MSBA Accelerated Repair Program:
Elizabeth Carter Brooks School
Window/Exterior Door & Boiler Replacement
New Bedford Public Schools
New Bedford, Massachusetts

BID DOCUMENTS
NOVEMBER 7, 2018

BID NUMBER: 18300505R

Owner's Project Manager: NV5
Project Managers
44 Pleasant Street
Watertown, MA 02472
t: (617) 744-3110
f: (617) 924-3800

Architect: Johnson Roberts Associates, Inc.
15 Properzi Way
Somerville, MA 02143
t: (617) 666-8585
f: (617) 666-8484

Structural Engineer: Roome & Guarracino, LLC
48 Grove Street
Somerville, MA 02144-2500
(t: (617) 628-1700
f: (617) 628-1711

Electrical, Mechanical & Plumbing Engineers: Garcia Galuska DeSousa
Consulting Engineers Inc.
370 Faunce Corner Road
N. Dartmouth, MA 02747-1217
(t: 508-998-5700
f: 508-998-0883

Hazardous Materials: Universal Environmental Consultants
12 Brewster Road
Framingham, MA 01702
(t: (508) 628-5486
f: (508) 628-5488

Owner's Commissioning Consultant: WSP USA
88 Black Falcone Avenue
Suite 201
Boston, MA 02210
(t: (617) 210-1600
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

Project Team

Architect: Johnson Roberts Associates, Inc.
15 Properzi Way
Somerville, MA 02143-3228
t: (617) 666-8585

Structural Engineer: Roome & Guarracino, LLC
48 Grove Street, Suite 301
Somerville, MA 02144-2500
t: (617) 628-1700

Mechanical, Plumbing,
Fire Protection &
Electrical Engineer: Garcia Galuska DeSousa, Inc.
370 Faunce Corner Road
Dartmouth, MA 02747
t: (508) 524-4647

Hazardous Materials
Consultant: Universal Environmental Consultants
12 Brewster Road
Framingham, MA 01702
t: (508) 628-5486

Owner's Project Manager: NV5
44 Pleasant Street
Watertown, MA 02472
t: (617) 744-3110

Owner's Commissioning
Consultant: WSP USA
88 Black Falcone Avenue
Suite 201
Boston, MA 02210
T: (617) 210-1600
TABLE OF CONTENTS

Section 000101 - Title Page
Section 000107 - Project Team
Section 000110 - Table of Contents

PART A  PROCUREMENT AND CONTRACTING REQUIREMENTS

Section 000115 - List of Contract Drawings
Section 001116 - Advertisement & Invitation to Bid
Section 002113 - Instruction to Bidders
Section 004000 - Form for Filed Sub - Bid
Section 004050 - Form for General Contractor Bid
Section 004100 - Bid Certifications & Submissions
Section 00520X - Forms of Agreement:
  Section 005201 - Standard Vertical Construction Contract
  Section 005202 - General Conditions
  Section 005203 - Equal Employment Opportunity
  Section 005204 - Contract Certifications & Submissions
  Section 007343 - Prevailing Wage Rates
  Section 007390 - Special Conditions
  Section 007550 - CORI Requirements

PART B  SPECIFICATIONS

DIVISION 1  GENERAL REQUIREMENTS

Section 010100 - Summary of Work
Section 012200 - Unit Prices
Section 012300 - Alternates
Section 013300 - Submittal Procedures
Section 013543 - Environmental Procedures
Section 014000 - Testing Laboratory Services
Section 015000 - Construction Facilities and Temporary Controls
Section 017700 - Project Closeout
Section 017823 - Operation and Maintenance Data
Section 017900 - Demonstration and Training
Section 018100 - Energy Code Requirements
Section 019113 - Commissioning Requirements
Section 019114 – Building Envelope Commissioning (BECx) Requirements

DIVISION 2  EXISTING CONDITIONS

Section 022820 - Asbestos Remediation
Section 024119 - Selective Demolition
Section 026000 – Excavation and Removal of Underground Oil Tank
DIVISION 3 - CONCRETE

Section 033000 - Cast-in-Place Concrete

DIVISION 4 - MASONRY

* Section 042000 - Unit Masonry

DIVISION 5 - METALS

Section 055000 - Miscellaneous Metals

DIVISION 6 - WOOD AND PLASTICS

Section 061100 - Rough Carpentry
Section 062000 - Finish Carpentry

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

* Section 071000 - Waterproofing, Dampproofing & Caulking
Section 072000 - Thermal Insulation
Section 074213 - Insulated Metal Wall Panels
* Section 075100 - Built-Up Asphalt Roofing
Section 077100 - Roof Specialties
Section 078400 - Firestopping

DIVISION 8 - DOORS AND WINDOWS

Section 081113 - Hollow Metal Doors and Frames
Section 081400 - Wood Doors
Section 081613 - Fiberglass Doors
Section 084213 - Aluminum-Framed Entrances
Section 084523 - Translucent Fiberglass Wall Panels
* Section 085113 - Aluminum Windows
Section 087100 - Door Hardware
Section 088000 - Glass and Glazing
Section 089000 - Louvers & Vents

DIVISION 9 - FINISHES

Section 092100 - Gypsum Board Assemblies
Section 092300 - Plaster Patching
* Section 093013 - Ceramic Tile
* Section 095100 - Acoustical Ceilings
Section 096500 - Resilient Flooring
Section 096800 - Carpet Tiling
* Section 099100 - Painting

TABLE OF CONTENTS
000110 - 2
DIVISION 10 – SPECIALTIES

- Section 101400 - Identifying Devices
- Section 102113 - Toilet Partitions
- Section 102813 - Toilet Accessories
- Section 108000 - Miscellaneous Specialties

DIVISION 11 – EQUIPMENT (Not Applicable)

DIVISION 12 – FURNISHINGS (Not Applicable)

DIVISION 13 - SPECIAL CONSTRUCTION (Not Applicable)

DIVISION 14 - CONVEYING SYSTEMS

- Section 144200 - Wheelchair Lifts

DIVISION 21 - FIRE PROTECTION (Not Applicable)

DIVISION 22 - PLUMBING

- Section 220000 - Plumbing

DIVISION 23 - MECHANICAL

- Section 230000 - HVAC
- Section 230548 - Vibration Control & Seismic Restraint
- Section 233813 - Commercial Kitchen Exhaust Hood

DIVISION 26 - ELECTRICAL

- Section 260000 - Electrical

DIVISION 31 - EARTHWORK

- Section 310000 - Earthwork
- Section 311000 - Site Preparation
- Section 312319 - Dewatering
- Section 312500 - Erosion and Sedimentation Control

DIVISION 32 - EXTERIOR IMPROVEMENTS

- Section 321216 - Asphalt Paving
- Section 321313 - Concrete Paving
- Section 321600 - Curbs
- Section 321723 - Pavement Marking
- Section 323000 - Site Improvements
DIVISION 33 - UTILITIES

Section 330000 - Site Utilities

* - Denotes Filed Sub-bid Category

END OF TABLE OF CONTENTS
LIST OF DRAWINGS

G1.1 TITLE PAGE
G1.2 SYMBOLS AND ABBREVIATIONS
C0.1 SITE LEGEND, NOTES, & DETAILS
C1.1 SITE PLANS
D1.1 EXISTING CONDITIONS PHOTOS
D2.1 FLOOR PLANS: DEMOLITION
D3.1 EXTERIOR ELEVATIONS: DEMOLITION
A1.1 PARTITION TYPES
A2.1 FLOOR PLAN
A2.2 ROOF PLAN
A3.1 EXTERIOR ELEVATIONS
A5.1 REFLECTED CEILING PLAN
A7.1 ENLARGED PLANS, INTERIOR ELEVATIONS, & DETAILS
A7.2 ELEVATIONS & DETAILS
A7.3 INTERIOR ELEVATIONS & DETAILS
A8.1 DOOR DETAILS & SCHEDULES
A8.2 WINDOW TYPES & DETAILS
A8.3 WALL SECTIONS & DETAILS
K-01 KITCHEN EXHAUST HOOD PLAN & DETAILS
P0.1 PLUMBING LEGEND, SCHEDULES, AND DETAILS
P1.1 GROUND FLOOR PLUMBING DEMO PLAN
P2.1 GROUND FLOOR PLUMBING RENO PLAN
MD-1 GROUND FLOOR HVAC DEMO PART PLANS
M-1 GROUND FLOOR RENO PART PLANS
M-2 HVAC SCHEDULES & DETAILS I
M-3 HVAC DETAILS II & KITCHEN PART PLAN
M-4 HVAC CONTROLS I
M-5 HVAC CONTROLS II
E-0 ELECTRICAL SYMBOL LIST & DETAILS
ED-0 GROUND FLOOR PLAN ELECTRICAL DEMO WORK
E-1 GROUND FLOOR LIGHTING PLAN NEW ELECTRICAL WORK
E-2 GROUND FLOOR POWER PLAN NEW ELECTRICAL WORK
E-3 GROUND FLOOR FIRE ALARM PLAN NEW ELECTRICAL WORK
VS-1 VIBRATION & SEISMIC DRAWING

END OF SECTION
INVITATION FOR BID
CITY OF NEW BEDFORD
NEW BEDFORD PUBLIC SCHOOLS

ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

#18300505R

November 7, 2018

Jonathan F. Mitchell
Mayor
New Bedford Public Schools
455 County Street
New Bedford, MA 02740
INVITATION FOR BIDS
ADVERTISEMENT
BID NUMBER 18300505R

The City of New Bedford, Massachusetts, Public Schools, in conjunction with the Purchasing Department (Awarding Authority) invites sealed bids from Contractors for the Elizabeth Carter Brooks School Window, Door & Boiler Replacement Project. **As the work of this contract is not predominately one trade, a DCAM Certified General Building Construction Contractor is to be this project’s General Contractor.** The estimated cost of the work is $3,000,000.

**Contract Documents**, including Drawings, Bidding Requirements, General Conditions, Specifications, and Addenda will be made available electronically and may be obtained after 9:00 AM Wednesday, November 7, 2018 by request for file transfer. Requests shall be accepted by emailing purchasing@newbedford-ma.gov. Documents will not be mailed. Paper copies of the documents may be seen or examined at the following place during normal business hours, after issuance of the documents: City of New Bedford, Purchasing Department, 133 William Street, Rm. 208, New Bedford, MA 02740, Monday through Friday – 8:30 AM - 4:00 PM.

Sealed Bids for the General Contract will be received by the New Bedford Purchasing Department, 133 William Street, New Bedford, Massachusetts, 02740 until 12:00 PM time, on Tuesday, December 11, 2018 at which time all bids will be publicly opened and read aloud. Included with General Bid shall be an Update Statement, DCAMM Certification and 5% bid deposit.

Sealed Bids for the following Filed Sub-trades: **Masonry; Waterproofing; Roofing; Windows; Acoustical Tile; Tile; Paint; Plumbing; HVAC; and Electrical** will be received by the New Bedford Purchasing Department, 133 William Street, Room 208, New Bedford, Massachusetts, 02740 until 12:00 PM time, on Tuesday, November 27, 2018 at which time all bids will be publicly opened and read aloud. Included with Sub-bids shall be an Update Statement, DCAMM Certification and 5% bid deposit.

A pre-bid conference will be conducted for the benefit of all potential bidders on **Tuesday, November 13, 2018 at 3:30 PM.** Meet at the Elizabeth Carter Brooks Elementary School, 212 Nemasket Street, New Bedford, MA, outside of the front entrance.

All questions and requests for interpretation must be submitted in writing to the Owner’s Project Manager (OPM) via email at Jennifer.Carlson@nv5.com. All questions regarding filed sub-bid work shall be submitted no later than 5:00 PM on Wednesday, November 21, 2018. All questions regarding general bidders’ work shall be submitted no later than 5:00PM on Wednesday, December 5, 2018.

Bids will be received by the City of New Bedford, Purchasing Department as noted above, at which time and place they will be publicly opened and read aloud. All bids shall be accompanied by a bid deposit that is five percent (5%) of the bid amount. Bid deposits may be in the form of Certified Check, Certificate of Deposit, or Bid Bond made payable to the City of New Bedford, Massachusetts.

The attention of Bidders is called to Massachusetts General Laws Chapter 149 sections 44A through 44H inclusive, qualification will be by the Division of Capital Asset Management (DCAMM). Furthermore, all bidders must submit a **Certificate of Eligibility and update statement** along with their bid. Any bid
submitted without the appropriate certificate shall be invalid. Procedures respecting bids and the selection of contractors shall be in conformance with the provisions of M.G.L. Chapter 149, Sections 44A-44H inclusive.

