AirFlow Corporation.
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Penn Ventilation Company, Inc.
h. Prefco Products, Inc.
i. Ruskin Company.
j. Vent Products Company, Inc.
k. Ward Industries, Inc.

5. Smoke dampers
a. Air Balance, Inc.
b. CESCO Products.
c. Greenheck.
d. Nailor Industries Inc.
e. Penn Ventilation Company, Inc.
f. Ruskin Company.

6. Manufactured turning vanes
   a. Ductmate Industries, Inc.
   b. Duro Dyne Corp.
   c. METALAIRE, Inc.
   d. Ward Industries, Inc.

7. Duct-mounting access doors – rectangular
   a. American Warming and Ventilating.
   b. CESCO Products.
   c. Ductmate Industries, Inc.
   d. Flexmaster U.S.A., Inc.
   e. Greenheck.
   f. McGill AirFlow Corporation.
   g. Nailor Industries Inc.
   h. Ventfabrics, Inc.
   i. Ward Industries, Inc.

8. Duct-mounting access doors – round
   a. Ductmate Industries, Inc.
   b. Flexmaster U.S.A., Inc.

9. Flexible connectors
   a. Ductmate Industries, Inc.
   b. Duro Dyne Corp.
   c. Ventfabrics, Inc.
   d. Ward Industries, Inc.

10. Flexible ducts
   a. ATCO
   b. Flexmaster U.S.A., Inc.
   c. Hart & Cooley, Inc.
   d. McGill AirFlow Corporation.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having [**G60 (Z180)**] [**G90 (Z275)**] coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 BACKDRAFT DAMPERS

A. Description: Multiple-blade, parallel action gravity balanced, with blades of maximum 6-inch (150-mm) width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

B. Frame: 0.052-inch thick, galvanized sheet steel, with welded corners and mounting flange.

C. Blades: 0.025-inch thick, roll-formed aluminum.

D. Blade Seals: Neoprene.

E. Blade Axles: Galvanized steel.

F. Tie Bars and Brackets: Galvanized steel.

G. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064 inch thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Molded synthetic.
5. Tie Bars and Brackets: Galvanized steel.

2.5 MOTORIZED CONTROL DAMPERS

A. General Description: AMCA-rated, parallel- or opposed-blade design; minimum of 0.1084-inch- (2.8-mm-) thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- (1.61-mm-) thick, galvanized-steel damper blades with maximum blade width of 8 inches (203 mm).

1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

3. Provide [**closed-cell neoprene edging**] [**parallel- or opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (995 Pa) when damper is being held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D**].

2.6 FIRE DAMPERS

A. Fire dampers shall be labeled according to UL 555.

B. Fire Rating: 1-1/2 hours.

C. Frame: Curtain type with blades outside airstream, fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

D. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

E. Mounting Orientation: Vertical or horizontal as indicated.

F. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

G. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

H. Fusible Links: Replaceable, 165 deg F (74 deg C) rated.

2.7 SMOKE DAMPERS

A. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

B. Fusible Links: Replaceable, 165 deg F (74 deg C) rated.

C. Frame and Blades: 0.064-inch- (1.62-mm-) thick, galvanized sheet steel.

D. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application.

E. Damper Motors: Modulating and two-position action.

1. Comply with requirements in Division 15 Section "Motors."
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
4. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
6. Electrical Connection: 115 V, single phase, 60 Hz.

2.8 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- (38-mm-) wide, [**single**] [**double**]-vane, curved blades of galvanized sheet steel set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into vane runners suitable for duct mounting.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.9 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

1. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
2. Provide number of hinges and locks as follows:

    a. Less Than 12 Inches (300 mm) Square: Secure with two sash locks.
    b. Up to 18 Inches (450 mm) Square: Two hinges and two sash locks.
    c. Up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches.
    d. Sizes 24 by 48 Inches (600 by 1200 mm) and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch (25-mm) thickness. Include cam latches.

1. Frame: Galvanized sheet steel, with spin-in notched frame.

2.10 FLEXIBLE CONNECTORS

A. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Select metal compatible with ducts.

C. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

D. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

2.11 FLEXIBLE DUCTS

A. Noninsulated-Duct Connectors: UL 181, Class 0, corrugated aluminum.
1. Pressure Rating: 8-inch wg positive or negative.
2. Maximum Air Velocity: 5000 fpm.
3. Temperature Range: Minus 100 to plus 435 deg F.
4. Basis of Design: Atco UPC #017.

B. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.
1. Pressure Rating: 10-inch wg positive and 0.75-inch wg negative.
2. Maximum Air Velocity: 5000 fpm.
3. Temperature Range: Minus 20 to plus 140 deg F, continuous at maximum pressure.
4. Insulation R-value: 4.2.
5. Basis of Design: Atco UPC #080.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with worm-gear action or Nylon strap, in sizes 3 through 18 inches to suit duct size.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Provide test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers[, **turning vanes,**] and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot (15-m) spacing.
5. On sides of ducts where adequate clearance is available.

I. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body Plus Ladder Access: 25 by 17 inches (635 by 430 mm).

J. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches (200 mm) in diameter.
2. Two-Hand Access: 10 inches (250 mm) in diameter.
3. Head and Hand Access: 12 inches (300 mm) in diameter.
4. Head and Shoulders Access: 18 inches (460 mm) in diameter.
5. Body Access: 24 inches (600 mm) in diameter.

K. Label access doors according to Section 15122 "Mechanical Identification."

L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

M. Connect diffusers to low pressure ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with draw bands.

O. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 15, Section 15950 "Testing, Adjusting, and Balancing."

END OF SECTION

SECTION 15837

CENTRIFUGAL FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes centrifugal fans [**and vent sets**].

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on [**actual site elevations**] [**sea-level conditions**].

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Vibration isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Submit with Shop Drawings. Show mechanical room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

D. Manufacturer Seismic Qualification Certification: Submit certification that modular outdoor air-handling units, accessories, and components will withstand seismic forces defined in Division 15 Section "Mechanical Vibration and Seismic Controls." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Maintenance Data: For centrifugal fans to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan Company.
3. Cook, Loren Company.
4. Greenheck.

2.2 MANUFACTURED UNITS

A. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, drive assembly, and support structure.

2.3 HOUSINGS

A. Materials and Fabrication: Formed and reinforced steel panels to make curved scroll housings with shaped cutoff, spun-metal inlet bell, and doors or panels to allow access to internal parts and components.

1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Fabrication Class: AMCA 99, Class I.
3. Horizontal Flanged Split Housing: Bolted construction.

B. Coatings: Powder-baked enamel, manufacturer's standard color.

2.4 WHEELS

A. Airfoil-Fan Wheels: Steel construction with smooth-curved inlet flange; heavy back plate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and back plate; cast-iron or cast-steel hub riveted to back plate and fastened to shaft with set screws.

B. Coatings: Powder-baked enamel.

2.5 SHAFTS

A. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

B. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.

C. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

2.6 BEARINGS

A. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.

1. Ball-Bearing Rating Life: ABMA 9, L_{10} of [**50,000**] [**120,000**] hours.
2. Roller-Bearing Rating Life: ABMA 11, L_{10} of [**50,000**] [**120,000**] hours.

2.7 BELT DRIVES

A. Description: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor: 1.5.

B. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

C. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.

D. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

1. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements; 0.1046-inch-(2.7-mm-) thick, 3/4-inch (20-mm) diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

E. Motor Mount: Adjustable for belt tensioning.

2.8 ACCESSORIES

A. Provide accessories as scheduled on the drawings.

B. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.

C. Companion Flanges: Galvanized steel, for duct connections.

D. Discharge Dampers: Heavy-duty steel assembly with parallel blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked outside of airstream to single control lever.

E. Inlet Screens: Galvanized steel welded grid screen.

F. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.

G. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

H. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

I. Isolation rails and restrained spring isolators.

2.9 MOTORS

A. Comply with requirements in Division 15, Section 15050 Basic Mechanical Materials and Methods, "Motors for Mechanical Equipment."

2.10 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Support roof-mounting units using restrained spring isolators having a static deflection of [**1 inch (25 mm)**] <**Insert other deflection**>. Vibration- and seismic-control devices are specified in Section 15071 "Mechanical Vibration Controls and Seismic Restraints."

1. Secure vibration and seismic controls to structure.

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

D. Install units with clearances for service and maintenance.

E. Label fans according to requirements specified in Section 15075 "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 15820 "Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Section 15950 "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 15838

POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Centrifugal roof ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on sea-level conditions.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material gages and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

   1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations with Division 7 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Centrifugal Roof Ventilators:

    a. Acme Engineering & Mfg. Corp.
    b. Cook, Loren Company.
    c. Greenheck Fan Corp.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

    1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

    1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
    2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
    4. Fan and motor isolated from exhaust airstream.

E. Accessories: (As Scheduled on the Drawings)
    1. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
    2. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
    3. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

    1. Configuration: Self-flashing without a cant strip, with mounting flange.
    2. Overall Height: 14 inches.

2.3 MOTORS

A. Comply with requirements in Section 15050 "Basic Mechanical Materials and Methods."

B. Enclosure Type: Guarded drip proof.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 for installation of roof curbs.

B. Install units with clearances for service and maintenance.

C. Label units according to requirements specified in Section 15075 "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in Section 15815, "Metal Ducts." Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 15820, "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Wire and ground equipment in accordance with Division 16 requirements.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Section 15950, "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 15855

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes:
   1. Ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:
   1. Section 15815 "Metal Ducts"
   2. Section 15820 "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. General: See Division 1 for general Submittal and product substitution requirements.

B. Pre-construction Shop Drawings: Provide the following before fabrication and installation:
   1. Product Data: For each product indicated, include the following:
      a. Data Sheet: Indicate sizes, materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
      b. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grilles, registers, and diffusers

    a. Anemostat
    b. Hart & Cooley, Inc
    c. Krueger.
    d. Metalaire.
    e. Price Industries (Basis of Design).
    f. Titus.
    g. Tuttle & Bailey.
    h. Metalaire.

2.2 CUSTOM LINEAR DIFFUSERS

A. Basis of Design: Price Industries JS Series.
1. Type: Continuous slot, with adjustable dual pattern controllers for adjustment of the discharge direction, as well as volume control, all from the face of the diffuser.
2. Fabrication: Custom fabricated curved aluminum extrusions or standard straight sections to match wall and ceiling surfaces. Ceiling vertical throw or wall horizontal throw applications as indicated on the Drawings. Single slot width as scheduled.
3. Frame: Surface mount concealed frame, finish to be selected.
4. Plenum: Galvanized steel with round or oval inlet.
5. Accessories: As Scheduled.

2.3 MODULAR CORE SQUARE CEILING DIFFUSERS

A. Basis of Design: Price Industries SMCD Series.
1. Type: Square, high capacity diffuser, with four field adjustable modular cores for 1, 2, 3, or 4 –way horizontal flow patterns, square neck, as scheduled.
2. Frame: Inverted T-bar type or surface mount as scheduled.
3. Fabrication: Steel with factory white baked enamel white finish.
4. Damper: Opposed blade type with removable key operator, operable from face. Provide where remote branch damper is not possible.
5. Accessories: As scheduled.
6. Sizes and Performance: As scheduled.

2.4 LOUVERED RETURN AND EXHAUST GRILLES AND REGISTERS

A. Basis of Design: Price Industries 500/600 Series.

1. Models:
   a. 530L: 35 degree fixed deflection, long front blades, ¾" blade spacing.
   b. 530S: 35 degree fixed deflection, short front blades, ¾" blade spacing.
   c. 535L: 35 degree fixed deflection, long front blades, 1/2" blade spacing.
   d. 535S: 35 degree fixed deflection, short front blades, 1/2" blade spacing.
2. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
3. Fabrication: 500 Series steel extrusions; 600 Series aluminum extrusions; with factory white baked enamel finish.
4. Damper: Provide where remote branch damper is not possible. Integral, gang-operated, opposed blade type with removable key operator, operable from face.
5. Provide panel for lay-in installation as scheduled.
6. Accessories: As Scheduled.
7. Sizes and Performance: As scheduled.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Coordinate with Architectural Reflected Ceiling Plans. Where architectural features or other items conflict with installation, notify Architect / Engineer for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated on the drawings, or as directed, before starting air balancing.