Attention is directed to the minimum wage rates to be paid on the work as determined by the Commissioner of Labor and Industries under the provisions of M.G.L. Chapter 149, Sections 26 and 27D inclusive. The successful general contractor and all sub-bidders will be required to submit a certified payroll and a statement of compliance on a weekly basis for review by the party designated by the Awarding Authority.

The Work of this Project shall require Minority/Women Owned Business participation pursuant to Chapter 193 of the Acts of 2004, and MGL Chapter 23A, Section 44 and MGL Chapter 7, Section 40N, as amended, and established as a policy by the City of New Bedford.

The Awarding Authority reserves the right to waive any and/or all informalities in the bidding. The Awarding Authority also reserves the right to reject any or all bids, or to accept any other than the lowest bidder should it be deemed to be in the best interest of the City of New Bedford, Massachusetts, to do so.

Awarding Authority
City of New Bedford
Susan Bruce, Director of Purchasing
INSTRUCTIONS TO BIDDERS

A. **FOREWORD:** The attention of all bidders is called to all applicable provisions of Massachusetts General Laws, Chapter 149 – Sections 44A to 44J, inclusive, Section 26 to 29 inclusive, and Chapter 30, Section 39F to 39M inclusive, and 39R of the General Laws of the Commonwealth of Massachusetts, as amended to date.

B. **GENERAL:** The Awarding Authority invites proposals for the Work described in the Contract Documents attached hereto. Before submitting his/her proposal each bidder shall visit the site, examine its conditions, thoroughly acquaint himself/herself with its obstacles and advantages for performing the Work, and compare the Contract Documents with the conditions found. All proposals submitted shall be subject to all applicable provisions of law, including, without limiting the generality of the foregoing, Chapter 30, Section 39F to 39M inclusive, and 39R, and Chapter 193 of the Acts of 2004, as amended to date.

C. **QUESTIONS:** All questions as to the interpretation of the Contract Documents shall be submitted in writing to the Owner’s Project Manager (OPM) via email at Jennifer.Carlson@nv5.com, and answers to such questions will be sent by the Awarding Authority only in the form of an Addendum, to every individual or firm on record as having taken a set of Contract Documents. No questions will be answered unless received by the dates indicated in the Invitation to Bid.

D. **BID FORMS:** The Awarding Authority will furnish to every person applying therefore a Form for General Bid and a Form for Sub-Bid.

E. **CONTRACT DOCUMENTS:** See the instructions indicated in the Invitation to Bid.

F. **REJECTION OF CERTAIN GENERAL BIDS REQUIRED BY LAW:** The law requires that every general bid, and every sub-bid, which is not accompanied by the prescribed bid deposit or which is not on a form furnished by the Architect or Awarding Authority or otherwise does not conform with Chapter 30, Section 39F to 39M inclusive, and 39R, and Chapter 193 of the Acts of 2004, as amended to date, or which is on a form not completely filled in or which is incomplete, conditional, or obscure, or which contains any addition not called for, shall be rejected by the Awarding Authority.

G. **FURTHER RIGHT TO REJECT GENERAL BIDS:** The Awarding Authority further reserves the right to reject any or all general bids if it be in the public interest so to do and to reject any sub-bid on any sub-trade if it determines that such sub-bid does not represent the sub-bid of a person competent to perform the Work as specified or that less than three such sub-bids were received and that the prices are not reasonable for acceptance without further competition.

H. **GENERAL BIDS:** General Bids must be submitted on the FORM FOR GENERAL BID, a sample of which is bound into the Contract Documents as Section 00300 and may be removed and used for additional copies. The General Bid shall be completely filled in, signed, enclosed in an envelope, sealed and plainly marked with the Project Name. The bid accompanied by a bid deposit in the amount of five percent (5%) of the bid price shall be filed with the Awarding Authority at the place designated in the Invitation to Bid. The bid shall be filed before the time designated in the Invitation to Bid for the opening of General Bids.

1. General Bids shall be for the complete Work as specified, with no Work to be performed by sub-bidders; and the General Contractor shall be selected on the basis of such General Bids.

2. If the bid is mailed, the General Bidders shall enclose their sealed bid in an outer envelope and address as follows:

   FROM: General Bidder’s Name and Business Address

   TO: City of New Bedford
       Purchasing Department
       133 William Street
       New Bedford, MA 02740

INSTRUCTION TO BIDDERS
002113 - 1
3. No telegraphic or facsimile transmission of bid or telegraphic or facsimile transmission modification of a bid will be considered. No bids received after the time fixed for receiving them will be considered. Late bids will be returned to the bidder unopened.

I. REQUIREMENTS FOR FOREIGN CORPORATIONS: The attention of all bidders is called to the provisions of General Laws Chapter 30, Section 39L, which provides that the Awarding Authority may not enter into a contract for construction Work and may not approve as a sub-contractor furnishing labor and materials for a part of any such Work a foreign corporation which has not complied with the requirements of of Chapter 156d, Section 151 of the General Laws. The term “foreign corporation” means a corporation not incorporated under the laws of the Commonwealth of Massachusetts.

J. SALES TAX: Purchases of building materials and supplies to be used on this project are entitled to exemption from the Sales and Use Tax if the conditions imposed by Paragraph 6 (f) of Section I of Chapter l4 of the Acts of 1966 are otherwise satisfied. Bidders are instructed to submit proposals on the basis that no Massachusetts Sales and Use Tax will be imposed on purchases of building materials and supplies used in connection with this Project.

K. CONSTRUCTION TIME: The Agreement will include a stipulation that any non-window Work be substantially completed no later than August 16, 2019. Any Window work must be substantially completed 2 months after said windows have shipped from the manufacturer. Any work not completed after August 16, 2019 must be performed on Second Shift, after 3PM. If the Contractor fails to meet the construction deadline, the Contractor is responsible for all Owner and Architect costs associated with the deadline not being met. The Architect is to perform two on-site punch lists each for non-window scope and window scope. If additional punch lists are needed, the Contractor shall be responsible for all Owner and Architect costs associated with the additional punch list visits.

L. WITHDRAWAL OF BIDS: A bidder may withdraw his bid, either personally or by written request, at any time prior to the scheduled time for opening bids. No bidder may withdraw his bid for a period of thirty calendar days after the date set for the opening thereof, and bids shall be subject to acceptance by the Owner during this period. Failure to submit a completed copy of the required Statement of Bidder Qualifications shall be cause for rejection of a General Bid by the Owner.

M. EXECUTION OF AGREEMENT:

The form of Agreement which the successful bidder will be required to execute is included in the Project Manual.

The bidder to whom the Contract is awarded shall, within fifteen calendar days after notice of award and receipt of Agreement forms from the Owner, sign and deliver required copies to the Owner.

At or prior to delivery of the signed Agreement, the bidder to whom the Contract is awarded shall deliver to the Owner those Certificates of Insurance required by the Contract Documents and such Labor and Materials Payment Bonds and Performance Bond as are required by the Owner.

Bonds and Certificates of Insurance shall be approved by the Owner before the successful bidder may proceed with the Work. Failure or refusal to provide Bonds or Certificates of Insurance in a form satisfactory to the Owner shall subject the successful bidder to loss of time from the allowable construction period equal to the time of delay in furnishing the required material.

N. METHOD OF AWARD: The contract will be awarded to the lowest responsible and eligible general bidder on the basis of the proposed contract price if such exists, and if the Awarding Authority, in its sole discretion, decides to award on the basis of such alternate. Special attention is called to the provisions of the General Laws, Chapter 149, Sections 44A to 44H defining the term "lowest responsible and eligible bidder" and giving the Awarding Authority the right to require essential information in regard to qualifications.
O. **TAX CERTIFICATION**: The successful Bidder will be required to submit a tax certificate as required by chapter 62C, Section 49A of the Massachusetts General Laws, as follows:

CERTIFICATE UNDER M.G.L. c.62C, S49A

I certify under the pains and penalties of perjury that ________________________________
has/have complied with all laws of the Commonwealth of Massachusetts relating to taxes.

__________________________
Employer Identification Number

__________________________
Name

__________________________
Date

__________________________
Title of Business Officer (if Applicable)

END OF INSTRUCTIONS TO BIDDERS
NON-TEXT PAGE
FROM:

______________________________________
______________________________________
______________________________________

TO: City of New Bedford
Purchasing Department
133 William Street, Room 208
New Bedford, MA 02740

ALL GENERAL BIDDERS EXCEPT THOSE EXCLUDED:

A. The undersigned proposes to furnish all labor and materials required for completing, in accordance with the hereinafter described Contract Documents, including Plans, Specifications and Addenda, all the Work specified in

Section No. _______ SUB-TRADE________________________ of the Specifications and in any Plans specified in such Section, prepared by JOHNSON ROBERTS ASSOCIATES INC., for the ELIZABETH CARTER BROOKS SCHOOL WINDOW, DOOR & BOILER REPLACEMENT PROJECT, for the Contract Sum of:

__________________________________________DOLLARS
($________________________)

And to perform the related sub-trade work as necessary to complete the work noted in Section 012300 ALTERNATES, 1.02 ALTERNATE NO.1–INSULATED METAL PANEL SYSTEM, for the Contract Sum of:

($________________________)

B. This sub-bid includes Addenda numbered _____________.

C. This sub-bid

______May be used by all General Bidders except:

______May be used only by the following General Bidders:

(To exclude General Bidders, insert "X" on one line only and fill in the blank following that line. Do not answer "C" if no General Bidders are excluded.)

D. The undersigned agrees that, if he is selected as a Sub-bidder, he will, within five (5) days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the General Bidder selected as the General Contractor, execute with such General Bidder a subcontract in accordance with the terms of this sub-bid, and contingent upon the execution of the General Contract, and, if requested so to do in the general bid by such General Bidder, who shall pay the premiums therefore, or if prequalification is required pursuant to Section 44D3/4, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the Awarding Authority, in the full sum of the subcontract price.

FORM FOR SUB-BID
004000 - 1
If prequalification is required pursuant to Section 44D3/4 of MGL Chapter 149, the undersigned sub-bidder further agrees to pay the premiums for the performance and payment bonds furnished by sub-bidders as required therein and that all the cost of all such premiums is included in the amount set forth in Item A of this sub-bid.

E. The names of all persons, firms, and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of Work for which the provisions of the Section of the Specifications for this sub-trade require a listing in this paragraph, (including the undersigned if customarily furnished by persons on his own payroll and in the absence of a contrary provision in the specifications) the name of each such class of Work or part thereof and the bid price for each such class of Work or part thereof are:

<table>
<thead>
<tr>
<th>Name:</th>
<th>Class of Work:</th>
<th>Bid Price:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Do not give bid price for any class or part thereof furnished by the undersigned.)

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the Drawings, Plans, Specifications and Addenda and that, if the undersigned is awarded the Contract, they will be used for the Work indicated at the amounts stated, if satisfactory to the Awarding Authority.

G. The undersigned further agrees to be bound to the General Contractor by the terms of the herein before described Plans, Specifications (including all General Conditions stated therein) and Addenda, and to assume toward the General Contractor by all the obligations and responsibilities that the General Contractor, by those documents, assumes toward the Owner.

H. The undersigned offers the following information as evidence of his qualifications to perform the Work as bid upon according to all the requirements of the Plans and Specifications:

1. Have been in business under present business name ______years.

2. Ever failed to complete any Work awarded? ______________ (if yes, briefly explain)

3. List one or more recent buildings with name of General Contractor and Architect on which you served as Sub-contractor for Work of similar character as required for this project.

<table>
<thead>
<tr>
<th>BUILDING TYPE</th>
<th>ARCHITECT</th>
<th>GENERAL CONTRACTOR</th>
<th>CONTRACT AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Bank Reference: ____________________________________________

FORM FOR SUB-BID
004000 - 2
I. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the Work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to awards made subject to section 44F.

The undersigned further certifies under penalties of perjury that this sub-bid is in all respects bona fide, fair, and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction Work in the Commonwealth under the provisions of sections twenty-nine F. of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

A bid deposit, in the amount of 5% of the proposed Contract Price, conditioned upon the faithful performance by the bidder of the agreements contained in this bid, shall be attached to this proposal. The undersigned agrees that, if he or she is designated as the successful bidder, but fails to execute a contract in accordance with the agreements contained in this bid, this bid security shall become the property of the Awarding Authority as liquidated damages.

J. TAXES: As required by MGL Chapter 62c, Section 49A, the undersigned certifies that he or she has complied with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

The undersigned hereby agrees that this bid shall be valid for a period of 30 days, Saturdays, Sundays, and legal holidays excluded, after the date designated for opening of the General Bids.

The undersigned agrees to furnish the following information prior to the time established for execution of the Contract.

1. Certificate of Corporate Vote, or names of Partners in a Partnership.
2. Massachusetts Foreign Corporation Certificate, if applicable.