END OF SECTION 15855

SECTION 15861

AIR FILTERS AND HOUSINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

1.3 DEFINITIONS

A. HEPA: High-efficiency particulate air.

1.4 SUBMITTALS

A. Product Data: Include dimensions; shipping, installed, and operating weights; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

B. Shop Drawings: Include plans, elevations, sections, and details to illustrate component assemblies and attachments.

1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
3. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For each type of filter and rack to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated. Other manufacturers systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

B. Electronic Air Cleaners and Electrical Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100 by a testing agency acceptable to authorities having jurisdiction.

C. Comply with NFPA 90A and NFPA 90B.

D. ASHRAE Compliance: Comply with provisions of ASHRAE 52.1 for method of testing and rating air-filter units.

E. Comply with NFPA 70 for installing electrical components.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide one complete set of filters for each filter bank.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Filters, and Filter-Housing Systems:

a. AAF International.
b. Camfil Farr Co.
c. Flanders Filters, Inc.

2. Filter Gages:
a. Dwyer Instruments Inc.

2.2 EXTENDED SERVICE PLEATED PANEL FILTERS

A. Basis of Design: AAF AmAir 300X Panel Filters, standard size, 24"x24"x4" deep.

B. Description: Factory-fabricated, viscous-coated, flat-panel type, disposable air filters with holding frames.
1. Media: High loft pleated fibrous glass.
2. Frame: Double wall board frame with wire support grid.

C. Performance:
1. Minimum Efficiency: 25-30%.

2.3 HEPA FILTERS

A. Basis of Design: AAF AstroCel HCX High Capacity, standard size 24"x24"x11-1/2" deep.

B. Description: Factory-fabricated HEPA filters with holding casing.
1. Media: UL 586, fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators.
2. Frame Material: Galvanized steel.
3. Media to Frame Side Bond: Silicone.
4. Face Gasket: Silicone.

C. Performance:
1. Minimum Efficiency: 99.97% at 0.3 micron.
2. Rated Airflow Capacity: 1500 CFM @ 1" water column initial static pressure.

2.4 PACKAGED BAG-IN / BAG-OUT SERVICE HOUSING (Waiting Exhaust System)

A. Basis of Design: AAF AirShelter BIBO, 2x1, 2250 CFM.

B. Packaged system shall include the following: (Refer to drawing and schedule for configuration)
1. Inlet transition.
2. Prefilter section to accommodate (2) 24 x 24 x 4 inch deep nominal pleated prefilters
3. BIBO HEPA Final Filter Section to accommodate (2) 24 x 24 x 11-1/2 inch final filters.
4. Outlet transition.
5. Flexible connection to connect between the outlet transition and the fan inlet.
6. Centrifugal fan
   a. Fan shall be mounted on packaged filter housing system skid. Fan capacity performance shall be as Scheduled on the Drawings. Refer to Section 15837 "Centrifugal Fans". Fan shall be provided with packaged system or by others.

C. Construction
1. The inlet and outlet flanges of the housing shall be turned outward to facilitate connection to adjoining components. Inlet and outlet flanges shall be drilled for field duct connections.
2. Sections of the Bag-In / Bag-Out housing assembly in series shall be factory welded together.
3. The housing pressure boundaries, which include the housing skin and internal HEPA filter frames, shall be fabricated from 12 and 14 gauge Type 304L stainless steel. All other welded components, including fittings used to provide housing penetrations and hardware welded to the housing for attaching the access doors shall be fabricated from

Type 304 stainless steel. A filter support shelf shall be provided for each HEPA filter section. The shelf shall be completely removable and shall be fabricated from 11 gauge Type 304 stainless steel. It shall not be subjected to any welding.

4. The majority of the hardware and components associated with the filter locking mechanism shall be Type 300 series stainless steel and shall also be replaceable. The only exception shall be materials supplied to prevent "galling" or friction welding of stainless steel components.

5. The housing shall be reinforced to withstand a positive and negative design pressure of 20 inches water gauge. Reinforcing shall be 14-gauge minimum and shall be welded to the outside of the housing.

6. All pressure boundary weld joints and seams shall be continuously welded. Weld joints and seams shall be visually inspected to ensure that they are smooth, free of defects and contain no burrs or sharp edges.

7. The housing shall be designed to accommodate 4-inch deep prefilters, 11-1/2 inch deep fluid seal HEPA filters and, as required. Each filter section shall be supplied with a separate access door for each row of filters. The access door shall be sealed to the housing by means of a silicone rubber gasket. The gasket shall be attached to the door and shall form a lip over the knife-edge style door flange. The access door shall be attached to the housing my means of four (4) removable handles which screw on to weld studs permanently welded to the housing and which draw the access door to the housing compressing the gasket between the door and the housing. The door shall be fully removable from the housing to facilitate filter installation and removal. The door attachment mechanism shall be designed so that it does not interfere with the filter removal and installation process. Housings of more than one filter wide shall be supplied with a filter removal rod in each prefilter, and HEPA filter track. The filter removal rod shall be operated from inside the filter change-out bag and shall allow the filters to be drawn to the change-out position.

8. The housing shall have a bag support collar which forms the perimeter of each access port and which is located inside each access door. The collar shall be seal welded to the housing and shall be formed with smooth surfaces and without irregularities to prevent any possibility of damage to the bag or leakage between the bag and collar. The collar shall incorporate two continuous grooves to accommodate both the elastic cord built into the mouth of the bag and a safety strap. An appropriately sized bag kit shall be supplied for each access door. Each bag kit shall consist of:

   a. An 8 mil. Thick transparent PVC bag fitted with a 1/4 inch diameter elastic cord hemmed into the bag opening and three formed glove sleeves to facilitate access to the inside of the bag and the enclosure during filter installation and removal. The mouth of the bag shall be sized so that when it is stretched over the bag support collar the elastic cord fits snugly and securely into the groove provided for that purpose. The bag shall be 108 inches long with a nominal circumference of 84 inches.

   b. A nylon safety strap to prevent the bag from sliding off the bag support collar during filter installation and removal.

c. A cinching strap to allow the bag to be tied off in a manner which will prevent it from being drawn into the housing.

d. The HEPA filter sealing mechanism shall be of the fluid seal type. The gasket seal mechanism shall be operated from the outside of the housing by a drive bolt. Separate mechanisms shall be provided for each tier of filters, one to provide continuous clamping force at the top face of the filter and the other to provide continuous clamping force at the bottom face. The clamping mechanism shall force a spring loaded pressure bar against the top or bott6m.face of the filter. Separate pressure bars shall be provided for each filter to ensure that each filter is individually clamped with a minimum uniform sealing force of 1,200 pounds per filter. It shall not be necessary to remove the housing access door to vary the compressive sealing force on the filter.

e. The fluid seal mechanism shall be operated from inside the housing by means of a lever arm. This lever arm shall in turn actuate the mechanism, which engages and disengages the filter from the continuous knife-edge sealing face of the filter-sealing surface using extractor clips, which are part of the filter. A single lever arm shall be provided for each tier of filters. The lever arm shall be operated through the door opening and from inside the bag during filter installation and removal. The filter sealing mechanism shall be designed in a manner such that the door cannot be closed until the filters have been correctly installed in the housing and the lever arm locked securely in place.

f. Prior to shipment from the factory the housing shall be tested for filter fit, operation of the filter clamping mechanism, and leak tightness. Both the filter sealing surface and the housing pressure boundary shall be leak tested by the "pressure decay method" in accordance with ASME N510-1989, "Testing of Nuclear Air-cleaning Systems", paragraphs 6.5.3 and 7. The filter sealing surface and the housing shall be guaranteed to meet the leak tightness requirements of ASME N509-1989, "Nuclear Power Plant Air-Cleaning Units and Components", Table 4-4, "Maximum Unit Leakage Rates" for ESF, leakage Class 1.

9. The Prefilter section shall include two pressure (2) taps, one upstream and one downstream of the filter, and factory installed Dwyer Magnehelic gauges, with a range of 0-2 inches water gauge mounted in a weatherproof enclosure to measure the static pressure loss across the filter.

10. The Final Filter section shall include two (2) pressure taps, one upstream and one downstream of the filter, and factory installed Dwyer Magnehelic gauges, with a range of 0-5 inches water gauge mounted in a weatherproof enclosure to measure the static pressure loss across the filter.

D. Provide the following factory installed options:
1. Weather Cover.
2. Lifting Lugs.
3. Test Ports.
4. Engraved Nameplate.
5. Spare bag kit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install filter frames according to manufacturer's written instructions.

B. Position each filter unit with clearance for normal service and maintenance.

C. Install filters in position to prevent passage of unfiltered air.

D. Coordinate filter installations with duct and air-handling unit installations.

E. Electrical wiring and connections are specified in Division 16 Sections.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components, filter and filter-frame installation, and electrical wiring. Report results in writing.

3.3 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

SECTION 15900

HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes:
   1. Control equipment for Emergency Department Renovation HVAC systems and equipment.

B. Related Sections include the following:
   1. Section 15940 "Sequence of Operations".

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. LAN: Local area network.

C. MS/TP: Master-slave/token-passing.

D. PICS: Protocol Implementation Conformance Statement.

1.4 SYSTEM DESCRIPTION

A. Control system consists of sensors, indicators, actuators, control elements, interface equipment, other apparatus, and accessories to as required to provide control of mechanical systems and equipment indicated in Section 15940, "Sequence of Operations".

B. The control system shall be an extension of the existing Siemens Control system. Provide components, electrical wiring, conduit, and transformers as required.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. Each control device labeled with setting or adjustable range of control.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Written description of sequence of operation.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including leakage and flow characteristics.
7. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
8. Listing of connected data points, including connected control unit and input device.
9. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
10. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

C. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

D. Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or monitoring and control revisions.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:

1. Maintenance instructions and lists of spare parts for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.

4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

H. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an approved installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

E. Comply with ASHRAE 135 for DDC system control components.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.8 COORDINATION

A. Coordinate location of thermostats, and other exposed control sensors with plans and room details before installation.

B. Coordinate supply of electrical circuits for control units.

C. Coordinate equipment with Division 16 to achieve compatibility with motor starters and annunciation devices.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Siemens (Only).

2.2 DDC EQUIPMENT

A. Workstation: Utilize existing Facility workstation and printer.

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

D. Application Software: Utilize existing systems software. Provide additional software as required to serve Fit-up systems and equipment. Update to latest version of software at Project completion. Include and implement the following capabilities from the control units:

1. Units of Measure: Inch-pound and SI (metric).
2. Load Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, DDC with fine tuning, and trend logging.
3. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
4. Programming Application Features: Include trend point, alarm messages, weekly scheduling, and interlocking.

2.3 CONTROL PANELS

A. Local Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

1. Fabricate panels of 0.06-inch- (1.5-mm-) thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
2. Panel-Mounted Equipment: Temperature and humidity controllers, relays, and automatic switches; except safety devices. Mount devices with adjustments accessible through front of panel.
3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.
4. Graphics: Color-coded graphic, laminated-plastic displays on doors, schematically showing system being controlled, with protective, clear plastic sheet bonded to entire door.

B. Alarm Panels: Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted in hinged-cover enclosure.

1. Alarm Condition: Indicating light flashes and horn sounds.
2. Acknowledge Switch: Horn is silent and indicating light is steady.
3. Second Alarm: Horn sounds and indicating light is steady.
4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.4 SENSORS

A. DDC Zone Sensors / Wall module:

1. Zone Sensors:
   a. Space temperature sensor including externally adjustable setpoint thumbwheel, occupied mode override and cancel push buttons; with plug-in communications jack.
   b. Local setpoint adjustment (55F-85F) by space/zone occupant(s) or utilizing DDC workstation or portable terminal.
   c. Accuracy: Plus or minus 0.5 deg F at calibration point.
   d. Wire: Twisted, shielded-pair cable.
   e. Color: Manufacturers standard white.
   f. Insulating Bases: For sensors located on exterior walls.

B. Equipment operation sensors as follows:
1. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

C. Digital-to-Pneumatic Transducers: Convert plus or minus 12-V dc pulse-width-modulation outputs, or continuous proportional current or voltage to 0 to 20 psig.