DATE________________________

(Name of Sub-Bidder)

By

(Title and Name of Person Signing)

(Business Address)

(Business Telephone No.) (City and State)

Note: If Bidder is a corporation, indicate State of Incorporation under signature; if a partnership, give full names of all partners.
The following information is furnished under the penalties of perjury:

If a corporation:

Incorporated in what State

President

Treasurer

Secretary

If you are a foreign (out of state) corporation, are you registered with the Secretary of the Commonwealth in accordance with the provisions of Chapter 156d Section 15.01 of the General Laws,

Sections 3 and 5

If you are selected by the General Contractor and awarded the sub-contract for this Work, you are required under Massachusetts General Laws Chapter 30, Section 39L to obtain from the Secretary of State, Foreign Corporation Section, Room 136 State House, a certificate stating that your corporation is registered, and furnish said certificate to this Awarding Authority.

If a Partnership: (Name all partners.)

Business Address

Name of Partner

Residence

Name of Partner

Residence

END OF FORM FOR SUB-BID
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

FORM FOR GENERAL BID

FROM:

______________________
______________________
______________________

TO: City of New Bedford
Purchasing Department
133 William Street, Room 208
New Bedford, MA 02740-5194

A. The undersigned proposes to furnish all labor and materials required for implementation of the ELIZABETH CARTER BROOKS SCHOOL WINDOW, DOOR & BOILER REPLACEMENT PROJECT,

in accordance with the accompanying Plans and Specifications prepared by JOHNSON ROBERTS ASSOCIATES, INC. for

the Contract Price specified below, subject to additions and deductions in accordance with terms of the Specifications,

B. This bid includes addenda numbered _________________.

C. The Proposed Contract Price is ________________________________

__________________________________________________________ DOLLARS ($______________________________)

D. The subdivision of the proposed Contract Price is as follows:

Item 1: The work of the General Contractor, being all work other than that covered by Item 2,

________________________________________________________________________ DOLLARS ($______________________________)

Item 2: Filed Sub-Bids as follows:

<table>
<thead>
<tr>
<th>SUB-TRADE</th>
<th>NAME OF SUB-BIDDER</th>
<th>AMOUNT</th>
<th>BOND REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASONRY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATERPROOFING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROOFING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WINDOWS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACOUSTICAL TILE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TILE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAINT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLUMBING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRICAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL OF ITEM 2 $______________________________
ALTERNATE NO.1:

Further, the undersigned proposes to furnish all labor and materials required for implementation of the work noted in Section 012300 ALTERNATES, 1.02 ALTERNATE NO.1–INSULATED METAL PANEL SYSTEM

The Proposed Alternate Price is ________________________________ DOLLARS ($__________________________)

D. The subdivision of the proposed Alternate Price is as follows:

Item 1: The work of the General Contractor, being all work other than that covered by Item 2,

                   ___________________________________________________ Dollars ($__________________________)

Item 2: Filed Sub-Bids as follows:

<table>
<thead>
<tr>
<th>SUB-TRADE</th>
<th>NAME OF SUB-BIDDER</th>
<th>AMOUNT</th>
<th>BOND REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASONRY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATERPROOFING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROOFING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WINDOWS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACOUSTICAL TILE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TILE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAINT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLUMBING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRICAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL OF ITEM 2 $_________________________________________
E. The undersigned agrees that each of the above-named sub-bidders will be used for the Work indicated at the amount stated, unless a substitution is made.

The undersigned agrees that if he is selected as General Contractor, he will promptly confer with the Awarding Authority on the question of Sub-bidders and that the Awarding Authority may substitute for any sub-bid listed above a sub-bid duly filed with the Awarding Authority by another sub-bidder for the sub-trade, against whose standing and ability the undersigned makes no objection; and that the undersigned will use all such finally selected sub-bidders at the amount named in their respective sub-bids and be in every way responsible for them and their Work as if they had been originally named in this General Bid the total Contract Price being adjusted to conform thereto.

F. The undersigned further certifies under the penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word “person” shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

Date:______________________________________________

Name of General Bidder:____________________________________

By ________________________________
(Name of Person Signing Bid and Title)

____________________________________
(Business Address)

____________________________________
(City and State)
STATEMENT OF BIDDER’S QUALIFICATIONS

This Statement shall be completed and a copy attached to the Form For General Bid. All questions must be answered. Additional sheets required for answers shall be included with Statement.

1. Name of Company

Address

Tel. No. FAX No. Email

2. Type Company: _____Partnership _____Corporation___ Other _______Date Formed: ________

3. List the like projects your company has performed, giving the information indicated below:

<table>
<thead>
<tr>
<th>Name/Address of Owner</th>
<th>Scope of Work</th>
<th>Contract Amount</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Identify the subcontractors for this proposed project:

<table>
<thead>
<tr>
<th>Name/Address of Subcontractor</th>
<th>Scope of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Has your present company ever failed to complete any work awarded to it and if so state where, when and why:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

1. Address of bank which has information that would enable them with your approval to advise regarding the financial stability of your company:

________________________________________________________________________

Signed_________________________ Print Name:______________________________________

Officer_________________________ Date:__________________________________________
VOTE OF CORPORATION AUTHORIZING
EXECUTION OF CORPORATE AGREEMENTS

At a meeting of the Board of Directors of ________________ duly called and held on _________________, 20____ at which a quorum was present and acting throughout, the following vote was duly adopted.

VOTED: That ____________________________, the____________________ of the corporation, be and hereby is authorized to affix the Corporate Seal, sign and deliver in the name and behalf of the corporation contract documents with the City of New Bedford, the above mentioned documents to include but not be limited to Bids, Proposals, Deeds, Purchase and Sales Agreements, Agreements, Contracts, Leases, Licenses, Releases and Indemnifications; and also to seal and execute, as above, surety company bonds to secure bids and proposals and the performance of said contract and payment for labor and materials, all in such form and on such terms and conditions as he/she, by the execution thereof, shall deem proper. A true copy

ATTEST:

____________________________________
Name (printed)

____________________________________ (Affix Corporate Seal)
Signature

____________________________________
Title

____________________________________
Date
EEO Bid Submission Checklist

[SEE SECTION005203 EQUAL EMPLOYMENT OPPORTUNITY FOR INSTRUCTION]

THE GENERAL BIDDER SHALL SUBMIT ALL THE FOLLOWING FORMS AS A PART OF ITS BID SUBMISSION, AND SHALL SUBMIT A COPY OF SUCH TO:

The City of New Bedford
Office of Equal Opportunity
133 William Street Room 208
New Bedford, MA 02740
ph: 979-1446 / fax: 508-991-6148

1. Certificate of Understanding: Certification of Compliance with Executive Order 11246
2. Schedule of Participation for Minority, Woman & Disadvantaged Business Enterprises
3. Letter of Intent - for each MBE/WBE/DBE Participation
4. MBE/WBE Contractor Identification Statement - for each MBE/WBE/DBE
5. Bidder’s Certification - must be completed and signed by the General Contractor and all Subcontractors who will work on the project (to include MBE/WBE/DBE and non-MBE/WBE/DBEs)
6. If applicable, a completed and signed MBE/WBE/DBE Unavailability Certification in the event that the work listed on the Schedule is not sufficient to fulfill the Requirement for MBE/WBE/DBE Participation. This certification must include a statement by the bidder of the reasons why it believes it is in compliance with this Provision, and a list of the names, addresses, telephone numbers and reason given for unavailability of the Minority /Woman/ Disadvantaged Contractor who was contacted by the Bidder with respect to the performance of work under the contract.

NOTE: FAILURE TO FULLY COMPLETE AND/OR TO SUBMIT ANY OF THE ABOVE-REFERENCED DOCUMENTS AT THE TIME OF THE BID SUBMISSION MAY RESULT IN THE BID BEING CONSIDERED DISAPPROVED.
BIDDERS CERTIFICATE OF UNDERSTANDING


Contractor ____________________________________________________ Project _________________________
Address _______________ ______________________ Tel. # _____________________ Project # ______
                                      _______________          ______________________ Fax # ________

I, the undersigned, understand that:
A. Minority Business Enterprises are to be awarded at least 11% of the total contract amount for construction/public works projects.
B. Woman Business Enterprises are to be awarded at least 5% of the total contract amount for construction/public works projects.
C. Disadvantaged Business Enterprises are to be awarded at least 4% of the total contract amount for airport projects.
D. All required MBE/WBE/DBE forms included in Instructions to Bidders are to be completed and submitted with the bid.
E. Prior to award of the contract, a pre-construction conference must be held (to be attended by the general contractor and all subcontractors, regardless of tier) at which time the following requirements will be discussed:  
a. Weekly Workforce Utilization Reports (Form CAD85) are to be submitted weekly with payroll reports within five (5) days of last payroll;
b. Quarterly Manpower Projection Tables (Form CAD85-1) are to be submitted with the Start of Construction notification;
c. Any project in the amount of $100,000+ is subject to the New Bedford Resident Hiring and the Responsible Employer Plan ordinances;
d. A minimum goal of 18% minority manpower utilization, in terms of total work hours in the aggregate workforce, in each trade or craft, on each project, will be maintained. The goal for female manpower utilization will be maintained at 6.9% according to regulations;
e. Minority and female work hours are to be uniform in each trade, and minorities and females are to be employed evenly on each project;
f. Minority or female employees are not to be transferred from project to project for the purpose of meeting goals;
g. 7.A roster of all minority and/or female applicants for employment must be maintained at each project site (Federal & Non-Federal) in the New Bedford Hometown Plan Area.
F. The submission of the above reports and adherence to hiring practices and equal opportunity performance of subcontractors is the responsibility of the prime contractor.

The bidder hereby certifies that he/she shall comply with the minority manpower ratio and specific affirmative action steps contained in the EEO above, including compliance with the minority contractor compliance specifications. The Contractor receiving the award of the contract shall be required to obtain from each of its subcontractors, and submit to the contracting or administering agency prior to the performance of any work under said contract, a certification by said sub-contractor, regardless of tier, that it will comply with the minority manpower ratio and specific affirmative action steps contained in this appendix.

Authorized Signature __________________________ Date

Name (Please Print or Type) __________________________ Title

Submit with Bid
### SCHEDULE OF PARTICIPATION

**DISADVANTAGED/MINORITY / WOMAN BUSINESS ENTERPRISES**

*to be completed by the Bidder*

<table>
<thead>
<tr>
<th>Item I - Minority Or Disadvantaged Business Enterprise Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Name: ____________________________________________________</td>
</tr>
<tr>
<td>Address: _____________________________________________________</td>
</tr>
<tr>
<td>Nature of Participation: ______________________________________</td>
</tr>
<tr>
<td>Dollar Value / % of Bid: ____________________________</td>
</tr>
<tr>
<td>2. Name: ____________________________________________________</td>
</tr>
<tr>
<td>Address: _____________________________________________________</td>
</tr>
<tr>
<td>Nature of Participation: ______________________________________</td>
</tr>
<tr>
<td>Dollar Value / % of Bid: ____________________________</td>
</tr>
</tbody>
</table>

**TOTAL BID PRICE** $______________ **TOTAL DBE or MBE COMMITMENT** $______________ %

<table>
<thead>
<tr>
<th>Item II – Woman Or Disadvantaged Business Enterprise Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Name: ____________________________________________________</td>
</tr>
<tr>
<td>Address: _____________________________________________________</td>
</tr>
<tr>
<td>Nature of Participation: ______________________________________</td>
</tr>
<tr>
<td>Dollar Value / % of Bid: ____________________________</td>
</tr>
<tr>
<td>2. Name: ____________________________________________________</td>
</tr>
<tr>
<td>Address: _____________________________________________________</td>
</tr>
<tr>
<td>Nature of Participation: ______________________________________</td>
</tr>
<tr>
<td>Dollar Value / % of Bid: ____________________________</td>
</tr>
</tbody>
</table>

**TOTAL BID PRICE** $______________ **TOTAL WBE or DBE COMMITMENT** $______________ %

The bidder agrees to furnish implementation reports, as required by the awarding authority, to indicate the MBE/WBE or DBE which it has used or intends to use. Breach of this commitment constitutes a breach of the contract.

General Bidder: ________________________________________________

Signature: _________________________________________________ Date: ______________________

BID CERTIFICATIONS & SUBMISSIONS

004100 - 5
LETTER OF INTENT

to be completed by the DBE/MBE/WBE

This form is to be completed by the DBE or MBE and WBE and must be submitted by the General Bidder as part of the Bid Proposal. A separate form must be completed for each MBE, WBE or DBE involved in the project.