2.5 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 15 Section "Motors."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

B. Electronic Damper Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Valves: Size for torque required for valve close-off at maximum pump differential pressure.
2. Dampers: Size for running torque calculated as follows:

a. Parallel-Blade Damper with Edge Seals: 7 inch-pounds/sq. ft. of damper.
b. Opposed-Blade Damper with Edge Seals: 5 inch-pounds/sq. ft. of damper.
c. Parallel-Blade Damper without Edge Seals: 4 inch-pounds/sq. ft of damper.
d. Opposed-Blade Damper without Edge Seals: 3 inch-pounds/sq. ft. of damper.
e. Dampers with Face Velocities of 1000 to 2500 FPM: Multiply the minimum full-stroke cycles above by 1.5.
f. Dampers with Face Velocities of 2500 to 3000 FPM: Multiply the minimum full-stroke cycles above by 2.0.

3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
6. Power Requirements (Two-Position Spring Return): 24-V ac.
7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
9. Temperature Rating: Minus 22 to plus 122 deg F.
10. Run Time: 30 seconds.

2.6 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Globe Valves NPS 2 and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.

C. Terminal Unit Control Valves: Bronze body, bronze trim, two- or three-port as indicated, replaceable plugs and seats, union and threaded ends.

1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.7 DAMPERS

A. Dampers: AMCA-rated, parallel or opposed-blade design; 0.1084-inch minimum, galvanized-steel frames with holes for duct mounting; damper blades shall not be less than 0.0635-inch galvanized steel with maximum blade width of 8 inches.

1. Blades shall be secured to 1/2-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. For standard applications, include optional closed-cell neoprene edging.

4. For low-leakage applications, use parallel- or opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4 inches wg when damper is being held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.8 ISOLATION ROOM PRESSURE CONTROL

A. The Isolation room shall be controlled by a TSI Controller, Model 8630. Isolation operation shall be negative air conditions, maintained at -0.01" w.g. relative to the corridor.

B. The room pressure control system shall be furnished and installed to monitor and control the measured room pressure. The system shall include a room pressure controller, a pressure sensor, a low voltage control transformer, low voltage control wiring, and a damper/actuator assembly. Components of the room pressure controller shall be part of a completely designed, tested, cataloged, and factory coordinated package by a single manufacturer, for single point responsibility.

C. The system shall continuously measure, display, output, and control the room pressure to meet the recommendations set forth in the Centers for Disease Control and Prevention's Guidelines for Preventing the Transmission of Mycobacterium Tuberculosis in HealthCare Facilities, 1994, Supplement 3: Engineering Controls and NFPA 45. Room pressure systems that infer room pressure through CFM offset measurement are not acceptable.

D. Pressure Sensor
1. The pressure sensor shall consist of two velocity sensing elements mounted in-line with each other and a temperature compensating element. The velocity sensing elements shall be ceramic coated platinum RTD for corrosion resistance and easy cleaning. Constant temperature thermal anemometry shall be used to make the air velocity measurement. Pressure transducers are not acceptable. The sensor shall be temperature compensated over a range of 55°F to 95°F.
2. The pressure sensor assembly shall consist of a molded plastic sensor, PVC tubing, an intumescent ring, and a matching sensor housing. The pressure sensor is mounted on one side of the wall, the matching sensor housing on the other side of the wall, with the PVC tubing penetrating the wall. The pressure sensor assembly shall be ANSI / UL 1479. The unit shall have a two hour fire rating.
3. The pressure sensor shall accurately measure room pressure from -0.20000 to +0.20000 inches w.c. The sensor shall be capable of measuring and displaying pressure down to 0.00015 inches w.c. The sensor shall be bi-directional to determine the proper direction of pressure.
4. The pressure sensor shall be capable of being mounted on either side of the wall (i.e. in the controlled space or in the reference space). A dip switch shall be provided to select which side of the wall the pressure sensor is mounted.

E. Room Pressure Controller
1. The room pressure controller shall measure, display and control room pressure. It shall provide access to menu driven programming options via a keypad. The keypad shall be a smooth spill proof membrane switch.
2. The case shall be manufactured with molded industrial grade plastic. Case should mount to a double gang electrical box (4" wide x 4" tall x 2.5" deep). There shall be a two line alphanumeric digital display indicating the measured room pressure in inches w.c. The

display shall have a range of -0.20000 to +0.20000 with a resolution of 5% of reading and shall be updated every one half second. Two indicator lights shall be on the front of the monitor to indicate the following conditions:

a. Red - ALARM conditions
b. Green - NORMAL or safe pressure condition.

3. There shall be low and high alarms for negative pressure. Each alarm shall be capable of having a unique set point. The controller shall have an audible alarm that sounds when the room is in an alarm condition. In addition, an alarm contact for low pressure alarm shall be SPST (N.O.). The contact shall close in a low alarm condition. An analog pressure output that via a keypad allows the user to select either a 0-10 VDC or 4-20 mA linear analog output. In addition the output pressure range shall be selectable, either -0.1 to +0.1 inches w.c. or -0.01 to +0.01 inches w.c. A negative pressure, no isolation input contact shall initiate the room pressure monitor to enable negative pressure alarms. When in no isolation mode, disable alarms. An analog flow station input shall be included for each room. RS-485 communications with field selectable Modbus or Cimetrics communications protocol. The RS-485 wiring shall be daisy chained from unit to unit and then sent to the building management system.

F. Transformer

1. The transformer shall be UL and CSA listed and shall have a primary side voltage of 120 VAC and a secondary side voltage of 24 VAC. The transformer shall have a rating of 20 VA with a 0.5 amps maximum.

G. Damper/Actuator Assembly

1. A damper/actuator assembly shall be provided to modulate the exhaust air out of the isolation room. The assembly shall come as a complete package from the room pressure control manufacturer.
2. The damper shall be constructed of the following: Frame and blade 16 gauge galvanized material. Shaft - 0.5" diameter zinc plated steel. Bearings oil impregnated bronze. Round butterfly dampers shall have two factory formed ridges to prevent binding. Rectangular dampers shall be opposed blade type. Round dampers shall be provided for sleeve or slip mounting.

H. Electric Actuator

1. The room pressure controller shall interface to an electric actuator with a control voltage of 0-10 volts. The control input current shall be less than 0.001 amps DC. The actuator shall be enclosed in a metal case (4.0 in. H X 2.5 in. W X 7.0 in. L) with a 7/8 in. knockout for electrical wiring. Electrical connections shall be made to screw terminals. The response time for 0 to 85 degrees of damper travel shall be 5 seconds with a torque of 400 in. oz. The actuator shall have an over current protection of 0.28 amps for stalled conditions to protect the actuator motor from overload.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units.

B. Verify that duct-, pipe-, and equipment-mounted devices and wiring are installed before proceeding with installation.

3.2 GENERAL INSTALLATION

A. Install equipment level and plumb.

B. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

C. Connect and configure equipment and software to achieve sequence of operation specified.

D. Verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate all 60 inches above the finished floor.

E. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.

F. Install automatic dampers according to Division 15 Section "Duct Accessories."

G. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

H. Install labels and nameplates to identify control components according to Division 15 Section "Mechanical Identification."

I. Install hydronic instrument wells, valves, and other accessories according to Division 15 Section "Hydronic Piping."

J. Install duct volume-control dampers according to Division 15 Sections specifying air ducts.

3.3 ISOLATION ROOM PRESSURE CONTROL INSTALLATION

A. The room pressure controller shall be installed as recommended by the manufacturer's installation instructions.
1. The Controls Contractor shall install the pressure sensor and the room pressure controller in each isolation room.
2. The Sheet Metal Contractor shall install the damper/actuator assembly checking for proper alignment and airflow.
3. Wiring shall be done by the Controls Contractor as specified by the manufacturer.

3.4 EXISTING REHEAT COILS WITH PNEUMATIC CONTROLS

A. Controls Contractor to remove existing pneumatic controls and associated components on existing reheat coils within the Fit-up area of work. Furnish and install new DDC controls.

3.5 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 16.

B. Install building wire and cable according to Division 16.

C. Install signal and communication cable according to Division 16.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

D. Connect manual-reset limit controls independent of manual-control switch positions.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.6 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Install piping adjacent to machine to allow service and maintenance.

B. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.

4. Calibration test electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

B. Engage a factory-authorized service representative to perform startup service.

C. Replace damaged or malfunctioning controls and equipment.

1. Start, test, and adjust control systems.
2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

D. Verify DDC as follows:

1. Verify software including automatic restart, control sequences, scheduling, reset controls, and occupied/unoccupied cycles.
2. Verify operation of operator workstation.
3. Verify local control units including self-diagnostics.

3.8 ISOLATION ROOM PRESSURE CONTROL - Equipment Start-up, Calibration, and Training

A. Start-up shall be performed by the manufacturer or a factory authorized representative.

B. Start-up shall include verifying the control of the Isolation room. Ceilings and doors shall be installed and the HVAC systems (exhaust and supply air) shall be properly air balanced before start-up shall occur.

C. The manufacturer shall include a thermal anemometer based air velocity meter with the room pressure control system. Specifications are based on TSI, Incorporated Model 8383 Digital Air Velocity Meter.

D. The manufacturer, or authorized factory representative, shall provide a minimum of 8 hours of training for building personnel.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of 40 hours' dedicated instructor time on-site.
3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

5. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.10 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

END OF SECTION

SECTION 15940

SEQUENCE OF OPERATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes:
   1. Control sequences for Emergency Department Renovation HVAC systems and equipment.

B. Related Sections include the following:

   1. Section 15726 "Modular Outdoor Air Handling Units".

   2. Section 15761 "Condensing Units".

   3. Section 15900 "HVAC Instrumentation and Controls" for control equipment and devices and submittal requirements.

1.3 ABBREVIATIONS

A. BMS: Building Management System.

B. DDC: Direct-digital controls.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.4 CONSTANT-VOLUME AIR-HANDLING UNIT (Areas Occupied 24 Hours Every Day)

A. Air handling system shall start through the BMS provided all safeties have been satisfied.

B. Fan Control: System commands supply and return fans to run continuously.

C. The stages of the associated DX cooling system, and economizer dampers will modulate in sequence to maintain space temperature setpoint.

D. The minimum outside air volume will be controlled by the BMS via modulating dampers / airflow-measuring station (furnished with the air handler) to maintain the minimum outside air CFM as scheduled.

E. Cooling/Economizer: Provide OA and RA temperature and humidity sensors. On call for cooling modulate open the outside air damper beyond its minimum position if the enthalpy of the outside air is less than the enthalpy of the return air. The mechanical cooling will be off whenever the unit is in economizer cooling or heating mode, the supply fan is off, or the discharge air temperature sensor has failed. If the enthalpy of the outside air exceeds the enthalpy of the return air, the mixed air dampers will remain at minimum position. On a further call for cooling the stages of mechanical cooling will sequence in order to achieve setpoint. Control of the outdoor air and return air dampers shall act in complementary fashion.

F. Stop Mode: The supply fan and return fan will be off, the outside air damper will be closed, and the DX cooling system will be off.

G. Safety Devices:
   1. Freeze Protection: Stop fans and close outside and relief air dampers if temperature downstream of cooling coil is below 37 degrees F (3 degrees C); signal alarm.

   2. Smoke detection: Stop fans and return system to STOP mode upon a signal from the fire alarm system. Wiring from the fire alarm device to the motor starters provided under Division 16.

   3. Building Management System Interface
      a. If communication with the BMS is lost and all safeties are satisfied, the AHU shall use the last controlling setpoints and operates in the Occupied mode.

H. Operator Station Display: Indicate the following on operator workstation display terminal:

   1. System graphic.
   2. System on-off indication.
   3. System fan on-off indication.
   4. Return fan on-off indication.
   5. Outside-air-temperature and humidity indication.

6. Space temperature and humidity indication.
7. Mixed-air-temperature indication.
8. Mixed-air damper position.
9. Heating-coil control-valve position.
10. DX Cooling System on-off indication.
11. Smoke detection alarm.

3.5 AIR-COOLED CONDENSING UNIT (CU-ED)

A. BMS interface furnished with Unit. Refer to Section 15671.

B. Unit to be started and stopped by the BMS system.

C. Monitor status of Unit. Signal Alarm to the BMS system upon Common / Trouble alarm.

3.6 DUCT-MOUNTED HEATING COILS (RH)

A. Modulate hot water control valve to maintain space setpoint of 72 deg F (adjustable).

B. Provide night setback control (adjustable).

C. Provide alarm when space temperature varies 10 deg F (adjustable) from space setpoint.

3.7 CLEAN STEAM HUMIDIFIER (H)

A. Humidifier control panel specified under Section 15752.

B. City water to clean steam humidification system. Float operated water make-up valve (furnished with humidifier) to allow make-up water to enter the humidifier basin at the same rate it evaporates. When fan is running, duct humidistat maintains humidity by modulating the control valve.