Project Title: ____________________________

Project Location: ______________________

To: ____________________________________
   (Name of Bidder)

From: __________________________________
   (Name of DBE/MBE/WBE)

Indicate DBE/MBE/WBE status

{ } an individual
{ } a partnership
{ } a corporation
{ } a joint venture with: ____________________________
{ } other (explain): ____________________________

It is understood that if you are awarded the contract, you intend to enter into an agreement to perform the activity described below for the prices indicated.

DBE/MBE/WBE PARTICIPATION:

<table>
<thead>
<tr>
<th>Description of Activity</th>
<th>Project Start Date</th>
<th>$ Amount</th>
<th>% of Bid Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>______________________</td>
<td>___________________</td>
<td>__________</td>
<td>_______________</td>
</tr>
</tbody>
</table>

The undersigned certify that they will enter into a formal agreement upon execution of the contract for the above-referenced Project

BIDDER                  DBE/MBE / WBE

<table>
<thead>
<tr>
<th>Authorized Signature</th>
<th>Date</th>
<th>Authorized Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>____________________</td>
<td>_____</td>
<td>____________________</td>
<td>_____</td>
</tr>
</tbody>
</table>

Address                  Address
________________________|________________________

Telephone / Fax          Telephone / Fax
________________________|________________________
MINORITY / WOMAN BUSINESS ENTERPRISE PROGRAM

CONTRACTOR IDENTIFICATION STATEMENT

Project Name: _________________________________________________ Project #:______________

Total Bid Price: $__________________________________  Bid Date: ________________

In accordance with the New Bedford Minority Business Enterprise Program, the undersigned bidder certifies that he/she:

1. is a bona fide Minority/Woman/Disadvantaged Business Enterprise currently certified by the State Office of Minority/Woman Business Assistance (SOMWBA); and such SOMWBA certification has not changed; and in the event of said status changing, it will immediately forward written notification to the City of New Bedford and SOMWBA; and

2. intends to perform certain work (specified by formal bid proposal) under a contract in connection with the above-named project, and that work will not be sublet to any company at any tier; and

3. will comply with the minority/woman workforce ratio and specific affirmative action steps contained in the EEO/AA Contract Provisions and shall obtain from each of its subcontractors a copy of the bidder’s certification and submit to the administering agency, prior to the award of such subcontract, regardless of tier, that he/she will comply with the minority/woman workforce ratio and specific affirmative action steps contained in these and the EEO/AA Contract Provisions.

SOMWBA CERTIFICATION CATEGORY: ________________________________________________

CONTRACTORS NAME: ________________________________________________
{   } MBE  {   }WBE  {   }DBE

ADDRESS: ________________________________________________
__________________________________________________________

TELEPHONE #: ______________________ FAX #: ______________________

REPRESENTATIVE NAME & TITLE: __________________________________________

AUTHORIZED SIGNATURE: ___________________________________________

GENERAL BIDDERS NAME: __________________________________________

Submit with Bid
BIDDERS CERTIFICATION

to be completed by General Contractor & each of its Subcontractors (MBE/WBE/DBE and non-MBE/WBE/DBE)

The undersigned bidder hereby certifies that he/she will comply with the Minority/Woman Workforce Ratio and Specific Affirmative Action Steps contained in the EEO/AA Provisions of this contract, including compliance with the Minority/Woman/Disadvantaged Business Enterprise as required under these contract provisions.

The contractor receiving the award of the contract shall be required to obtain, from each of its subcontractors, regardless of tier, a copy of this Bidder’s Certification indicating that it will comply with the Minority/Woman Workforce Ratio and Specific Affirmative Action Steps contained in these EEO/AA Contract Provisions, and submit it to the contracting agency prior to the award of such contract and subcontract.

Name of General Contractor

Name of Subcontractor

{ } MBE   { } WBE   { } DBE   { } Non-MBE/WBE

Signature of Authorized Representative

Signature of Authorized Representative

Name & Title (Printed or Typed)

Name & Title (Printed or Typed)

Date

Date
MINORITY / WOMAN BUSINESS ENTERPRISES
UNAVAILABILITY CERTIFICATIONS

to be completed by General Contractor

(the Bidder shall prepare additional copies of this information form in the quantity necessary to comply with the bidding requirements)

I, _____________________________________________________, ___________________________

Name         Title

date of ____________________________________________, I contacted the below listed MBE/WBE/DBE

certify that on ____________________________________________, I contacted the below listed MBE/WBE/DBE
requesting a bid for
Project __________________________________________ as an { } MBE, { } WBE or { } DBE for the provision of
{ } Goods & Services or { } Labor to accomplish

Subcontract Work Offered to this MBE/WBE/DBE Company

_______________________________________________________________

Name of Prospective Sub-Contractor

_______________________________________________________________

Address                City and State                Telephone #

Contact was made by { } Telephone { } In Person

Said sub-contractor was unavailable for work on this project or unable to prepare a bid for the following reason(s): (check appropriate answer):

{ } MBE/WBE/DBE Firm Declined Job

{ } MBE/WBE/DBE Firm offered to do a job at the price of $ __________________________, which was not acceptable because: __________________________________________________________

{ } Other __________________________________________________________

The above information is accurate and complete, to the best of my knowledge and belief. Signed under the pains and penalties of perjury.

_______________________________________________________________

Signature of Authorized Representative, General Contractor                Date

Submit with Bid
MINORITY / WOMAN/DISADVANTAGED BUSINESS ENTERPRISES

REQUEST FOR WAIVER

Upon exhausting all known sources and making every possible effort to meet the minimum requirements for MBE/WBE/DBE participation, the Contractor may seek relief from these requirements by filing this form (completed) NO LATER THAN FIVE (5) working days following the bid opening. Failure to comply with this process shall cause the bidder to be rejected, thereby rendering the contractor not eligible for award of the contract.

General Information

Project Title: ___________________________ Location: ___________________________

Bid Opening (time/date): ___________________________ Location: ___________________________

Bidder: ____________________________________________

Mailing Address: ____________________________________________

__________________________________________________________________________

Contact Person: ____________________________________________

Telephone No.: (____________) ___________________________ Ext.

Minimum Requirements

The contractor must show that good faith efforts were undertaken to comply with the percentage goals, as specified. The bidder seeking relief must show that such efforts were taken appropriately, in advance of the time set for opening bid proposals, to allow adequate time for response(s) by submitting the following: (please check all that apply and attach applicable documentation)

A. A detailed record of the effort made to contact and negotiate with minority, woman or disadvantaged business enterprises, to include:

(  ) 1. Names, addresses and telephone numbers of all such companies contacted;

(  ) 2. Copies of written notice(s) which were sent to MBE/WBE/DBE potential subcontractors prior to bid opening;

(  ) 3. Copies of advertisements prior to bid opening, as appearing in general publications, trade-oriented publications, and applicable minority/women focused media detailing the opportunities for participation;
4. A detailed statement as to why each subcontractor contacted (a) was not willing to do the job or (b) was not qualified to perform the work as solicited; and

5. In the case(s) where a negotiated price could not be reached, the bidder should detail what efforts were made to reach an agreement on a competitive price

6. Contractor certifies that 100% of the project is to be carried out with his/her own workforce. no subcontractors are to be utilized.

B. The Agency may require the contractor to produce such additional information, as it deems appropriate and may obtain whatever other information it deems necessary to reach a conclusion from any source.

C. No later than fifteen (15) days after receipt of all necessary information and documentation, a decision will be made in writing to the bidder. If the waiver request is denied, the facts upon which a denial is based will be set forth. A contractor who is dissatisfied with the decision may then appeal that decision to the Equal Opportunity Employment Agency.

Certification

The undersigned herewith certified that the above information and appropriate attachments are true and accurate to the best of my ability, and that I have been authorized to act on behalf of the bidder in this matter.

__________________________________________________

(authorized original signature) Date

Submit to: Equal Employment Opportunity
Compliance Officer
133 William Street, Room 208
New Bedford, MA 02740

To be completed by the City of New Bedford’s EEO

Bid Date

Date Received by EEO Initials

BID CERTIFICATIONS & SUBMISSIONS 004100 - 11
CITY OF NEW BEDFORD
STANDARD VERTICAL CONSTRUCTION CONTRACT
For Projects Over $100,000 Subject to M.G.L. c149, §44A -F

OWNER - CONTRACTOR AGREEMENT

This agreement (“Contract”) is made as of the _____ day of________________, 2018, by and between the City of New Bedford acting by and through its Purchasing Department with a principal place of business at133 William Street, New Bedford, MA 02740 and __________ ________________________________, a ________________________________, with a principal place of business at ________________________________, hereinafter called the “Contractor.”

Terms used in this Owner - Contractor Agreement which are defined in the General Conditions of the Contract shall have the meanings designated therein.

The Awarding Authority and the Contractor agree as follows:

Article 1. Scope of Work. The Work under this Contract is defined as all work required by the Contract Documents for the construction of ________________________________, City of New Bedford Contract No. ____________________________, in accordance with and as described in the Plans and Specifications dated February 14, 2018, prepared by Johnson Roberts Associates Inc. (“Designer”), as modified by Addenda Nos. ____________ dated __________ 2018.

Article 2. Time for Completion. The Contractor shall commence the Work under this Contract on the date specified in the written “Notice to Proceed.” The Contractor shall bring the Work to Substantial Completion as follows: any non-window Work be substantially completed no later than August 15, 2018, and window work must be substantially completed 2 months after windows have shipped from the manufacturer. The Contractor shall bring the Work to Final Acceptance within 45 days after the date specified for Substantial Completion.

Article 3. Contract Price. The Awarding Authority shall pay the Contractor, in current funds, for the performance of the Work, subject to additions and deductions by Approved Change Order(s), the Contract Price of ____________________________ Dollars ($ ______________). The Unit Prices, if any, approved by the Awarding Authority are those included in the Contractor’s General Bid. The following Alternates have been accepted and their costs are included in the Contract Price:

Article 4. Approved Subcontractors. The filed Subcontractors listed in the Contractor’s General Bid submitted by the Contractor have been approved for the performance of the specified portions of the Work. No other filed Subcontractors and no non-filed Subcontractors shall be used for these or any other portions of the Work without the prior written approval of the Awarding Authority.
Article 5. Certifications. Pursuant to M.G.L. c. 62(c), s.49 (a), the individual signing this Contract on behalf of the Contractor hereby certifies, under the penalties of perjury, that to the best of his or her knowledge and belief the Contractor has complied with any and all applicable state and federal tax laws. The individual signing this Contract on behalf of the Contractor further certifies under penalties of perjury that the Contractor is not presently debarred from doing public construction work in the Commonwealth under the provisions of M.G.L. c. 29, s. 29F, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder and is not presently debarred from doing public construction work by any agency of the United States.

Article 6. The Contract Documents: The following documents form the Contract, are incorporated by reference herein, and are referred to as the “Contract Documents:”
- The Instructions to Bidders
- The General Bid submitted by the Contractor
- This Owner — Contractor Agreement
- The General Conditions of the Contract
- The Supplementary General Conditions
- The Plans and Specifications, including Addenda identified in Article 1 above
- All Approved Change Orders issued after execution of this Owner - Contractor Agreement

Article 7. Minority Business Enterprise and Women Business Enterprise Participation Goals and Minority/Women Workforce Utilization Percentages: The applicable goals, if any, for minority business enterprise and woman business enterprise participation established for this Contract are as follows:


The applicable minority workforce utilization percentage, if any, is ____________.

The applicable women workforce utilization percentage, if any, is ____________.

Article 8. Liquidated Damages. For the purposes of Article VI of the General Conditions of the Contract, liquidated damages for delay shall be as follows:

$______________________________Per day
In witness whereof, the parties hereto have caused this instrument to be executed under seal as of the date of ________________ 20__

<table>
<thead>
<tr>
<th>Contractor:</th>
<th>City Of New Bedford,</th>
</tr>
</thead>
<tbody>
<tr>
<td>By:</td>
<td>By: Jonathan F. Mitchell</td>
</tr>
<tr>
<td>Title:</td>
<td>Title: Mayor</td>
</tr>
</tbody>
</table>

CERTIFIED that funds are available

<table>
<thead>
<tr>
<th>By: Robert Ekstrom</th>
<th>By:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title: City Auditor</td>
<td>Title:</td>
</tr>
</tbody>
</table>

APPROVED as to Form and Legality

<table>
<thead>
<tr>
<th>By: Shannon Shreve</th>
<th>By: Ari Sky</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title: Counsel II</td>
<td>Title: Chief Financial Officer</td>
</tr>
</tbody>
</table>

Purchasing Department

<table>
<thead>
<tr>
<th>By: Susan Bruce, Director of Purchasing</th>
</tr>
</thead>
</table>
GENERAL CONDITIONS

1.0 ARTICLE 1 - DEFINITION OF TERMS

1.1 DEFINITION OF TERMS

A. Wherever in the Bid or Contract Documents the following terms, or pronouns in place of them, are used, the intent and meaning shall be as follows:

1. **Acceptance**: Formal written acceptance by the City of the completed Work.

2. **Addenda**: Written interpretation of and/or revisions to the Bid Documents issued by the City prior to opening of Bids.

3. **Alteration**: A change or substitution in the form, character, or detail of the Work done or to be done within the original scope of the Contract.

4. **Award**: Award by the City of a Contract

5. **Bid**: Offer of the Bidder for the Work when submitted on the prescribed Bid Form, properly signed, dated, and guaranteed, and which includes the Schedule of Bid Prices.

6. **Bid Bond (Bid Security, Bid Guaranty, Bid Deposit)**: The cash, cashier's or treasurer's check, certified check, or Bidder's Bond accompanying the Bid submitted by the Bidder, as a guaranty that the Bidder will enter into a Contract with the City for the performance of the Work and furnish acceptable bonds and insurance if the Contract is awarded to the Bidder.

7. **Bid Documents**: Documents provided by the City for the purpose of soliciting Bids for the Work. Bid Documents will include, as applicable, Notice to Bidders, Instructions to Bidders, Contract Specifications, Contract Drawings, Geotechnical Data Reports, and Addenda.

8. **Bid Form**: Form(s) issued by the City for the submittal of a Bid for a specific project and includes the Schedule of Bid Prices, certifications, affidavits and other forms.

9. **Bidder**: An individual, firm, partnership, corporation, or combination thereof, submitting a Bid for the Work on the prescribed Bid Form.

10. **Change Order**: A document executed and issued to the Contractor by the City amending the Contact.

11. **City**: The City of New Bedford.

12. **Commonwealth**: Commonwealth of Massachusetts

13. **Contract**: The written agreement executed by the City and the Contractor, setting forth the obligations of the Parties thereunder.

14. **Contract Bonds**:

   a. **Performance Bond**: A bond executed by the Contractor and the Contractor's Sureties in the full amount of the Contract to ensure the faithful performance of the Contract.

   b. **Labor and Materials Payment Bond**: A bond executed by the Contractor and the Contractor's Sureties in the full amount of the Contract to ensure the payment of labor, materials, and rental of equipment.
15. **Contract Documents**: The Contract Specifications and Contract Drawings with revisions made during the Bid period by Addenda and information included in the Bid accepted by the City and all authorized changes to the Contract issued subsequent to the execution of the Contract.

16. **Contract Drawings (Drawings)**: Plans, profiles, typical cross sections, general cross sections, elevations, and details referenced in the Contract Documents, or Addenda thereto approved by the Engineer, all of which show locations, character, dimensions, and details of the Work.

17. **Contract Item**: A specifically described unit of work for which a price is provided in the Contract.

18. **Contract Specifications**: A set of documents issued by the City for the intended Work which includes the Bid Form, Contract Forms, Contract Bonds, General Conditions, technical provisions, and other requirements, forms and exhibits identified therein.

19. **Contract Time**: Number of calendar days allowed or specified date(s) for completion of the Contract.

20. **Contractor**: The individual, firm, partnership, corporation, or combination thereof, private, municipal or public, including joint ventures, which, as an independent contractor, has entered into a Contract with the City, as Party or Parties of the Second Part, and who is referred to throughout the Contact Documents by singular number.

21. **Days** : Every day shown on the Calendar, Saturdays, Sundays and holidays included.

22. **Director** : Director of the Department of the City for which the project is being performed.

23. **Engineer** : The City of New Bedford designee acting within the scope of the particular duties entrusted to this person.

24. **Engineer’s Estimate of Quantities** : List of quantities of work estimated to be performed as contained in the Schedule of Bid Prices in the Bid Form.

25. **Extra Work** : Work which is not included in the Contract as awarded, but found to be necessary for the satisfactory completion of the Contract within its intended scope; and bears a reasonable subsidiary relation to the full execution of the Work originally described in the Contract.

26. **Extra Work Order** : An order in writing issued by the Engineer to the Contractor prior to performing the Extra Work, setting forth the Extra Work to be done, the basis of payment and time adjustments, if any. Following the issuance of an Extra Work Order, a Change Order will be executed to amend the Contract Documents.


28. **Hazardous Environmental Condition** : The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

29. **Indicated** : A term meaning as shown on the Contract Drawings (Drawings), as described in the Specifications, or as required by other Contract Documents.
30. Instructions to Bidders: Explanation of procedures to be followed in preparing and submitting Bids.

31. Notice to Bidders: Advertisement for Bids for a specific Contract. Notice to Bidders will indicate time and place for submitting and for opening of Bids, location of the Work, a brief description of the Work to be provided, and Bid Guaranty required.

32. Notice to Proceed: Written notice from the City to the Contractor to proceed with the Work.

33. Owner: The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

34. Owner’s Project Manager (OPM): The Owner’s representative assigned to the Project.

35. Project: The total activities for which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

36. Provide: In reference to Work to be performed by the Contractor, “provide” means furnish, install, and (as applicable) test complete in place.

37. Reference Utility *Standards: Drawings and specifications, published by municipalities, utility companies, railroads and other responsible agencies/entities which are included or referenced in the Contract Documents.

38. Resident Engineer: The on-site representative of the Owner’s Project Manager.

39. Specifications: Directions, provisions, and requirements contained in the Contract Specifications.

40. Subcontractor: The individual, firm, partnership, corporation, vendor, supplier, or combination thereof to whom the Contractor, with written approval of the City, sublets any part of the Contract.

41. Supplementary Conditions: Supplements and additions to the General Conditions.

42. Surety: Corporate body bound with and for the Contractor for the full and complete performance of the Contract and for the payment of all legal debts pertaining to the Work, and who executed the Contract Bonds.

43. Value Engineering: The systematic application of recognized techniques which identify the function of a product or service, and provide the necessary function or service reliably at lower overall cost.

44. Work: All the construction, materials, equipment, and contractual requirements as specified, shown, or indicated in the Contract Documents, including all alterations, amendments, or extensions thereto made by authorized changes.

END OF ARTICLE I
2.0 ARTICLE 2 - SCOPE OF WORK

2.1 INTENT OF THE CONTRACT

A. Intent of the Contract is to provide for the completion in every detail of the Work. The Contractor shall complete the Work to the satisfaction of the Engineer at the prices set forth and agreed upon. Where portions of the Work are described in general terms, but not in complete detail, the best general practice shall be followed. Only materials and workmanship of best standard quality shall be used. The Contractor shall, unless otherwise specified, furnish all labor, superintendence, materials, tools, equipment and incidentals necessary to complete the Work in a proper, thorough, and workmanlike manner.

2.2 CHANGES IN THE WORK

A. The City reserves the right at any time during the progress of the Work to make alterations to, deviations from, additions to, and deletions from the Contract Drawings and Specifications. Such changes shall not invalidate the Contract nor release the Surety. The Contractor agrees to accept the Work as changed, the same as if it had been a part of the original Contract. Such changes will be authorized in writing by the Engineer. The Contractor shall accept as full compensation for Work, except as specified in paragraph "B" and paragraph "C" of this Article, the Contract unit prices stipulated in the Contract for the actual quantity of Work provided in an acceptable manner. Such changes shall not invalidate the Contract, nor any part thereof.

B. Wherever an alteration, deviation, addition, or deletion involves a change in the nature of design or in the type of construction which increases or decreases the cost of performance of the Work or requires the Contractor to furnish materials or provide work of a kind not susceptible of classification for payment under any of the items scheduled in the Bid, the City and the Contractor may enter into Supplementary Agreements covering the Work to be done and the manner and method of payment therefore. If the Contractor and the City disagree on increased or decreased costs, the changes shall be by a Change Order.

C. If the changes, in the opinion of the Engineer, are of sufficient magnitude as to require additional time to complete the Contract, such time adjustment may be made in accordance with the provisions of Article 6.8.

2.3 EXTRA WORK

A. The Contractor shall do any work not herein provided for when and as ordered in writing by the Engineer, such written order to contain particular preference to this Article and to designate the Work to be done as Extra Work.

B. Unless specifically noted in the Change Order, Extra Work will not extend the time of completion of the Contract as stipulated in Article 6.8.A.6.

C. Determination of the Engineer will be final upon all questions concerning the amount and value of Extra Work, except as provided in Article 5.19.

D. Payment for Extra Work will be in accordance with Article 7.4.

2.4 RESERVED

2.5 INCREASED OR DECREASED CONTRACT QUANTITIES

A. The Work is bid on a lump sum basis. The Bid Form does not include quantities and unit rates for which quantity adjustments can be made.

B. The Engineer may order omitted from the Work any items or portions of Work. Such omission shall not operate as a waiver of any conditions of the Contract nor invalidate any of the provisions thereof, nor shall the Contractor have any claim for anticipated profit. Also, see Article 7.5
C. Except as specified herein, no allowance will be made for any increased expenses, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor resulting either directly or indirectly from such increased or decreased quantities or from unbalanced allocation, among the Contract Items of overhead expenses on the part of the Contractor and subsequent loss of expected reimbursement therefore, or from any other cause.

2.6 BEFORE STARTING WORK

A. Preliminary Schedules: Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. A preliminary Progress Schedule; indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. A preliminary Schedule of Submittals; and

3. A preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

4. The preliminary schedule shall be consistent with, or based on, the Critical Path Methodology (CPM) discussed in Division 1, Section 01325 Schedule of Operations.

2.7 PRE-WORK CONFERENCE

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.6.A, procedures for handling submittals, processing Applications for Payment, and maintaining required records.

2.8 INITIAL ACCEPTANCE OF SCHEDULES

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with paragraph 2.6.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefore.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

2.9 WARRANTY OF WORK

A. Neither final acceptance, final payment, nor any provision in the Contract Documents nor partial or entire operation or occupancy of the Work by the City shall constitute an acceptance of the Work not done in
accordance with the Contract Documents or relieve the Contractor of liability with respect to any express warranties or responsibility for faulty materials or workmanship.

B. Except where longer periods of warranty are specified for certain items, the Contractor warrants all Work done under the Contract to be free from faulty materials and workmanship for a period of 1 year from date of acceptance thereof.

C. Upon receiving notification from the City, the Contractor shall immediately make the required repairs or replacements to any work found defective. If repairs or replacement are not started within 10 days from the date of notification and prosecuted to completion, the City reserves the right to employ others to complete the Work. The Contractor agrees, upon demand, to pay the City all amounts that it expends for such repairs or replacements.

D. All remedied work shall carry the same warranty as the original work starting with the date of acceptable replacement or repair.

2.10 CHANGED CONDITIONS

In accordance with Chapter 30, Section 39N of the General Laws of the Commonwealth, as amended, the following paragraph shall apply to the Contract:

A. If during the progress of the Work, the Contractor or the awarding authority discovers that the actual or latent physical conditions encountered at the site differ substantially or materially from those indicated in the Contract Documents either the Contractor or the City may request an equitable adjustment in the Contract price of the Contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a Contractor, or upon its own initiative, the City will make an investigation of such physical conditions, and, if they differ substantially or materially from those indicated in the Contract Documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents and are of such a nature as to cause an increase or decrease in the cost of performance of the Work or a change in the construction methods required for the performance of the Work which results in an increase or decrease in the cost of the Work, the City will make an equitable adjustment in the Contract price and the Contract will be modified in writing accordingly.

1. Filing, investigation, and settlement of all claims made under said Chapter and Section shall be as follows:

   a. The Contractor shall promptly, and before such conditions are disturbed, notify the Engineer in writing describing in full detail the actual or latent physical conditions at the site where it is maintained, that conditions differ substantially or materially from those conditions indicated in the Contract Documents. The Engineer will promptly investigate the conditions and will promptly submit a written report of its findings and determinations to the City. No claim of the Contractor will be allowed unless the Contractor has given the detailed notice specified, nor shall it be allowed if such conditions are disturbed prior to their investigation by the Engineer.

   b. No adjustment or allowance of any kind except as provided in Article 6.8 will be made to the Contractor due to delay or suspension of the Work or any portion thereof where the actual or latent physical conditions encountered at the site differ substantially and materially from those indicated in the Contract Documents.

   c. No claim will be approved and no adjustment or allowance made when encountering actual or latent physical conditions at the site that differ substantially and materially from those indicated in the Contract Documents unless such conditions were in existence at the time of the Award of the Contract.
d. Any dispute concerning a question of changed conditions under this Article that is not disposed of by agreement shall be decided by the Consultant. If a Consultant has not been retained by the City for this project, said dispute shall be decided by the Engineer. The decision of the Consultant or Engineer shall be final.

e. If as provided in "a" of this Subsection an equitable adjustment is to be made or contemplated, the Contractor shall submit promptly in writing to the Engineer an itemized statement of the details and amount of work together with his estimated costs for the same and the Engineer shall require the Contractor to keep actual costs and certify the same to the City in writing.