C. Humidifier Safeties:
1. Humidifier shall be prevented from operating until a vane-type airflow switch (furnished with humidifier) proves flow.
2. Hard-wired high limit humidistat, set 90% R.H., shall stop the fan and override the humidity controller signal and close the humidifier valve if duct relative humidity exceeds high limit setpoint.
3. Locate the humidistat (furnished with humidifier) in the return duct main.

3.8 GENERAL TOILET EXHAUST FAN (EF-7R)

A. Exhaust fan to be started and stopped by the BMS. Normal mode is 24 hours/day.

B. Monitor status of fan. Alarm to the BMS system upon loss of airflow.

3.9 WAITING AREA PACKAGED EXHAUST SYSTEM (EF-ED)

A. Exhaust Fan to be started and stopped by the BMS. Normal mode is 24 hours per day.

B. Monitor status of fan. Alarm to the BMS upon loss of airflow.

3.10 ISOLATION ROOM EXHAUST FAN (EXISTING FAN)

A. Exhaust Fan to be started and stopped by the BMS. Normal mode is 24 hours per day.

B. Monitor status of fan. Alarm to the BMS upon loss of airflow.

3.11 ISOLATION ROOM PRESSURE CONTROL

A. Isolation Room Pressure Controller / Monitor is Specified under Section 15900.

1. The room pressure controller shall modulate the exhaust damper to maintain differential pressure set point of –0.01 inches water column.

B. Alarms shall be wired to the BMS. Analog signals shall be input into the BMS for trending.

END OF SECTION 15940

SECTION 15761

AIR COILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The requirements of Section 15000, "Basic Mechanical Requirements" apply to work defined by this Section.

C. The requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work defined by the Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-water coils.

B. Related Sections include the following:

1. Section 15900 "HVAC Instrumentation and Controls" for coil temperature-control valve requirements.

1.3 SUBMITTALS

A. Product Data: Include rated capacities of selected models; pressure drop; shipping, installed, and operating weights; installation instructions; and startup instructions for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Maintenance Data: For air coils to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Comply with ARI 410, "Standard for Forced-Circulation Air-Cooling and Air-Heating Coils," for components, construction, and rating.

1. Certify coils to ARI 410, "Standard for Forced-Circulation Air-Cooling and Air-Heating Coils."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Water Coils:
   a. Carrier Corporation.
   b. Heatcraft Inc.; Heat Transfer Division.
   c. McQuay.
   d. Trane Co. (The).
   e. USA Coil and Air.
   f. York International.

2.2 HOT-WATER COILS

A. Description: Self-draining coil fabricated to ARI 410.

B. Piping Connections: Threaded, on same end.

C. Tubes: Copper, complying with ASTM B 75 (ASTM B 75M).

D. Tubes: Red brass, complying with ASTM B 111 (ASTM B 111M).

1. Tube Diameter: [**0.625 inch (15.9 mm)**] [**1.0 inch (25.4 mm)**].
2. Minimum Tube Thickness: 0.020 inch (0.51 mm).

E. Fins: Copper with fin spacing as required.

F. Fin and Tube Joint: Mechanical bond.

G. Frames: Galvanized-steel channel frame.

H. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.

1. Working Pressure Ratings: 200 psig, 325 deg F.

I. Source Quality Control: Test to 325 psig underwater.

J. Performance and sizes as scheduled on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and units to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Unless otherwise indicated, connect piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.

3.4 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Straighten bent fins on each air coil.

3.5 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

B. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

END OF SECTION

SECTION 16010

GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 REFERENCES

A. Conditions of the Contract, Specifications, Change Orders, Addenda, Drawings and Division 1 General Requirements, apply to work of this section. Where paragraphs of this section conflict with similar paragraphs of Division 1, requirements of this section shall prevail.

1.2 DEFINITIONS

A. As used in this section, "provide" means "furnish and install", "furnish" means "to purchase and deliver to the project site complete with every necessary appurtenance and support and to store in a secure area in accordance with manufacturers instructions", and "install" means "to unload at the delivery point at the site or retrieve from storage, move to point of installation and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

B. "Concealed" shall mean hidden from sight in walls, chases, furred spaces, above ceilings, within enclosed cabinets, underground, in trenches or otherwise enclosed. "Exposed" shall mean within sight in closets, finished rooms, under counters, behind and/or under equipment and/or otherwise visible.

1.3 EXAMINATION OF SITE

A. Before submitting a bid, the Electrical Contractor shall visit and carefully examine site to identify existing conditions and difficulties that may affect the work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions.

B. Before starting work in a particular area of the project, the Electrical Contractor shall examine the conditions under which work must be performed including preparatory work performed under other Sections of the Contract, or by the Owner and report conditions which might adversely affect the work in writing to the Engineer. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing conditions and preparatory work.

1.4 SCOPE

A. The work to be accomplished under these specifications includes providing all labor, materials, equipment, consumable items, supervision, administrative tasks, tests and documentation required to install complete and fully operational electrical systems as described herein and shown on the Drawings. The Electrical Contractor shall completely coordinate the work of this section with the work of other trades.

B. The Electrical Contractor shall file plans, obtain permits and licenses, pay fees and obtain necessary inspections and approvals from authorities that have jurisdiction, as required to perform work in accordance with all legal requirements.

C. The Work shall be complete from point of service to each outlet or device with all accessory construction and materials required to make each item of equipment or system complete and ready for operation. The work shall include but not be limited to the following. The Electrical Contractor shall provide:

1. Power and lighting distribution systems including panelboards, overcurrent devices, raceway, cable and wire.

2. Branch circuits and devices for power and convenience receptacles.

3. All motor wiring, safety disconnects, and motor starters unless integral with equipment.

4. Complete interior lighting system including normal and emergency fixtures, exit signs, lamps, controls, trim and accessories.

5. Extensions to the Owner's existing addressable Fire Alarm system, including pull stations, area smoke detectors, indicating appliances, power extenders, wiring, auxiliary contacts for equipment interlocking, and other devices shown on the Drawings. All devices shall be compatible with owner's existing system. The electrical contractor shall provide any additional manufacturer programming required.

6. Empty conduits and back boxes for telephone and data outlets.

7. All work associated with the relocation and new Code Red and Code 99 buttons including equipment, wiring, raceway and programming required.

8. Security card readers, door locking equipment, wiring, raceway and programming required for electronically controlled access doors. Equipment shall be compatible with the existing Siemens system.

9. Control wiring not provided by Division 15000.

10. All support material and hardware for raceway, cable tray and electrical equipment.

11. Building wall, floor and roof penetrations for raceway.

12. Branch circuits to control panels and devices furnished under other sections.

    For estimating purposes, include an allowance to provide (1) 120Volt, 20Amp circuit for HVAC controls. Allowance shall include 100 feet of conduit and wire and a 20Amp circuit breaker.

13. Termination of all cable and wire unless otherwise noted.

D. Install the following items furnished by others:

1. Motors
2. Control Panels

1.5 RELATED WORK IN OTHER SECTIONS

A. The following work is not included in this Section and shall be performed under other sections:

1. Cutting and patching of masonry, concrete, tile, and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal decks.

2. Installation of access panels in ceilings and wall construction.

3. Painting, except as specified herein.

4. The Owner will contract separately with the telephone system supplier, who will provide all telephone cable and wire, protectors and telephone equipment within the building through conduits provided under this contract.

5. The Owner will contract separately with the data system supplier, which will provide all data system cable and wire, protectors and equipment within the building through conduits provided under this contract.

6. The Owner will contract separately with the nurse call system supplier, who will provide all nurse call system equipment, boxes, cable, wire and protectors.

B. The Electrical Contractor shall identify locations of penetrations, excavations, structural supports, etc. required for the completion of the Work of this Section to the General Contractor in a timely manner.

1.6 CODES, STANDARDS, AND AUTHORITIES

A. All work shall be performed strictly as required by rules, regulations, standards, codes, ordinances, and laws of local, state, and Federal governments, and other authorities that have lawful jurisdiction. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of publications, standards, rulings, and determinations of:

1. Local and state building, plumbing, mechanical, electrical, fire and health department and public safety codes agencies.

2. American National Standards Institute (ANSI)

3. American Society for Testing and Materials (ASTM)

4. National Fire Protection Association (NFPA)

5. Occupational Safety and Health Act (OSHA)

6. National Electrical Manufacturer's Association (NEMA)

7. Factory Mutual Association (FM)

8. National Electrical Code (NEC)

9. National Electrical Safety Code (NESC).

10. The BOCA National Building Code.

B. All materials and equipment shall be listed by Underwriters Laboratories (UL), and approved for intended service.

C. When requirements cited in this Paragraph conflict with each other or with Contract Documents, the most stringent requirements shall govern conduct of work. The Engineer may relax this requirement when such relaxation does not violate the ruling of authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing.

1.7 WARRANTY

A. Refer to Division 1 General Requirements for Warranty Requirements.

1.8 CONTRACT DRAWINGS

A. Work to be performed under this section is shown on the electrical drawings listed in Division 1 General Requirements.

B. The listing of electrical drawings does not limit responsibility of determining full extent of work required by contract documents. The Electrical Contractor shall refer to architectural, plumbing, HVAC, structural, and other drawings and other sections that indicate types of construction with which work of this section must be coordinated. The Electrical Contractor shall check with the General Contractor and other subcontractors to determine whether there will be any interference by such trades with the electrical work and shall participate in the production of coordination drawings in accordance with Section 01040. If the Electrical Contractor fails to check with the General Contractor and subcontractors and the electrical work is later found to interfere with their work, then he shall make necessary changes, without additional cost to the Owner, to eliminate such interference.

C. Drawings are diagrammatic and indicate general arrangement of systems and work included in contract. Information and components shown on riser diagrams or called for in the specifications but not shown on plans, and vice versa, shall apply and shall be provided as though required expressly by both. It is not intended to specify or to show every offset, fitting, or component; however, contract documents require components and materials whether or not indicated or specified as necessary to make electrical installation complete and operational.

1.9 DISCREPANCIES IN DOCUMENTS

A. It shall be the responsibility of each bidder to examine the drawings and specifications carefully before submitting his bid, with particular attention to errors, omissions, conflicts with provisions of laws and codes imposed by authorities having jurisdiction, conflicts between portions of drawings, or between drawings and specifications, and ambiguous definition of the extent of coverage in the contract. Any such discrepancy discovered shall be brought to the immediate attention of the Engineer for correction. Should any of the aforementioned errors, omissions, conflicts or ambiguities exist in either or both the drawings and specifications, the Electrical Contractor shall have the same explained and adjusted in writing before signing the contract or proceeding with work. Failure to notify the Engineer in writing of such irregularities will cause the Engineer's interpretation of the Contract Documents to be final. No additional compensation will be approved because of discrepancies thus resolved.

B. The drawings and these specifications are intended to comply with all the above mentioned rules and regulations. If discrepancies occur, the Electrical Contractor shall immediately notify the Architect in writing of said discrepancies and apply for an interpretation and, unless and interpretation is offered in writing by the Architect prior to the execution of the contract, the applicable rules and regulations shall be complied with as a part of the contract.

C. In case of difference between building codes, specifications, state laws, industry standards and the contract documents, the most stringent shall govern. Should the Electrical Contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, and industry standards, he shall bear all costs arising in correcting these deficiencies.

1.10 EQUIPMENT AND MATERIALS

A. All equipment and materials shall be new and of the quality specified. All materials shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged during construction shall not be repaired at the jobsite, but shall be replaced with new materials.

B. All equipment installed on this project shall have local representation, local factory authorized service and a local stock of repair parts.

C. No equipment or material shall be installed in such a manner as to void a manufacturers warranty. The Electrical Contractor shall notify the Architect of any discrepancies between the Contract Documents and manufacturer's recommendations prior to execution of the work.

1.11 RECORD DRAWINGS

A. As work progresses, and for duration of the Contract, the Electrical Contractor shall maintain a complete and separate set of prints of Contract Drawings at job site at all times and record work completed and all changes from original Contract. Drawings shall clearly and accurately include work installed as a modification or added to the original design.