B. If the Contractor and the City fail to agree on an equitable adjustment to be made under this Article, then the Contractor shall accept as full payment for the Work in dispute an amount determined in accordance with Article 7.3.B.

2.11 CONTRACTOR PROPOSED CHANGES

A. Contractor may at any time submit to the Engineer for the Engineer's review and approval or denial, proposed changes to the Contract Documents that will benefit the City. Upon acceptance of the proposed changes, the provisions of Article 2.2 and/or 2.4 (as applicable) shall apply. Denial of a proposed change shall neither provide the Contractor with any basis for claim for damages nor release the Contractor from contractual responsibilities.

2.12 COMMUNITY RELATIONS

A. The Contractor shall establish and maintain a continuing liaison with persons residing or doing business in the vicinity of the Project site, for the purpose of minimizing inconveniences resulting from construction, and shall appoint a representative, acceptable to the Engineer, for community relations. The representative shall have the authority to act directly, or through the Contractor's approved Superintendent, regarding all valid requests or complaints. Information as to their disposition by the Contractor shall be furnished to the Engineer. The name and telephone number of the Contractor’s community relations representative shall be furnished to those residents or businessmen in the community who might reasonably be expected to be affected by the construction.

END OF ARTICLE 2
3.0 ARTICLE 3 - CONTROL OF WORK

3.1 AUTHORITY OF THE ENGINEER

A. The Engineer will decide all questions relating to interpretation of the Contract Documents, and may alter, adjust, and approve same when necessary; all questions relating to quality, quantity, value, and acceptability of materials to be furnished and work provided or to be provided; all questions relating to progress of the Work and need for and manner of correcting same, and also the need for and terms of delay and suspensions; all questions relating to the need for and terms of Extra Work; all questions relating to the supervision, control and director of Work on the site and the use thereof; and all questions as to the acceptable fulfillment of the Contract by the Contractor.

B. Attention of the Contractor is directed to the following limitations on the scope of the duties entrusted to the Engineer.

1. Engineer nor OPM will not supervise, direct, control or have authority over or be responsible for the Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of the Contractor to comply with laws and regulations applicable to the furnishing or performance of the Work. Engineer will not be responsible for the Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

3.2 CONTRACT DRAWINGS

A. Contract Drawings showing the general arrangement and such details as necessary to give a comprehensive idea of the construction contemplated will be furnished by the City. As work progresses, the Contract Drawings may be supplemented by the Engineer as required to amplify or control the work. The Contractor shall perform the work required by such supplements without additional compensation, except as provided by the Contract.

3.3 CONFORMITY WITH DRAWINGS AND SPECIFICATIONS

A. Attention is directed to Chapter 30, Section 391 of the General Laws of the Commonwealth that provides that no willful and substantial deviation from Contract Drawings and Specifications shall be made unless directed in writing by the Engineer duly authorized by the City to approve such deviation. Chapter 30, Section 391 further provides that in order to avoid delays in the prosecution of the Work, such deviation may be authorized by a written order of the Engineer authorized to approve such deviation, and that within 30 days thereafter such written order shall be confirmed by a certificate of the City.

B. All work provided and all materials furnished shall be in conformity with the dimensions, details, physical, and chemical characteristics of materials and other specific requirements of the Contract.

C. Where definite tolerances are specified in the Contract, such tolerances shall fix the limits of conformity. Where tolerances are not specified in the Contract, the Engineer will determine the limits of conformity in each individual case and such determination shall be final and conclusive and mutually accepted by all parties.

D. If materials or the finished product in which the materials are used are not within conformity with the Contract Documents, but acceptable work has been produced, the Engineer will make a determination whether the work shall be accepted and remain in place.

E. If the Engineer finds the materials, or the finished product in which the materials are used or the work provided, are not in conformity with the Contract Documents and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by the Contractor, at no additional cost to the City.
3.4 COORDINATION OF CONTRACT SPECIFICATIONS

A. Contract Specifications and all supplementary documents are essential parts of the Contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete Work. In the event of any discrepancy between a Drawing and figures written thereon, the figures, unless obviously incorrect, are to govern over scaled dimensions.

B. The Contractor shall take no advantage of any apparent error or omission in the Contract Documents. If the Contractor discovers such an error or omission, the Engineer shall be notified immediately. The Engineer will then make such corrections and interpretations as may be deemed necessary to fulfill the intent of the Contract.

3.5 COOPERATION BY CONTRACTOR

A. The Contractor will be given 1 copy of the Contract Documents. The Contractor shall have 1 copy of the Contract Documents on the work site and available for reference at all times during the prosecution of the Work.

1. Additional copies of the Contract Documents beyond the stated number may be requested by the Contractor and will be furnished by the City at the expense of the Contractor.

B. Prior to starting Work the Contractor shall designate in writing the name, title, qualifications, and experience of his proposed representative (job superintendent) who, upon approval by the City, shall have complete authority to represent and to act for the Contractor. A facsimile of the authorized representative’s signature shall be furnished to the Engineer. The authorized representative or a substitute acceptable to the Engineer shall be present at the work site at all times while work is actually in progress on the Project. Arrangements for responsible supervision acceptable to the Engineer shall be made for emergency work that may be required during periods when Work is suspended. The Contractor shall notify the Engineer, in writing, of any proposed change of his representative, and shall provide identical information for approval of the new representative.

1. The job superintendent shall have the following minimum qualifications and experience:

   a. A minimum of 10 years of related window, door, boiler replacement and ADA upgrades experience within an existing building.

C. The Contractor shall ascertain that the materials and workmanship are in accordance with the Contract Documents.

D. The Contractor shall carry on his work under the direction of the Engineer such that representatives of municipal departments may enter on the work site without interference to make changes in their facilities which may be affected by the Work. The Contractor shall have no claim for, or because of any delay that may be due to or result from work of utility owners, state or municipal departments. No allowance of any kind will be made except as provided in Article 6.8. Nothing contained herein shall be construed to hold the Contractor responsible for any acts or omissions by such utility owners, state or municipal departments, or their contractors.

E. RESERVED

F. The Contractor shall not unreasonably encumber the project site with his materials. All flammable or combustible materials shall be properly stored to prevent, by effective measures, fire. Waste materials
accumulated from the Work shall be accumulated off-site at a location to be designated by the City until ultimate disposal by the Contractor at an appropriately licensed off-site facility.

3.6 ADJACENT CONTRACTS

A. The City reserves the right at any time to contract for and perform other or additional work on or near the Work covered by the Contract. The intent of this Article is to provide for the cooperation of contractors where the City deems it expedient or necessary and in the best interest of the City to let separate contracts for the performance of other work on or near the location of the Work being performed under the Contract, but it is not intended to indicate an intention on the part of the City to let separate contracts for work within the scope of or necessary for the successful completion of the Contract.

B. When separate contracts are let within the limits of any one project (either prior to Award of Contract, as specified in the Bid, or as specified above), each contractor shall conduct their work so as not to interfere with or hinder the progress or completion of the work being performed by other contractors.

1. Contractors working within the same area shall cooperate with each other as directed and shall coordinate work schedules through the Engineer to minimize conflicts.

C. Each contractor involved shall assume all liability, financial or otherwise, in connection with its contract and shall protect and save harmless the City from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced because of the presence and operations of other contractors working within the limits of the same project. No allowance of any kind will be made except as provided in Article 6.8.

1. Work beyond the limits of the project that is reasonably related to or inferred from the Work required by the Contractor that is due to the work of adjacent contractors within the limits of the project shall be performed by the Contractor, at no additional cost to the City.

D. The Contractor shall arrange the work and shall place and dispose of the materials being used so as not to interfere with the operations of other contractors within the limits of the same Project. The Contractor shall join the work with that of others in an acceptable manner and perform the work in proper sequence to that of others.

3.7 RESERVED

3.8 AUTHORITY AND DUTIES OF ENGINEER'S ASSISTANTS AND OPM RESIDENT ENGINEER

A. The Engineer may appoint assistants and representatives. The assistants, representatives, and OPM Resident Engineer are authorized to inspect work and materials, to give directions pertaining to the Work or to the safety and convenience of the public, to approve or reject materials and to make measurements of quantities.

B. In case of any dispute arising between the Contractor and the Engineer's assistants/OPM Resident Engineer, as to materials furnished or the manner of providing work, the Engineer's assistants/OPM Resident Engineer are authorized to reject materials or to suspend work until the dispute is referred to and decided by the Engineer.

C. The Engineer's assistants/OPM Resident Engineer are not authorized to revoke, alter, enlarge, relax, or release any requirements of these Specifications, nor to issue instructions contrary to the Contract Drawings and Specifications.
D. The Engineer's assistants/OPM Resident Engineer will not act as foremen or perform other duties for the Contractor.

E. The City will not accept responsibility whatsoever for Extra Work performed for which there is no specific proper written authorization.

3.9 INSPECTION OF WORK

A. All materials and each part or detail of the Work shall be subject to inspection by the Engineer. The Engineer shall at all times have access to the Work and be furnished with information and assistance by the Contractor as required, at no additional cost to the City, to make a complete and detailed inspection.

B. The Contractor, if requested by the Engineer, shall before acceptance of the Work, remove or uncover such portions of the finished work as directed. After examination, the Contractor shall restore said work to the standard required by the Contract Documents. Should work exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as Extra Work. Should work exposed or examined prove unacceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed, will be at no additional cost to the City.

C. Any work done or materials used without authorization by the Engineer may be ordered removed and replaced, at no additional cost to the City.

D. The Contractor shall furnish written information to the Engineer stating the original sources of supply of all materials manufactured away from the Work site. This information shall be furnished at least two weeks (or as otherwise required by the Engineer) in advance of the incorporation in the Work of such materials.

E. When any unit of government or political subdivision is to pay a portion of the cost of the Work, its respective representatives shall have the right to inspect the Work. Such inspection shall in no sense make any unit of government or political subdivision a party to this Contract, and shall in no way interfere with the rights of either party hereunder.

F. Inspection of Work shall not relieve the Contractor of any of his obligations to fulfill the requirements of the Contract Documents.

G. Failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor obligate the City to make final acceptance.

H. The Contractor shall give prior notice to the Engineer when work on the various items is to be performed by him or his subcontractors. If work is suspended on any item, prior notice shall be given to the Engineer before resumption of such work. Except in the case of an unforeseen emergency, neither the Contractor nor any subcontractor shall perform any Work requiring inspection at hours other than during the normal work day without prior approval of the Engineer.

3.10 REMOVAL OF DEFECTIVE OR UNAUTHORIZED WORK

A. Defective work shall be promptly remedied, or removed and replaced, notwithstanding that such work has previously been inspected and approved or estimated for payment. If the work or any part thereof shall be found defective at any time, the Contractor shall, at no additional cost to the City, make good such defect in a satisfactory manner.

B. Work performed and Extra Work done without written authorization will be considered unauthorized work and the Contractor will receive no compensation therefore. If required by the Engineer, unauthorized work shall be remedied, removed, or replaced, at no additional cost to the City.
C. Upon failure of the Contractor to remedy, remove, or replace defective or unauthorized work, or to comply promptly with any requirement of the Engineer made under this Article, the City may cause defective or unauthorized work to be remedied, removed, or replace by others and deduct the costs thereof from any monies due or to become due to the Contractor.

3.11 FINAL ACCEPTANCE

A. Upon substantial completion of the Work, the Contractor shall present, in writing, to the City its certification that the Work has been substantially completed. Within 21 days thereafter, the City as a result of its inspection of the Work will present to the Contractor either a written declaration that the Work has been substantially completed or an itemized list of incomplete or unsatisfactory Work items required by the Contract sufficient to demonstrate that the Work has not been substantially completed. The City may include with such list a notice setting forth a reasonable time, which shall not in any event be prior to the Contract completion date, within which the Contractor must achieve substantial completion of the Work. If the City fails to respond, by presentation of a written declaration or itemized list as aforesaid, to the Contractor's certification within the 21 day period, the Contractor's certification shall take effect as the City's declaration that the Work has been substantially completed.

B. If the Work or any part thereof is not acceptable to the Engineer at the time of the inspection, the Contractor will be notified in writing of the particular defects or parts to be remedied before final acceptance. If the Contractor has not arranged within a period of 5 days after the date of transmittal of such notice of non-acceptability, to complete the Work as directed by the Engineer, the City may, without further notice and without in any way affecting the Contract, make such other arrangements as may be considered necessary to insure satisfactory completion of the Contract. The cost of completing such Work will be deducted from any moneys due or which may become due to the Contractor under the Contract.