B. At completion of work and prior to final request for payment, the Electrical Contractor shall submit a complete set of reproducible record drawings showing all systems as actually installed.

1.12 SHOP DRAWINGS

A. After the Contract is awarded, but prior to proceeding with the Work, the Electrical Contractor shall obtain complete shop drawings, product data, (and samples when requested), from manufacturers, suppliers, vendors, and Subcontractors for all materials and equipment specified herein, and submit data and details of such materials and equipment for review by the Architect and Engineer. Prior to submission of the shop drawings, product data and samples to the Architect and Engineer, the Electrical Contractor shall review and certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Further, the Electrical Contractor shall check all materials and equipment after their arrival on the jobsite and verify their compliance with the Contract Documents. The requirements of Section 01330 will be required in the Architect's office each time shop drawings, product data and/or samples are submitted for review. This time period shall be considered by the Electrical Contractor when scheduling his Work.

B. Refer to Division 1 for specific submittal requirements and quantity of copies to be submitted.

C. The shop drawing submittal shall include all data necessary for interpretation as well as manufacturer's name and catalog number. Sizes, capacities, colors, etc., specified on the drawings shall be specifically noted or marked on the shop drawings.

D. Submittals shall contain only information specific to systems, equipment and materials required by Contract Documents for this Project. Do not submit catalogs that describe products, models, options or accessories, other than those required, unless irrelevant information is marked out or unless relevant information is highlighted clearly. Marks on submittals, whether by Contractor, Subcontractor, manufacturer, etc., shall not be made in red ink. Red is reserved for review process.

E. If the Electrical Contractor proposes an item of equipment other than that specified or detailed on the drawings which requires any redesign of the wiring or any other part of the mechanical, electrical or architectural layout, the required changes shall be made at the expense of the trade furnishing the changed equipment at no cost to the Owner.

F. Manufacturer's names are listed herein and on the drawings to establish a standard for quality and design. Where one manufacturer's name is mentioned, products of other manufacturers will be acceptable (except where noted) if, in the opinion of the Engineer the substitute material is of quality equal to or better than that of the material specified. Where two or more manufacturer's names are specified, material shall be by one of the named manufacturers only.

1.13 BULLETINS, MANUALS, AND INSTRUCTIONS

A. Refer to Division 1 for specific submittal requirements and quantity of copies to be submitted.

1.14 SPACE, EQUIPMENT ARRANGEMENT AND ACCESS

A. Minimum clearances in front of or around equipment shall conform to the latest applicable code requirements.

1.15 MARKING AND LABELING

A. All panelboards shall be labeled with engraved phenolic plates, minimum 3/4" high with 3/8" engraved letters. Plates shall be black, (red for emergency), screw on type with white lettering. Punch tapes with mastic backings are not acceptable. Nameplates shall indicate equipment designation, voltage, and source from where it is fed as indicated on the following example for a panelboard:

LRXR-B
208Y/120V
From LRXR

B. All starters, disconnect switches and other specified equipment shall be marked with engraved laminated plastic plates, minimum 1/2" high with 1/4" engraved letters. Where individual switches or circuit breakers in power or distribution panelboards do not have cardholders, they shall be marked with 1/2" high labels. Nameplates shall indicate equipment designation, voltage, and source from where it is fed.

C. All receptacles shall have panelboard and circuit number supplying them labeled on the device cover plates. This labeling shall be installed below the receptacle on the outlet cover plate. Example – LRXRB, Ckt # 2. Labeling tape shall be Dymo or approved equal.

D. All empty conduits shall have labels tied to the pull string at each end of each empty conduit, marked as to identification of each end. Junction boxes with circuits provided for future use shall be labeled with appropriate circuit designation.

E. Cardholders for panelboard shall be filled out with typewritten identification of each circuit, except that the word "spare" shall be written in soft pencil to identify all circuit breakers installed that are not used.

1.16 WORK IN EXISTING FACILITIES

A. All work shall be accomplished while the Owner's facility is in normal operation. All construction activities shall be conducted with minimal disruption to the Owner's operation.

B. Power outages, bus tie-ins, service change overs and the like shall be scheduled in writing with the Owner.

1.17 WIRING METHODS

A. Above Grade Wiring.

Unless otherwise noted, all wiring shall be installed in raceway.

1. All conduit installed outdoors, all risers between floors and conduit exposed to physical damage shall be rigid steel, rigid aluminum or intermediate metal conduit.

2. Unless otherwise noted, all power distribution wiring including feeders and branch circuits shall be installed in electrical metallic tubing (EMT).

3. All nurse call system wiring shall be installed in EMT.

4. All fire alarm system wiring in new walls shall be installed in EMT. Fire alarm wiring in existing walls and above ceilings shall be permitted to be approved fire alarm type MC cable.

5. All control wiring including automatic temperature control wiring provided by Division 15000 shall be installed in EMT.

6. All emergency circuit wiring shall be installed in EMT.

7. All telephone and data wiring shall be plenum rated and provided and installed by the Owner. Equipment back-boxes and EMT shall be installed from the device to above accessible ceiling by the Electrical Contractor.

1.18 WIRING DEVICES

A. Lighting toggle switches shall be 20 Amp, side wired, heavy duty, specification grade, 120 volt.

B. Lighting dimmer switches shall be 120 volt. They shall be Lutron Skylark series with preset dimmer and on/off switch.

C. Receptacles in patient care areas shall be heavy duty, hospital grade, 120 volt grounding, NEMA 5-20R, side wired, ivory (red for emergency).

D. Receptacles in other than patient care areas shall be specification grade, 120 volt grounding, NEMA 5-20R, side wired, ivory (red for emergency).

E. Acceptable manufacturers are GE, Hubbell, Slater, and Arrow-Hart.

1.19 DEVICE PLATES

A. All device face plates shall be high impact resistant thermoplastic, Hubbell P-X series or equal by Arrow, Hart, Hegeman or Slater. Face plates shall be ivory for devices connected to normal power and red for devices connected to emergency power. Provide coverplates with required number of gangs for symbols designated on drawings.

B. Nameplate designations for device plates. Example – LRXRB, Ckt # 2.

END OF SECTION 16010

SECTION 16030

ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of Section 16010, General Requirements for Electrical Work apply to the work of this Section.

B. This Specification Section covers the field inspection, mechanical completeness, and electrical acceptance tests required for electrical apparatus, wire, cable and other miscellaneous equipment and material installed and wired by the Electrical Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. The equipment to be tested under this Section is generally provided under other Specification Sections.

PART 3 - EXECUTION

3.1 EXECUTION

A. Upon completion of the installation, the Electrical Contractor shall perform field tests on all equipment, materials and systems to ensure that the entire installation is sound and that all circuits will function properly and as intended.

B. All tests shall be performed with proper regard for the protection of equipment and the Electrical Contractor shall be responsible for adequate protection of all personnel during such tests.

C. Prior to energizing or placing in service any electrical equipment, testing and checking shall be completed.

D. The witnessing or waiving of witnessing of any test shall not relieve the Electrical Contractor of its guarantees for material, equipment and workmanship.

F. The Electrical Contractor shall promptly advise the Engineer in writing concerning the failure of any equipment or material to pass the tests performed, or to properly function as intended, or to meet calibration accuracy required. After the defects have been corrected, the test(s) shall be repeated.

3.2 ROTATING EQUIPMENT

A. All motors shall be subjected to a one minute megger test, resistance measured to ground with all phase leads tied together. Minimum insulation resistance values are as follows:

Equipment Rating (volts)	600 or less
Megger Rating (volts)	1000
Min Resistance (megohms)	10

If minimum resistance values are not obtained, the equipment shall be dried out as required, and the above test repeated.

B. The following visual inspection shall be made on all motors:

1. Check bearings for free rotation.
2. Check all ventilation openings for blockages.
3. Check bearing lubrication and correct as necessary.
4. Check that frame is grounded.
5. Check motor leads for proper connection and color coding.

C. The Electrical Contractor shall check all motors for proper rotation by bumping motors. Coupled motors shall not be bumped. The Electrical Contractor shall correct motor connections as necessary.

3.3 WIRE AND CABLE

A. Control and Instrument Wiring - Control and instrument field wiring furnished by the Electrical Contractor shall be visually inspected and tested for continuity to insure that all field wiring is installed in accordance with Contract Drawings and/or equipment manufacturers drawings. Verify all field conductors are properly identified with wire numbers.

B. Low Voltage Power Wiring - All 480 Volt and 208 Volt power wiring shall be subjected to one minute 1000V megger tests. Minimum insulation resistance shall be 50 megohms. Megger tests shall be performed between each phase (A-B, B-C, and C-A) and three phases tie together to ground.

3.4 FUNCTIONAL TESTING

A. Unless otherwise noted, the Electrical Contractor shall energize and operate all alarm and control circuits installed by him under simulated or actual system conditions to verify the correctness of wiring. All control circuits shall be checked in their entirety.

END OF SECTION 16030

SECTION 16050

INSTALLATION OF ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL

A. The provisions of Section 16010, General Requirements for Electrical Work, apply to the work of this section.

B. Included in the work of this section is the assembly, installation and wiring of all parts and subassemblies of panelboards, disconnect switches, variable speed drives and similar equipment.

C. Testing shall be performed in accordance with Section 16030 Electrical Acceptance Testing.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment to be installed under this section is generally furnished under other specification sections.

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment shall be completely assembled, installed and connected and shall be fully prepared and made ready for operation.

B. After installation, all operating parts shall be inspected to insure correct mechanical operation.

C. No overall painting of equipment will be required, but housing surfaces which have been soiled or marred shall be touched up or refinished with primer and color coat.

D. All equipment shall be provided with engraved nameplates in accordance with Section 16010 and the drawings.

3.2 SUPPORTS

A. The Electrical Contractor shall size and provide all supports necessary for the installation of the electrical equipment.

B. Channel framing shall be manufactured by Unistrut, Kindorf, B-Line or approved equal.

C. In dry, non-corrosive areas, channel framing shall be galvanized steel or aluminum and all nuts, bolts and hardware shall be carbon steel, cadmium plated or hot dipped galvanized.

D. In outdoor, wet or damp areas, channel framing shall be aluminum or 304 stainless steel and nuts, bolts and hardware shall be 304 stainless steel.

E. Supports shall be sized with a minimum safety factor of four or 200 lbs. whichever is greater.

F. Fastening to steel may be welded or bolted. Fastening to solid masonry or concrete shall be machine bolts with expansion shields. Fastening to hollow masonry shall be by toggle bolts.

3.3 WIRING

A. All external connections to electrical equipment shall be completed by the Electrical Contractor. Wiring shall be neatly formed, trained and tied with nylon cable ties in all equipment.

B. All power conductors shall be color coded. All control wiring shall be identified with sleeve type wire markers with wire numbers matching those on the manufacturers schematic and connection diagrams.

C. All bus work shall be properly phased "A", "B", "C" left to right, front to back or top to bottom.

3.4 PANELBOARDS

A. The Electrical Contractor shall mount equipment at locations shown on the drawings, install all interiors, branch circuit protective devices, complete all external connections and install exterior trim.

B. The panelboard circuit directory card shall be completed in accordance with Section 16010.

3.5 MOTOR SAFETY SWITCHES, LOCAL MOTOR STARTERS AND VARIABLE SPEED DRIVES

A. Equipment shall be installed at locations shown on the drawings. The Electrical Contractor shall provide all support material and framing required for proper support.

B. Enclosures installed on concrete surfaces or surfaces where condensation is likely to occur shall clear the mounting surface by at least 1/4 inch.

C. Conduit shall be bottom entry to all enclosures installed outdoors or in wet or damp areas.

3.6 MOTORS

A. Motor connections shall be made with compression lugs installed on the motor leads and the motor branch circuit conductors, bolted together.

B. Motor connections shall be wrapped with varnished cambric tape, then insulated with Super 33 Scotch Vinyl electric tape or insulated with motor connection kits as manufactured by Raychem or 3M.