C. Substantial completion, for the purposes of this Project, shall be divided into two scopes of work: windows and non-windows construction. For non-windows construction, substantial completion mean the related non-window Work required by the Contract has been completed except for Work having a Contract price of less than 1 percent of the then adjusted total Contract price (less the window cost installation). For window related work, substantial completion shall mean once all new windows have been installed.

D. Also, see Article 5.24.

E. Also, see Article 7.9.

END OF ARTICLE 3
4.0 ARTICLE 4 - CONTROL OF MATERIALS

4.1 RESERVED 4.2
RESERVED 4.3
RESERVED

4.4 DEFECTIVE MATERIALS

A. Contractor furnished materials rejected by the Engineer shall be removed immediately from the site of the Work unless otherwise permitted by the Engineer. No rejected material, the defects of which have been subsequently corrected, shall be used in the Work unless approved in writing by the Engineer. If the Contractor fails to comply promptly with a request by the Engineer, made under the provisions of this Article, the Engineer may cause the removal and replacement of rejected material and the cost thereof will be deducted from any moneys due or to become due the Contractor.

4.5 ASBESTOS MATERIALS

A. The Contractor shall not furnish or install asbestos or materials containing asbestos under this Contract.

4.6 BANNED MATERIALS A.

Lead Paint

1. The Contractor shall not furnish or apply lead containing paint on surfaces within the limits of the Contract.

   a. A lead containing paint is defined by the Consumer Product Safety Commission's Lead Containing Paint Poisoning Prevention Act of 1979 as any coating whose dried film contains greater than 0.06 percent by weight of lead.

END OF ARTICLE 4
5.0 ARTICLE 5 - LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

5.1 LAWS TO BE OBSERVED

A. The Contractor shall keep fully informed concerning all requirements of law, including all state and federal laws, county and municipal ordinances, and regulations which in any manner affect those engaged or employed in the Work, or the materials used, in the Work, or such orders and decrees of bodies or tribunals having jurisdiction or authority over the same. The Contractor shall protect, indemnify and hold harmless the City and the Engineer, and all of their officers, agents, and employees against all claims and liabilities arising from or based on the violation of any such requirement of law whether by the Contractor, his employees, agents, or subcontractors. If any discrepancy or inconsistency is discovered in the Contract Documents in relation to any such requirements of law, the Contractor shall immediately report the facts to the Engineer in writing. The Contract shall be governed by the laws of the Commonwealth.

B. The City of New Bedford requires all corporate vendors soliciting business with the City of New Bedford which are not Massachusetts Corporations to be registered as a Foreign Corporation in the Commonwealth of Massachusetts. Therefore, "out of state businesses", in accord with Massachusetts General Laws Chapter 156d, Section 15.01, must register as a foreign corporation doing business in Massachusetts and appoint a Resident Agent for service of process within the State of Massachusetts. The necessary forms may be downloaded from the state web site www.state.ma.us/sec.

C. Other out-of-state business organizations, such as individual proprietorship, partnership and joint ventures, shall appoint an agent in this Commonwealth for the service of legal process and furnish a copy of such appointment to the State Secretary prior to the issuance of a contract by the City.

D. Work shall be in accordance with the Massachusetts State Building Code.

   1. The Contractor shall protect and indemnify the City and its representatives against any claim or liability arising from or based on the violation of any law, ordinance, safety code, regulation, order or decree whether caused by the Contractor, its employees or its subcontractors employed on the Project.

   2. Such laws, ordinances, codes, regulations, orders, or decrees may restrict and limit the Contractor's working hours or use of certain types of equipment on the Project. The Contractor shall become familiar with such restrictions and limitation prior to submitting a Bid.

   3. The Contractor shall give all necessary notices, obtain all permits as required and pay all government taxes, fees, and other costs in connection with the Work. The Contractor shall file all necessary drawings, prepare all documents, and obtain all necessary approvals of all governmental departments that have jurisdiction. The Contractor shall obtain all required Certificates of Inspection prior to acceptance and final payment for the Work. Compensation for conforming to all provisions of this Article, except as may be provided otherwise in Supplementary Conditions, shall be considered as included in the prices for the various contract Items of Work and no additional compensation will be allowed therefore.

E. Without limiting the Contractor's responsibility for ascertaining and complying with all applicable laws, ordinances, regulations, orders, and decrees, the Contractor's attention is called particularly to the requirements stated in the Sections of Division 1, General Requirements, specifying the general requirements for furnishing, installing and operating temporary controls during construction.
5.2 PERMITS AND LICENSES

A. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes and give all notice necessary and incidental to the due and lawful prosecution of the Work.

B. Permits and licenses shall be in the name of the City.

5.3 MOTOR VEHICLES

A. Motor vehicles (except vehicles used solely for transporting employees to and from the Contract location) used wholly or in part within the Commonwealth by the Contractor or a subcontractor, or by a person directly or indirectly employed by them in the execution of the Contract, shall be appropriately registered in the and bear valid registration plates.

B. Motor vehicles used solely for transporting employees to and from the Contract location shall be registered as required under Chapter 90, Section 3, of the General Laws of the Commonwealth, as amended.

C. A vehicle shall not be driven on any way, as defined in Section 1 of Chapter 90 of the General Laws of the Commonwealth, unless it is constructed or loaded so as to prevent any of its load from dropping, shifting, leaking, or otherwise escaping therefrom. (Chapter 85, Section 30, of the General Laws of the Commonwealth as amended.)

D. All diesel construction equipment shall have emission control devices installed, such as oxidation catalysts or particulate filters on the exhaust system side of the diesel combustion engine equipment.

5.4 INSURANCE REQUIREMENTS

A. The Contractor shall carry Commercial General Liability Insurance for personal injury, bodily injury and property damage with limits not less than $1,000,000 per occurrence, $1,000,000 aggregate covering all work performed under this Contract. The insurance should include the following:

1. All operations.

2. Contractual liability.

3. Coverage for the so-called "X, C, U" hazards, i.e., collapse of building, blasting, and damage to underground property.

Completed operations hazard for a period of at least 2 years following acceptance by the City of the completed Contract.

5. Use of watercraft, aircraft when applicable.

B. Pollution Liability Insurance

1. The Contractor or his designated subcontractor shall carry Pollution Liability in an amount not less than $1,000,000 per occurrence and $5,000,000 aggregate, for sudden and gradual occurrences arising out of the work being performed under this Contract including, but not limited to, all hazardous material identified under this Contract.

2. The Contractor shall designate the disposal site and furnish a Certificate of Insurance from the Disposal Facility for Environmental Impairment Liability insurance covering liability for sudden and accidental occurrences in the amount of not less than $3,000,000 per occurrence and $6,000,000 aggregate and shall also include liability for non-sudden occurrences in the amount of not less than $5,000,000 per occurrence and $10,000,000 aggregate.
3. The Contractor shall designate the hauler and furnish a Certificate of Insurance from the hauler for Automobile Liability insurance with endorsement MCS90 for the liability arising out of the transportation of hazardous material with an amount not less than $5,000,000 annual aggregate.

4. Certificates of Insurance shall clearly state the hazardous materials exposure identified under the Contract.

C. Automobile Liability Insurance

1. Include the use of all vehicles; owned, leased, hired and non-owned, with limits not less than $1,000,000 combined single limit covering all work performed under the Contract.

D. Railroad Protective Insurance (RPI)

1. RPI is not applicable to this Contract.

E. The Contractor shall carry Worker's Compensation Insurance, including Employers Liability Insurance as provided, by Chapter 152, as amended, of the General Laws of the Commonwealth covering all work performed by him under the Contract.

F. The Contractor shall carry Umbrella Liability Coverage with limits of not less than $10,000,000 per occurrence, covering all work performed by him under this Contract.

G. The Contractor shall carry Builder's Risk Insurance ("All Risks" form) on a 100 percent completed value basis for the full insurable portion of such Work for the benefit of the City, the Contractor and all subcontractors.

The required insurance coverage’s hereinbefore specified shall be placed with insurance companies licensed by the Massachusetts Division of Insurance to do business in the Commonwealth of Massachusetts and having a Best's rating of B+ or better, shall be taken out before the Contract is commenced and be kept in full force and effect throughout the term of the Contract, shall be primary to and non-contributory to any coverage’s maintained by the City, and shall require that the City be given at least 30 days advance written notice in the event of any cancellation or materially adverse change in coverage. All such required insurance, with the possible exception of Pollution Liability Insurance, shall be written on an occurrence basis form, as opposed to a claims made basis form. The City shall be named as an additional insured under the Commercial General Liability, Automobile Liability, Umbrella, Pollution Liability, and Builder's Risk Insurance Policies. The Workers' Compensation and Employers' Liability Insurance Policies shall include a waiver of subrogation in favor of the City. All such insurance as is required of the Contractor shall be provided by or in behalf of all subcontractors to cover their operations performed. The Contractor shall be held responsible for any modifications, deviations or omissions in the compliance with these requirements by the subcontractors. At the inception date of the Contract and throughout the term of the Contract, the City shall be provided with certificates of insurance evidencing that such insurance policies are in place and provide coverage as required. The following statement affirming that coverage completely complies with contract requirements shall be included in the special items section of the certificate or in an attached special items addendum page:

I. The aforementioned insurance coverage’s completely comply with Article 5.4, Insurance Requirements, paragraphs A through 1, inclusive, City of New Bedford Contract No. 936.

5.5 PATENTED DEVICES, MATERIAL AND PROCESSES

A. The Contractor shall indemnify and save harmless the City and all persons acting for or on behalf of the City from all claims and liability of any nature or kind, and all damages, cost and expenses, including attorney's fees, arising from or occasioned by an infringement or alleged infringement of any patents or patent rights on any invention, process, material, equipment, article, apparatus, or any part thereof, furnished and installed by the Contractor, or arising from or occasioned by the use of manufacture thereof, including their use by the City. In case such materials, equipment, devices, or processes are held to constitute an infringement and their use enjoined, the Contractor, at his expense, shall:
1. Secure for the City the right to continue using said materials, equipment, devices, or processes by suspension of the injunction or by procuring a license or licenses; or

2. Replace such materials, equipment, devices, or processes with non-infringing materials, equipment, devices, or processes; or

3. Modify them so that they become non-infringing, or remove the enjoined materials, equipment, devices, or processes and refund the sums paid therefore without prejudice to any other rights of the City or the Engineer.

B. When Federal funds are involved, patent rights to any patentable result arising out of the Work, as well as all information, designs, specifications, know-how, data, and findings, shall be made available to the Government for public use, unless the Federal Department involved shall, in specific cases where it is legally permissible, determine that it is in the public interest that it not be so made available.

5.6 RESERVED

5.7 RESERVED

5.8 RESERVED

5.9 RESERVED

5.10 PROTECTION AND RESTORATION OF PROPERTY

A. Compensation for conforming to all provisions of this Article, unless compensation is authorized in writing by the Engineer, as specified in Article 2.3, or as may be provided otherwise in the Supplementary Conditions, shall be considered as included in the prices for the various Contract items of Work and no additional compensation will be allowed therefore.

B. RESERVED

C. The Contractor shall confine his movements and operations insofar as possible to the area within the limits of the Work, and the area outside the limits of the Work shall not be disturbed except as directed.

D. The Contractor shall, at no additional cost to the City, preserve and protect from injury all property along and adjacent to the proposed Work. The Contractor shall be responsible for and shall repair, at no additional cost to the City, any and all damage and injury thereto, arising out of or in consequence of any act or omission, neglect or misconduct in the execution of the Work, or in consequence of the non-execution thereof by the Contractor or his employees or subcontractors in the performance of the Work covered by the Contract prior to completion and acceptance thereof.

E. Although the Contract Drawings may indicate the approximate location of existing items in the vicinity of the Work, accuracy and completeness of the information is not guaranteed by the City. Before commencing any work or operations that may endanger or damage structures, the Contractor shall carefully locate all such structures and conduct his operations in such manner as to avoid damage thereto. When necessary, the Contractor shall cooperate with representatives of the City in order to avoid damage to their structures by furnishing and erecting suitable supports, props, shoring, or other means of protection.

5.11 PROTECTION OF PUBLIC LANDS

A. In the execution of any Work within or adjacent to any state or national forest, park, or other public or private lands, the Contractor shall comply with all of the regulations of the appropriate authorities having jurisdiction over such forest, park, or lands. The Contractor shall keep the areas in his construction operations in an orderly condition and properly dispose of all refuse and discarded materials.
B. The Contractor shall obtain construction permits that may be required for Contract operations, not a part of the Contract, in accordance with the requirements of the regulations of the appropriate authorities.