END OF SECTION 16050

SECTION 16060

INSTALLATION OF WIRE AND CABLE

PART 1 - GENERAL

1.1 GENERAL

A. The Provisions of Section 16010, General Requirements for Electrical Work, apply to the Work of this Section.

1.2 CODES AND STANDARDS:

A. Products shall comply with the following codes and standards and shall be UL-listed and labeled where applicable.

IEEE 48	Standard Test Procedures and Requirements for High Voltage Alternating Current Cable Terminations.
UL 486A	Wire Connectors and Soldering Lugs for use with Copper Conductors.
UL 510	Electrical Insulating Tape

1.3 SUBMITTALS

A. Manufacturers product data sheets

PART 2 - PRODUCTS

2.1 WIRE AND CABLE

A. Wire and cable are specified in other Sections of Division 16000.

2.2 TERMINATIONS AND SPLICES

A. Power Wiring:

1. Terminal lugs, connectors and splices shall be tin plated, high conductivity copper compression type. They shall have chamfered barrels and be permanently identified with conductor sizes.

2. Terminal lugs for conductors No. 3/0 AWG and larger shall be long barrel NEMA two hole type.

3. Hydraulic crimping tools with proper die sizes which require full closure before reopening shall be used.

B. Lighting and branch circuits.

1. Splices and taps in lighting and branch circuit wiring shall be 3M Hyflex connectors or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Conductors shall be carefully handled during installation to avoid damage of any kind. They shall be unreeled or uncoiled slowly in order to prevent damage to the insulation or sheath due to sudden bending. Repeated bending shall be avoided. Sharp kinks shall be avoided in unreeling, uncoiling and pulling.

B. Suitable precautions shall be made to protect all installed wiring against damage due to construction activities.

3.2 PREPARATION OF RACEWAYS

A. Raceways shall be substantially completed before any wiring is installed in them. Plug conduit ends to exclude dust, moisture, plaster or mortar while area is under construction. Before any wiring is pulled into a conduit, the conduit shall be cleaned and tested for obstructions and cleared of foreign material that may be found.

3.3 PULLING INTO RACEWAYS

A. All possible care shall be taken in pulling of wiring into conduits or other raceways. Where several cables are contained in one conduit, all such cables shall be pulled in together.

B. The use of pulling lubricants shall be restricted to non hardening type, approved by UL and the cable manufacturer.

3.4 SPLICES AND TERMINATIONS

A. All power and control wiring shall be continuous and shall not be spliced unless otherwise indicated on the Drawings.

B. Connections in motor terminal boxes shall be made by installing compression type lugs on the motor branch circuit conductors and the motor leads. Then bolt the lugs together and insulate with a motor lead connection kit, Raychem, 3M or equal.

C. Control wiring terminated on terminal blocks provided with saddle clamps does not require terminal lugs. Where screw or stud type terminal blocks are provided, control wiring shall be terminated with insulated, crimp type locking forks, Thomas & Betts STA-KON or approved equal.

3.5 IDENTIFICATION

A. All feeder and branch circuit conductors shall be color coded as follows:

Phase	208Y/120V	480Y/277V
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

B. All conductors larger than #6 AWG shall be identified with colored tape at all junction and termination points.

C. Each control conductor shall be identified with a preprinted, sleeve type wire marker. The wire numbers shall match those shown on the Drawings or on manufacturer's schematic and connection diagrams.

3.6 TESTING

A. Wire and cable shall be tested in accordance with Section 16030, Electrical Acceptance Testing.

END OF SECTION 16060

SECTION 16070

GROUNDING

PART 1 - GENERAL

1.1 GENERAL

A. The provisions of Section 16010, General Requirements for Electrical Work apply to the Work of this Section.

B. The Electrical Contractor shall provide a complete grounding system including bonding jumpers, equipment grounding conductors, connections and other materials as may be required.

1.2 CODES AND STANDARDS:

A. Products shall comply with the following codes and standards and shall be UL listed and labeled.

NFPA 70	National Electrical Code
UL 467	Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated grounding conductors shall be provided with insulation equivalent to the insulation on the associated phase conductors and be colored green.

PART 3 - EXECUTION

3.1 EQUIPMENT GROUNDING CONDUCTORS

A. A separate insulated green copper conductor shall be installed as an equipment grounding conductor in all raceway and with every feeder, branch circuit and control circuit. This shall be in addition to the grounded metallic conduit system.

B. All equipment grounding conductors shall be terminated at both ends.

3.2 CONNECTIONS

A. Grounding connections shall be made to clean, dry surfaces. All scale, rust, paint, grease and other contamination shall be removed prior to making connections.

3.3 RACEWAY AND EQUIPMENT

A. All raceway, cable tray and non-current carrying metal equipment and enclosures shall be electrically continuous and bonded to the grounding system.

B. Where equipment is provided with a ground bus, all equipment grounding conductors shall be terminated on the bus. The Electrical Contractor shall perform all drilling and tapping required and provide all hardware.

3.4 HOSPITALS

A. Grounding in patient care areas shall be in accordance with NEC Article 517.

END OF SECTION 16070

SECTION 16110

RACEWAY AND FITTINGS

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of Section 16010 General Requirements for Electrical Work apply to the work of this Section.

1.2 CODES AND STANDARDS

A. Products shall comply with the following codes and standards and shall be UL-listed and labeled:

UL 1	Flexible Metal Conduit
UL 6	Rigid Metal Conduit
UL 360	Liquid Tight Flexible Steel Conduit
UL 514B	Fittings for Conduit and Outlet Boxes
UL797	Electrical Metallic Tubing
UL870	Wireways, Auxiliary Gutters and Associated Fittings

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid steel conduit shall be hot dipped galvanized inside and out, including all threads. The conduit shall be furnished in nominal 10 foot lengths, with both ends threaded and one galvanized coupling provided with each length. The threads opposite the coupling end shall be protected by a plastic cap. Minimum conduit size shall be 3/4" or as shown on the drawings.

B. Electrical metallic tubing (EMT) shall be of zinc coated steel with an interior coating of lacquer or enamel. Minimum conduit size shall be 3/4" or as shown on the drawings.

C. Liquid tight flexible conduit shall be constructed with a flexible core of galvanized steel and an oil resistant PVC jacket to form a liquid tight raceway. The overall jacket shall be wrinklefree and suitable for use in temperatures from -40 deg. C to + 100 deg. C. Liquid tight shall be Anaconda "Sealtite" type UA or approved equal.

D. Flexible metal conduit shall be hot dipped galvanized, spiral wrapped, interlocked strip steel.

2.2 CONDUIT FITTINGS

A. Bushings.

1. Insulated bushings for conduit sizes 1-1/4 inches and larger shall have metal bodies and threads, with molded-on high impact phenolic thermosetting insulation to prevent conductor insulation damage. Bushings shall be Type IBC insulated bushings as manufactured by O.Z./Gedney or an approved equal. Insulated bushings for conduit sizes 1 inch and smaller may be of plastic, O.Z./Gedney Type "A", or an approved equal.

2. Insulated grounding bushings shall be similar to the insulated bushings described above, except they shall have set screws to lock the bushings on the conduits and shall have mechanical type lugs attached. The lugs shall be sized to accept the ground wire sizes as set forth in the latest edition of the National Electrical Code, but in no case smaller than No. 8 AWG wire. Grounding bushings shall be Type BLG as manufactured by O.Z./ Gedney or an approved equal.

3. Male bushings shall be Thomas and Betts Corporation insulated throat chase nipples, or a product of equal construction. Bushings used only to pass conductors through metal partitions, etc. shall be O.Z./Gedney, Type "ABB".

4. Bushings for use with EMT shall be O.Z./Gedney type SBT or approved equals.

B. Hubs. Water tight conduit connections are required on all NEMA 3R, 4 and 4X enclosures and all electrical equipment located outdoors or in damp or wet areas. Where hubs or water tight threaded connections are not provided as part of the enclosure, water tight hubs shall be Myers "Scru-Tite", or approved equal. All other terminations shall be double locknut and bushing.

C. All conduit fittings shall be provided with neoprene gaskets and sheet metal covers, except that cast covers shall be used for sizes 1-1/2 inches and larger. EMT fittings, connectors and coupling connections shall be double set screw. Cover screws shall be captive. All conduit fittings shall be Crouse Hinds, Appleton, Killark or approved equal.

D. Fittings for use with liquid-tight flexible conduit shall be zinc plated malleable iron O.Z./Gedney type 4Q or approved equal.

E. Fittings, connectors and couplings for flexible metal conduit shall be squeeze set screw type with insulated throat.

F. Locknuts. Locknuts shall be installed on all conduit fittings. Conduit fittings for raceways larger than 1-1/4" shall be fitted with double locknuts. Locknuts shall be hot dipped galvanized steel or malleable iron. Standard locknuts shall be used for connections to NEMA 1 enclosures. Sealing locknuts with integral gasket shall be used for connections to NEMA 12 enclosures.

2.3 PULL AND JUNCTION BOXES

A. Pull and junction boxes shall be of code gauge galvanized steel with continuously welded joints. Boxes less than 100 cubic inches shall be 0.625" thick. Boxes greater than 100 cubic inches shall be #16 MSG. Screws shall be sheet metal screws.

B. Unless otherwise shown on the drawings, all boxes installed indoors shall be rated NEMA 1 and all boxes installed outdoors shall be rated NEMA 3R.

2.4 OUTLET BOXES

A. Outlet boxes for concealed work shall be 4" by 1 ½" deep minimum, cadmium plated, zinc coated sheet steel or hot dipped galvanized and not less than #12 gauge. Each ceiling outlet designated for a lighting fixture shall have a fixture support secured in place with bolts and nuts. Ceiling boxes shall be octagonal with lugs and screws for back plates.

B. Outlet boxes installed outdoors, in concrete or exposed, shall be cast iron alloy or copper free aluminum with gasketed covers and hubs.

C. Wall device boxes shall be 4" square by 1 ½" deep minimum with matching plaster frame for single or two gang outlets. For larger boxes, use solid type or special units. In masonry, use deep boxes as required.

D. Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and to fulfill installation requirements for individual wiring situations.

2.5 SUPPORTS

A. The Electrical Contractor shall size and provide all supports necessary for the installation of all raceway.

B. Channel framing shall be manufactured by Unistrut, Kindorf, B-Line or approved equal.

C. In dry, non-corrosive areas, channel framing and angle shall be galvanized steel or aluminum and all nuts, bolts and hardware shall be carbon steel, cadmium plated or hot dipped galvanized. Beam clamps shall be galvanized steel or malleable iron.

D. In outdoor, wet or damp areas channel framing and angle shall be aluminum or 304 stainless steel and nuts, bolts and hardware shall be 304 stainless steel. Beam clamps shall be hot dipped galvanized steel or malleable iron.

E. Supports shall be sized with a minimum safety factor of four or 200 lbs. whichever is greater.

PART 3 - EXECUTION

3.1 GENERAL

A. Wiring methods are specified in Section 16010 General Requirements for Electrical Work.

3.2 INSTALLATION

A. Conduit, EMT, boxes & enclosures shall be installed so that they are mechanically secure, electrically continuous and neat in appearance.

B. Exposed runs shall be installed to conform to the shape of the surface over which they are run. Where they are run over a plane surface, they shall be straight and true. All exposed conduits shall be run parallel and perpendicular to building column lines and walls. Diagonal runs will not be permitted. Conduit runs in groups shall be supported by means of common members made of channel framing. Group mounting is not required where the group consists of only two conduits. Fastening to solid masonry or concrete shall be machine bolts with expansion shields. Fastening to hollow masonry shall be with toggle bolts.

C. Unless otherwise approved, spacing between conduit supports shall not exceed ten feet. Conduits shall not be supported from structural members marked "Removable" on the structural drawings. Conduit hangers and supports shall be fastened to buildings and structural members only and not to any equipment or piping. Separate conduits a minimum of 6" from flues, steam and hot water lines. Install conduit above mechanical piping wherever possible.

D. All conduit supports other than structural members shall be galvanized. The use of perforated strap or plumber straps will not be permitted.

E. Conduit up to 1-1/2 inches may shall be supported by one-hole malleable iron straps with clamp backs. Conduit 2 inches and larger shall be supported by two-hole straps.

F. Conduit runs shall not exceed 100 feet between boxes, fittings or devices.

G. All conduit crossing building or structure expansion joints shall be provided with approved expansion fittings.

3.3 BENDS

A Field bends shall be made with approved bending tools. All field-formed bends shall be of maximum radius permitted by the design and construction conditions.

B. Where a group of exposed conduits change direction, the bends shall have a common center in order to maintain the uniformity and neat appearance of the group, having regard for the minimum bending radius of the largest conduit in the group.

C. Bends shall be uniform radius and free from cracks, crimps or other damage to the conduit or it's coating and shall not unduly flatten the conduit section.

3.4 JOINTS AND TERMINATIONS

A. All joints in rigid conduit shall be threaded, using standard couplings. The use of running threads, threadless or split couplings is prohibited. When reaming out of conduit ends to remove burrs and rough edges, care shall be exercised to avoid excessive reaming which results in the weakening of the conduit wall at the end.

B. All joints shall be made up wrench tight and with a minimum of wrench work in order to avoid wrench cuts.

C. All cut threads shall be thoroughly painted with a coating of a rust inhibiting primer.

D. EMT couplings and fittings shall be compression type up to 1-1/4 inch and double set screw type 1-1/2 inch and larger.

E. All conduit terminations in panels, enclosures, outlet boxes and equipment shall be provided with bushings.

3.5 FLEXIBLE CONDUIT

A. Flexible conduit shall be use to terminate all, lighting, motors, unit lanterns, transformers, pilot devices and vibrating equipment.

B. Liquid tight flexible conduit and fitting shall be used outdoors and in all damp or wet areas, or where exposed to grease or oil.

C. Connections to lighting fixtures shall be maximum length of 6 feet. All other flexible connections shall be maximum 18 inches.

3.6 PENETRATIONS

A. Fire resistant walls and floors shall be sealed with approved material and shall maintain the original fire rating.

END OF SECTION 16110

SECTION 16200

600 VOLT WIRE

PART 1 - GENERAL

1.1 GENERAL

A. The provisions of Section 16010, General Requirements for Electrical Work apply to the Work of this Section.

1.2 CODES AND STANDARDS

A. Products shall comply with the following codes and standards and shall be UL-listed and labeled:

ASTM B-3	Soft or Annealed Copper Wire
ASTM B-8	Concentric Lay Stranded Copper Conductors
NEMA WC-5	Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
UL 44	Rubber Insulated Wires and Cables
UL 83	Thermoplastic Insulated Wires and Cables

1. 3 SUBMITTALS

A. Manufacturer's product data sheets.

PART 2 - PRODUCTS

2.1 GENERAL

A. All conductors shall be annealed soft drawn copper, with 98% conductivity, in accordance with ASTM B-3.

B. The jacket of all wire shall be printed with the following information:

1. Manufacturer
2. Size
3. Insulation type
4. Maximum voltage
5. UL label

C. All insulation shall be rated 600 volt.

2.2 POWER WIRING

A. All power wiring shall be stranded, Class B strand in accordance with ASTM B-8, minimum size #12 AWG.

B. Feeders and motor branch circuits shall have type XHHW insulation.

C. All lighting and convenience receptacle branch circuit wiring shall be type THHN/THWN.

2.3 CONTROL WIRING

A. Control wiring shall be stranded, Class B strand in accordance with ASTM B-8, minimum size #14 AWG.

B. Wiring for control circuits shall be THHN/THWN.

2.4 FIXTURE WIRE

A. Where high temperature fixture wire is required it shall be silicone rubber type SF-2.

PART 3 - EXECUTION

3.1 GENERAL

A. All wire shall be installed in accordance with Section 16060, Installation of Wire and Cable.

B. All wire shall be tested in accordance with Section 16030, Electrical Acceptance Testing.

END OF SECTION 16200

SECTION 16415

MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 GENERAL

A. The provisions of Section 16010, General Requirements for Electrical Work apply to the Work of this Section.

B. The work of this section includes locally installed, enclosed combination magnetic motor starters and manual motor starters.

1.2 CODES AND STANDARDS

A. Products shall comply with the following codes and standards and shall be UL listed and labeled.

NEMA ICS-2	Industrial Control Devices, Controllers and Assemblies.
UL 508	Industrial Control Equipment.

1.3 SUBMITTALS

A. Manufacturers Product Data Sheets

B. Dimensioned Outline Drawings.

C. Control wiring diagrams.

1.4 MANUFACTURERS

Subject to compliance with the specification requirements.

Allen-Bradley
Cutler-Hammer
General Electric
Square D

PART 2 - PRODUCTS

2.1 MAGNETIC MOTOR STARTERS

A. Motors: Each motor shall have a disconnect and starter furnished under this section. Starters which are part of a "factory assembled" control panel will be furnished under division 15, and will be noted as such on the drawings.

B. Unless otherwise noted, magnetic motor starters shall be NEMA rated full voltage type. The disconnecting means shall be circuit breaker type, non-fused or fused switch as shown on the Drawings. Minimum starter size shall be NEMA 1.

C. All components including the disconnecting means shall be installed in a single enclosure rated NEMA 1 for indoor locations and NEMA 3R or 4 for wet, damp and outdoor locations.

D. The disconnecting means shall be provided with an external operating handle which is interlocked to prevent opening the door when the handle is in the ON position and prevent closing the disconnect when the door is opened. The interlock shall be de-featable. The handle shall be padlockable in the OFF position.

E. Circuit breakers shall be adjustable magnetic trip, motor circuit protector type.

F. The short circuit rating of the assembly shall be a rating equal to the panelboard branch circuit breaker feeding the assembly.

G. Each motor starter shall be provided with a control power transformer to provide 120 VAC control power. The transformer shall be provided with two primary fuses and one secondary fuse. The transformer shall be extra capacity with a minimum rating of 100 VA.

H. Overload relays shall be three-pole, trip free, manually reset Class 20, solid state, with an external reset mechanism.

I. Contactor coils shall be provided with surge suppressors.

J. Sufficient auxiliary contacts shall be provided for all interlocks. A minimum of two normally opened and one normally closed spare contacts shall be provided.

K. Door mounted pilot devices shall be heavy-duty oil tight. Pilot lights shall be transformer type. A HAND-OFF-AUTO maintained contact selector switch, red RUN and green READY pilot lights shall be provided on each enclosure.

L. All control wiring shall be brought to terminal blocks for connection of field cabling. Minimum wire size shall be #14 AWG.

M. Connections for motor leads shall be suitable for copper conductors applied at their 75°C rating.

2.2 MANUAL MOTOR STARTERS

A. Single phase fractional HP manual motor starters shall be toggle operated, enclosed, one or two pole switches as required by the installation.

B. The enclosure shall be NEMA 1 for indoor locations and NEMA 3R or 4 for outdoor, wet and damp locations. A handle guard shall be provided to allow the toggle operator to be padlocked in the OFF position.

C. Starters shall be provided with trip free melting alloy overloads.

PART 3 - EXECUTION

3.1 Equipment shall be installed in accordance with Section 16050, Installation of Electrical Equipment.

3.2 The Contractor shall verify motor nameplate amperes and motor service factors and shall set all solid state relays for magnetic motor starters and provide all overload heater elements and fuses for manual motor starters. Overload heater elements shall be sized in accordance with motor nameplate amperes.

END OF SECTION 16415

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.1 GENERAL

A. The provisions of Section 16010, General Requirements for Electrical Work apply to the Work of this Section.

1.2 CODES AND STANDARDS

A. Products shall comply with the following codes and standards and shall be UL-listed and labeled:

NEMA AB-1	Molded Case Circuit Breakers
NEMA PB-1	Panelboards
UL 50	Enclosures for Electrical Equipment
UL 67	Panelboards
UL 489	Molded Case Circuit Breakers and Circuit Breaker Enclosures
UL 943	Ground Fault Circuit Interrupters

1.3 SUBMITTALS

A. Manufacturer's product data sheets.

B. Circuit breaker schedules.

1.4 MANUFACTURERS

A. Panelboards shall be manufactured by General Electric. No substitutions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Panelboards, including lighting and appliance panelboards and power distribution panelboards, shall be of the sizes, rating and arrangement shown on the Drawings.

B. Panelboards shall be provided complete with all overcurrent devices, accessories and trim.

C. All panelboards shall be provided with safety barriers for dead front construction.

D. The required short circuit ratings of assembled panelboards are shown on the Drawings. The short circuit rating of every overcurrent device in the panel shall meet or exceed the panel rating. Unless otherwise noted on the Drawings, series rated combinations will not be permitted.

2.2 CABINETS

A. Boxes shall be code gauge galvanized sheet steel.

B. Trim shall be code gauge steel, ANSI-61 gray finish with stainless steel flush type lock/latch handle. All locks shall be keyed alike.

C. Trim for surface mounted panels shall be door-in-door construction such that the gutter space may be exposed by a hinged door.

D. Directory frames shall be metal frame with plastic covers.

2.3 BUS

A. All bus work shall be 1000 amp/sq.in. copper.

B. Unless otherwise noted on the Drawings, neutral busses shall be 100% rated with adequate connections for all outgoing neutral conductors.

C. Panelboards shall be provided with copper ground busses.

D. Bus shall be designed for sequence phase connection to allow the installation of one, two or three pole branch circuit breakers in any position.

2.4 OVERCURRENT DEVICES

A. Overcurrent devices shall be trip-free molded case, bolt-on, thermal magnetic circuit breakers.

B. Main circuit breakers shall be individually mounted and bolted to bus assembly. Back-fed branch mounted circuit breakers are prohibited.

C. Front faces of all circuit breakers shall be flush. Trip indication shall be clearly shown by the handle position between the ON and OFF positions.

D. Ground fault circuit breakers shall require no more panel space than standard breakers.

E. Where circuit breakers are used for switching of lighting circuits, type "SWD" circuit breakers shall be provided.

F. All connections shall be rated for 75°C copper conductors.

PART 3 - EXECUTION

3.1 PANELBOARDS

A. Provide one (1) spare 3/4" conduit for every two (2) spare circuits in flush mounted branch circuit panels. The conduits shall extend from the top of each panel to 1 foot above hung ceilings turned out from the wall towards panel access side and be terminated with a cap.

B. Panelboards shall be installed in accordance with Section 16050, Installation of Electrical Equipment.

END OF SECTION 16470

SECTION 16490

SAFETY SWITCHES

PART 1 - GENERAL

1.1 GENERAL

A. The provisions of Section 16010 General Requirements for Electrical Work apply to the Work of this Section.

1.2 CODES AND STANDARDS

A. Products shall comply with the following codes and standards and shall be UL-listed and labeled:

NEMA KS-1	Enclosed Switches
UL 98	Enclosed and Deadfront Switches

1.3 SUBMITTALS

A. Manufacturer's product data sheets.

1.4 MANUFACTURERS

A. Subject to compliance with the specification requirements:

Cutler-Hammer
General Electric
Square D
Siemens

PART 2 - PRODUCTS

2.1 Safety switches shall be 600 or 240 VAC, NEMA heavy duty, horsepower rated visible blade type. Switches shall be non-fused or fused as indicated on the Drawings.

2.2 The switch operating mechanism shall be spring activated quick make - quick break.

2.3 The external operating handle shall indicate the switch position, ON in the up position, OFF in the down position and shall be padlockable in the OFF position. A de-featable interlock shall be provided to prevent opening the cover when the switch is ON and prevent closing the switch contacts when the cover is opened.

2.4 Switches shall be provided with arc suppressors and line terminal shields.

2.5 Single speed motors shall be provided with three pole switches. Two speed motors shall be provided with six pole switches.

2.6 Switches shall be provided with a factory supplied ground kit.

2.7 Fused switches shall be provided with class RK1 fuses. Bussman Low-Peak, dual element time delay or approved equal. Fuse sizes shall be as indicated on the drawings. Provide one (1) set of spare fuses for each fuse type and rating used on this project.

2.8 Safety switches installed indoors shall be provided with NEMA 1 enclosures. Safety switches installed outdoors or in wet areas shall be provided with NEMA 3R or 4 enclosures.

PART 3 - EXECUTION

3.1 Safety switches shall be installed in accordance with Section 16050 Installation of Electrical Equipment.

END OF SECTION 16490

SECTION 16500

INTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of Section 16010 General Requirements for Electrical Work, Section 16060 Installation of Wire and Cable, and Section 16110 Raceway and Fittings apply to the work of this section.

1.2 CODES AND STANDARDS

A. Products shall comply with the following codes and standards and shall be UL-listed and labeled:

CBM Labels	Certified Ballast Manufacturers Assoc.
NEC Art. 410	National Electrical Code
FCC, Part 18	RFI and EMI
ANSI C62.41	Line Transient Protection
UL 1570	Fluorescent Lighting Fixtures
UL 1572	HID Lighting Fixtures
UL 1571	Incandescent Lighting Fixtures
UL 924	Emergency Lighting and Power Equipment
UL 1088	Temporary Lighting

1.3 SUBMITTALS

A. Submit manufacturer's product data, photometrics, and installation instructions for each type of light fixture specified. Fixture submittals will be in booklet form with separate sheet for each fixture assembled in "luminaire type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet.

B. Submit on a separate sheet for each HID and fluorescent fixture type specified, the ballast manufacturer, type and technical data for that ballast.

C. Submit on a separate sheet for each light fixture specified, the proposed lamp and manufacturers data for that lamp.

1.4 MANUFACTURERS

A. Provide products of the manufacturers specified on the contract drawings and as listed under Part 2 of this section.

PART 2 - PRODUCTS

2.1 GENERAL

A. Light fixtures shall be provided with housings, trims, ballasts, lamp holders, sockets, reflectors, wiring and other components required, as a factory-assembled unit for a complete installation.

B. Provide electrical wiring within light fixtures suitable for connecting to branch circuit wiring in accordance with N.E.C. Article 410, Paragraph 24.

C. Deliver interior lighting fixtures in factory fabricated containers and wrapping, which properly protect fixtures from damage.

D. Store interior lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, humidity, extreme temperatures, laid flat and on skids to keep off floors and ground.

E. Fixtures installed in ceilings, suspended from ceilings or on walls shall have a plastic film covering protecting the lens, louver and lamps from dust, dirt and debris. Plastic film shall not be removed until construction is completed.

2.2 FLUORESCENT FIXTURES

A. General: Provide fluorescent fixtures of sizes, types and ratings indicated and specified in the Lighting Fixture Schedule on the Contract Drawings.

B. Fluorescent-Lamp Ballasts: Provide low-energy solid state fluorescent lamp ballasts, operating lamps with a frequency of >20KHz and capable of operating lamp types indicated. Ballasts shall be high power factor >0.90, Class A sound rating and have a lamp current crest factor of 1.7 or less and total harmonic distortion less than 20%. Ballasts shall be UL listed, Class P, and meet FCC 47CFR Part 18 Non-Consumer and meet applicable ANSI standard.

1. Ballasts that operate T8 lamps shall have the following requirements:

   a. Ballast factor shall be 0.90
   b. Ballast shall be instant start for maximum efficiency and parallel wired such that if one lamp fails, the remaining lamps stay lit.
   c. Ballast must be capable of 0□ starting.

2. Ballasts that operate T4, compact fluorescent and smaller diameter lamps shall have the following requirements:

   a. Ballasts shall have an end of lamp life sensing circuit capable of shutting the lamp down to prevent lamp glass from cracking and lamp base sockets from melting.
   b. Ballast factor shall be 0.80 - 1.15.
   c. Ballasts for T4 compact fluorescent lamps shall be Programmed Rapid Start type to operate lamps in series. Ballast shall digitally control lamp starting to

maintain manufactures rated lamp life under any lamp starting cycles. Ballast input voltage shall be a dedicated input voltage, i.e. 120V.

3. Manufacturers: Subject to compliance with the requirements, provide ballasts by one of the following:

   a. Osram Sylvania Inc.
   b. Advance
   c. Magnetek

C. Fluorescent Dimming Ballasts: Provide solid state electronic dimming ballasts, capable of operating lamp, types specified, with high power factor rapid start, and Class A sound rating. Ballast shall have a lamp crest factor of 1.7 and below and a total harmonic distortion not to exceed 20%.

1. Ballasts shall be Programmed Rapid Start to operate lamps in series. Ballast shall digitally control lamp starting to maintain manufacturers rated lamp life under any lamp starting cycles.

2. Ballasts shall have anti-flash circuitry, such that lamp will start in any light level mode without flashing to full light output.

3. T5 or T8 lamp dimming range shall be 100% - 5% with a ballast factor range of 0.96 - 0.06

4. Manufacturers: Subject to compliance with requirements provide dimming ballasts by one of the following:

   a. Lutron Electronics Co., Inc.
   b. Osram Sylvania, Inc.

2.3 LAMPS

A. Provide fluorescent lamps of types as indicated on the contract drawings.

B. T8 Lamp Type:

1. Lamp shall have an average rated life of 20,000 hours, and a minimum 82 CRI. A 32 Watt lamp shall be minimum 2950 lumens. A 17 Watt lamp shall be minimum 1400 lumens.

2. Lamp color temperature shall be 3500K unless otherwise noted.

C. T5 Lamp Type:

1. Lamp shall have an average rated life of 20,000 hours, and a minimum 82 CRI. A 40 Watt lamp shall be minimum 3150 lumens.

2. Lamp color temperature shall be 3500K unless otherwise noted.

D. Compact Fluorescent (T4) Lamp Type:

1. Lamps shall have an average rated life of 10,000 hours, and a minimum 82 CRI. A 26 Watt lamp shall be minimum 1800 lumens.

2. Lamps shall have 4 pin bases for operation on electronic ballasts.

3. Lamp color temperature shall be 3500K unless otherwise noted.

E. ANSI Standards. Lamps shall comply with applicable ANSI standards.

F. Lamps shall be manufactured by GE, Osram Sylvania, Philips Lighting Co. or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine all areas and conditions under which lighting fixtures are to be installed and structure which will support lighting fixtures. Notify the General Contractor in writing of any conditions which are detrimental to proper installation and completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Coordinate light fixture installations with other trades. Fluorescent light fixtures should be installed at least two feet away from smoke detectors. Coordinate all lighting fixtures with mechanical piping and duct work to allow for proper clearance.

3.2 INSTALLATION

A. Install all lighting fixtures at locations and heights indicated, in accordance with the architectural reflected ceiling plans.

B. All recessed lighting fixtures installed in ceiling which require a fire resistance rating shall be installed in accordance with the BOCA National Building Code.

C. Provide fixtures and/or fixture outlet boxes with hangers, channel or other method of fastening and supporting fixtures required for proper installation.

D. Tighten connectors and terminals, including screws and bolts in accordance with equipment manufacturer's published torque tightening values for equipment connectors. All screws and bolts shall have washers.

3.3 SPLICES AND TERMINATIONS

A. Twist on wire connectors shall be installed which utilize square-wire spring grips and thermo plastic shells. Install connectors to meet the manufacturer's torquing requirements. Install wire connectors of size required so as not to exceed the manufacturers UL-listed CSA recognized wire combinations.

3.4 FIELD QUALITY CONTROL

A. At date of substantial completion, all lamps which are not functioning, have color deficiencies, or are noticeably dimmed shall be replaced with new lamps as determined by the Engineer.

B. All lamps used for temporary lighting in new light fixtures shall be replaced with new lamps.

C. All light fixtures shall be cleaned of dirt and debris upon completion of construction. All finger prints and smudges shall be cleaned.

D. All installed fixtures during remainder of construction shall be protected in accordance with Section 2.1 Paragraph E of this specification section.

E. All light fixtures shall be grounded in accordance with article 250 and 410 of the NEC. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

F. All light fixtures damaged in shipping or during installation shall be replaced with new fixtures at no cost to the Owner.

G. Furnish stock or replacement lamps amounting to 15%, but no less than six lamps, of each type and size lamp used in each type of lighting fixture. Deliver replacement stock as directed to Owner's storage space.

END OF SECTION 16500

SECTION 16700

FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 GENERAL

A. Provisions of Division 1 and Section 16010, General Requirements for Electrical Work, apply to the work of this section.

B. The work of this section includes providing modification and expansion to the existing addressable fire detection, alarm and control system in compliance with the addition of new equipment shown on the drawings. Provide all additional equipment required for a complete installation, including all additional programming, accessories, raceway, wiring, terminations, documentation, testing and start-up services.

1.2 CODES AND STANDARDS

A. The Fire Alarm System shall comply with the following codes and standards:

NFPA 13	Sprinkler Systems
NFPA 70	National Electric Code
NFPA 72	National Fire Alarm Code
NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
NFPA 92A	Recommended Practice for Smoke-Control Systems
NFPA 101	Life Safety Code
ADA	Americans Disabilities Act

B. All equipment shall be UL listed.

C. The system shall comply with all State and Local Codes including any requirements of the local Fire Department.

1.3 SUBMITTALS

A. Manufacturer's product data sheets and installation instructions.

B. Battery calculations.

C. Floor plans showing wiring, location and address of each device.

1.4 MANUFACTURERS

A. Equipment shall be compatible with the Owner's existing system and not void any warranties.

PART 2 - PRODUCTS

2.1 SYSTEM OPERATION

A. Drawings supplied with this specification shall be used by the Contractor as a guide to the required quantities and locations of system equipment. The Contractor shall follow all manufacturers instructions and provide any additional equipment necessary to provide a complete and operational system meeting the intent of the system design.

B. The fire alarm system shall be a compatible with the existing multiprocessor based fire alarm system.

C. Each initiation device shall have full analog detection capabilities and will maintain operating characteristics stored in dedicated EEPROM memory, identify its exact location, and shall operate as described elsewhere in these specifications.

D. The services of a trained technician employed by the system supplier shall demonstrate the operation of the system to the satisfaction of the Owner's Representative, and make all additional adjustments to the system operation as required.

2.2 FIRE ALARM CONTROL PANEL

A. New devices and equipment shall be coordinated with the existing main control panel.

2.3 DEVICES

A. Smoke Detectors: Provide analog photoelectric smoke detectors where shown or required.

B. Duct Smoke Detectors: Provide analog photoelectric duct smoke detectors mounted in air ducts where shown or required. Each detector shall be supplied with duct mounting plate, remote indicator, and sampling tubes sized accordingly to duct width. Provide the required auxiliary relay outputs or addressable relay control modules with each detector in order to accomplish the required HVAC control and override functions. Provide control wiring to shutdown fans where required.

C. Notification Appliances: Flush mounted combination horn/strobe audio/visual signaling appliances shall be provided. Stand alone devices may be used to augment the combination units where necessary. Specific audible and visual characteristics shall be as follows:

1. Visual signals: Furnish and install self-synchronizing xenon strobes. Minimum intensity is 15/75 cd unless otherwise shown on drawings.

2. Audible signals: Provide audible signal with a minimum sound output of 87 dBA at 10 feet. Minimum sound levels shall be at least 15dBA above the average ambient sound level or 5 dBA above the maximum sound level in all areas.

3. All visual notification appliances with sight of each other shall be synchronized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall provide all equipment and materials required for a fully operational system. The Contractor shall prepare layout drawings showing device locations, raceway size, wiring runs, conduit fill and terminations.

B. All wiring in new walls shall be installed in electrical metallic tubing or galvanized rigid steel conduit. Wiring installed in existing walls and above ceilings shall be permitted to be approved fire alarm type MC cable

C. All junction boxes and fittings shall be color coded red. Junction Box Covers shall be labeled Fire Alarm System.

D. Coordinate device locations with other trades to assure proper installation of devices. Coordinate with other trades where work pertains to fire alarm system (i.e. air handling unit control, fire sprinkler system).

E. The manufacturer shall provide on-site supervision of the installation to assure system is installed to meet manufacturers installation requirements.

3.2 TESTING

A. System Acceptance for all newly installed equipment:

1. A pretest shall be held with the installer and the manufacturer's technical representative present. In addition to the requirements listed below, the pretest shall demonstrate that each smoke detector is operative and produces the intended response. Each smoke detector shall be tested in accordance with the manufacturer's recommendations to initiate an alarm at its installed location. After certification of a complete pretest, the installing contractor shall provide the authority having jurisdiction with written documentation from the manufacturer's authorized representative of the outcome of the test and then shall re-inspect in the presence of the authority having jurisdiction and the manufacturer's authorized technical representative. A complete test shall be conducted as follows: the installing contractor, in the presence of a representative of the authority having jurisdiction, shall manually operate every manual fire alarm station, activate every rate of rise type thermodetector with heat, manually operate or electrically short out every fixed temperature thermodetector, actuate every smoke detector with smoke in accordance with the manufacturer's recommendations to demonstrate that smoke can enter the chamber and initiate an alarm and activate every water sprinkler/standpipe flow switch by a flow of water.

2. Each manual fire alarm station, thermodetector, smoke detector, sprinkler system switching circuits, flow switch circuit and each alarm horn/strobe circuit shall be opened in at least two locations to test for the correctness of the supervisory circuitry. All communications shall be tested completely.

B. The manufacturer's representative shall provide on-site training for the Owner's representatives upon completion of acceptance testing.

END OF SECTION 16700