5.12 HAZARDOUS ENVIRONMENTAL CONDITION AT SITE

A. Reference is made to the Division 13 General Specification for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Engineer in the preparation of the Contract Documents.

B. Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Division 13 General Specifications. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their related entities with respect to:

1. The completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. Other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. Any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. The Contractor shall take all necessary steps not to disturb or exacerbate Hazardous Environmental Conditions.

E. If Contractor encounters hazardous environmental condition or if Contractor or anyone for whom, Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected there (except in an emergency as required by Article 5.13 and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.

F. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered to Contractor written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefore as provided in Article 5.17.

G. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the work, then either party may make a Claim therefore as provided in Article 5.17. Owner may have such deleted portion of the work performed by Owner's own forces or others at the Owner's discretion.
H. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (1) was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

5.13 EMERGENCIES

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

5.14 DISPOSAL OF MATERIALS OUTSIDE THE WORK SITE

A. Unless otherwise specified in the Contract Specifications, the Contractor shall make his own arrangement for disposing of waste and excess materials outside the work site, at no additional cost to the City.

B. RESERVED

C. Unless otherwise provided in the Contract Specifications, full compensation for all costs involved in disposing of materials as above specified, including all costs of hauling, shall be considered as included in the price paid for the Contract Item involving such materials and no additional compensation will be allowed therefore.

D. In the disposal of excavated material, and other waste and excess materials, the Contractor shall adhere to all applicable laws of the Commonwealth of Massachusetts and to municipal and local ordinances and regulations.

5.15 SAFETY AND FIRST AID REQUIREMENTS

A. The Contractor shall adhere to all precautions necessary to the safety and health of the workmen in accordance with provision of Federal Regulation 29 CFR Parts 1926.58 and 1910.1001, and Massachusetts Regulations 453 CMR 6.00.

B. The Contractor's safety program shall be submitted in writing to the Engineer for review within 5 days after receipt of a Notice of Award. The proposed safety program shall include the name, experience, and qualifications of the Contractor's proposed safety representative. No work at the job site shall begin until
the Engineer has reviewed the Contractor's safety program and safety representative. Implementation and enforcement of the safety program for the forces of the Contractor and all subcontractors shall be the responsibility of the Contractor.

C. The Contractor's safety representative shall have a thorough knowledge of safety and OSHA regulations. If, in the opinion of the Engineer, the Contractor's safety representative is not effective in carrying out the duties assigned and as described below, the Engineer may request, in writing, that the Contractor replace the safety representative.

D. The duties of the safety representative shall include maintenance of the Contractor's safety program, enforcement of safe practices, and the use of safety equipment and personal protection equipment, and other such activities as may be required by OSHA to maintain job safety and accident prevention. The safety representative shall not be changed, terminated, nor reassigned without the written approval of the Engineer.

E. Attention of the Contractor is specifically directed to the General and Supplemental Conditions of this Contract, which shall be made a condition of each subcontract entered into pursuant to the Contract. Further, that the Contractor and any subcontractor shall not require any laborer or mechanic employed in performance of the Contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to health or safety, as determined under construction safety and health standards (Title 29, Code of Federal Regulations, Part 1518, Published in the Federal Register on April 17, 1971) promulgated by the United States Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (83 Stat. 96).

F. The City may stop any work that it considers to be unsafe. 5.16

RESPONSIBILITY FOR DAMAGE CLAIMS

A. The Contractor shall indemnify, defend, and save harmless the City and all its officers, agents, and employees against all suits, claims, or liability of every name and nature, for or due to any injuries to persons or damage to property arising out of or in consequence of the acts of the Contractor in the performance of the Work covered by the Contract or failure comply with the terms and conditions of said Contract, whether by the Contractor or the Contractor's employees or subcontractors.

B. The Contractor shall be held responsible for any and all claims for damage to structures and utilities due to Contractor's operations or to the operations of any of the Contractor's subcontractors.

C. The provisions of this Article shall in no way relieve the Contractor from any liability for damage to property of others caused by the Contractor's negligence or that of the Contractor's employees nor shall they be construed to require the City to indemnify the Contractor against any loss resulting from such acts of negligence.

5.17 CLAIMS AGAINST CONTRACTOR FOR PAYMENT OF LABOR AND MATERIALS

A. The Contractor shall be responsible for prompt payment for all services, labor, equipment and materials furnished by or through the Contractor for purposes of the Contract.

B. Forthwith after the Contractor receives payments, the Contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in an court proceedings barring such payment and also less any amount claimed due from the subcontractor by the Contractor.

C. Not later than 65 days after each subcontractor substantially completes its work in accordance with the Contract Documents, the entire balance due under the subcontract less amounts retained by the City as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor, and the City will pay that amount to the Contractor. The Contractor shall forthwith pay to the subcontractor the full amount received from the City less any amount specified in any court proceeding barring such payment and also less any amount claimed due from the subcontractor by the Contractor.
D. Each payment made by the City to the Contractor pursuant to subparagraphs “1” and “2” of this Article for the labor performed and the materials furnished by a subcontractor shall be made to the Contractor for the account of that subcontractor: and the City will take reasonable steps to compel the Contractor to make each such payment to each such subcontractor. If the City has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the Contractor or which is to be included in a payment to the Contractor for payment to the subcontractor as provided in subparagraphs “1” and “2” the City shall act upon the demand as provided in this Article.

E. If within 70 days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the Contractor the balance due under the subcontract, including any amount due for extra labor and materials furnished to the Contractor, les any amount retained by the City as the estimated cost of completing the incomplete and unsatisfactory items of Work, the subcontractor may demand direct payment of that balance from the City. The demand shall be by a sworn statement delivered to or sent by certified mail to the City, and a copy shall be delivered to or sent by certified mail to the City, and a copy shall be delivered to or sent by certified mail to the Contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventeenth day after the subcontractor has substantially completed the subcontract work. Within 10 days after the subcontractor has delivered or so mailed the demand to the City and delivered or so mailed a copy to the Contractor, the City may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the City and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract, including any amount due for extra labor and materials furnished to the Contractor and of the amount due for each claim made by the Contractor against the subcontractor.

F. Within 15 days after receipt of the demand by the City, but in no event prior to 70 days after substantial completion of the subcontract work, the City will make direct payment to the subcontractor of the balance due under the subcontract, including any amount due for extra labor and materials furnished to the Contractor, less any amount (1) retained by the City as the estimated cost of completing the incomplete or unsatisfactory items of Work, (2) specified in any court proceedings barring such payment, or (3) disputed by the Contractor in the sworn reply; provided, that the City will not deduct from a direct payment any amount as provided in part (3) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph “4”. The City will make further direct payment to the subcontractor forthwith after the removal of the basis for the deductions from direct payments made as provided in parts (1) and (2) of this subparagraph.

G. Within 15 days after receipt of the demand by the City, but in no event prior to 70 days after substantial completion of the subcontract work, the City will make direct payment to the subcontractor of the balance due under the subcontract, including any amount due for extra labor and materials furnished to the Contractor, less any amount (1) retained by the City as the estimated cost of completing the incomplete or unsatisfactory items of Work, (2) specified in any court proceedings barring such payment, or (3) disputed by the Contractor in the sworn reply; provided, that the City will not deduct from a direct payment any amount as provided in part (3) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph “4”. The City will make further direct payment to the subcontractor forthwith after the removal of the basis for the deductions from direct payments made as provided in parts (1) and (2) of this subparagraph.

H. The City will forthwith deposit the amount deducted from a direct payment as provided in part (3) of subparagraph “5” in an interest bearing joint account in the names of the Contractor and the subcontractor in a bank in Massachusetts selected by the City or agreed upon by the Contractor and the subcontractor and shall notify the Contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the Contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

I. All direct payments and all deductions from demands for direct payments deposited in an interest bearing account or accounts in a bank pursuant to subparagraph “6” shall be made out of amounts payable to the Contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later became payable to the Contractor and in the order of receipt of such demands from subcontractors. All direct payments will discharge the obligation of the City to the Contractor to the extent of such payment.
J. The will deduct from payments to the Contractor amounts which, together with the deposits in interest bearing accounts pursuant to subparagraph "6", are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall be a right in such deductions prior to any claims against such amounts by creditors of the Contractor. Subcontractor, for contracts awarded as provided in paragraph (a) of Section 39M, Chapter 30 of the General Laws of the Commonwealth shall mean a person approved by the in writing as a person performing labor and furnishing materials pursuant to a contract with the Contractor.

5.18 PAYMENT OF TAXES

A. Contract prices paid for the Work shall include full compensation for all taxes which the Contractor is required to pay whether imposed by federal, state, or local government, including, without being limited to, federal excise tax.

1. Fines and penalties, including interest, are the responsibility of the Contractor and all costs associated therewith shall be borne by the Contractor, at no additional cost to the City.

B. The Massachusetts Sales Tax, Chapter 64H, Section 6 and the Massachusetts Use Tax, Chapter 641, Section 7, states that these taxes are not applicable to the sales of construction materials and supplies incorporated, consumed, employed or expended in construction projects of the City. This exemption is also applicable to rental charges for construction vehicles, equipment, and machinery rented, specifically for use on the site of the City's construction projects. Bidders are directed to exclude any allowance for Sales or Use Tax from their Bid Form as said tax would relate to the foregoing specific categories.

5.19 CLAIMS OF CONTRACTOR FOR COMPENSATION

A. No person or corporation, other than the signer of the Contract as Contractor, now has any interest Hereunder, and no claim shall be made or be valid, and neither the City nor any member, agent, or Employee thereof, shall be liable for, or be held to pay, any money except as provided in Articles 2.2, 2.3, 2.4, 2.5,7.2 of the Agreement.

B. All claims of the Contractor for compensation other than as provided for in the Contract due to any act or omission or commission by the City or its agents must be made in writing to the Engineer within 10 day’s after the beginning of any work or the sustaining of any damage due to such act. Such written statement shall contain a description of the nature of the Work provided or damage sustained, and the Contractor, shall on or before the 15th day of the month succeeding that in which such Work is performed or damage sustained file with the Engineer an itemized statement of the details and amount of such work or Unless such statement shall be required, the claim for compensation shall be forfeited and invalidated, and the Contractor shall not be entitled to payment due to any such work or damage. Such notice by the Contractor and the keeping of costs by the Engineer shall not in any way be construed as proving the validity of the claim.

C. The provisions of this paragraph shall not apply to changes in quantities as provided under Article XX. The provisions of this paragraph shall not apply to changes in quantities as provided under Article 2.5 or to Extra Work ordered by the Engineer in writing.

D. On the basis of information provided in writing by the Contractor’s own employees, servants, or agents, the Contractor shall certify, in writing, that the Work for which he is claiming payment, other than as provided for in the Contract, is work actually performed, and the costs as shown are the amounts legally due for providing such Work for which payment is claimed.

E. The Engineer will determine all questions as to the amount and value of such Work, and the fact and extent of such damage and will notify the Contractor in writing of this determination.
F. Acceptance by the Contractor of the final payment made under the provisions of Article 7.9 shall operate as and shall be a release to the City and every member, agent, and employee thereof, from all claim and liability to the Contractor for anything done or furnished for, or relating to, the Work, or for any act or neglect of the City or of any person relating to or affecting the Work except the claim against the City for the remainder, if any there be, of the amounts kept or retained as provided in Article 5.17. For claims for extensions of time, see Article 6.8.

5.20 OPENING PORTIONS OF CONTRACT FOR OPERATION OR OCCUPANCY

A. Any portion of the Work which is in acceptable condition for operation or occupancy may be opened for operation or occupancy as directed in writing by the City, but such operation or occupancy shall not be construed as an acceptance of the Work or part thereof, nor shall it act as a waiver of any of the provisions of the Contract Specifications or of the Contract; provided, however, that on such portions of the Work as are opened for such use, the Contractor shall not be required to assume any expense entailed in maintaining that portion of the Work opened for operation or occupancy. The City will be responsible for maintenance and any damage to the Work caused solely by the operation or occupancy of any portion of the Contract which has been opened to operations or occupancy as stipulated above, and it may order the Contractor to repair or replace such damage, whereupon the Contractor shall make such repairs at Contract unit prices so far as the same are applicable, or as Extra Work under the provisions of Article 2.3, if there are no applicable items in the Contract.

B. If the Contractor is dilatory in completing items of the Work, the Engineer may order all or a portion of the Work open to occupancy, but in such event the Contractor shall not be relieved of his liability and responsibility during the period the Work is so opened prior to final acceptance. The Contractor shall conduct the remainder of his operations so as to cause the least interference to occupancy. Additional costs incurred by the Contractor in conducting the remainder of his operations due to his being dilatory with parts of the Work shall be assumed by the Contractor, at no additional cost to the City.

5.21 CONTRACTOR’S RESPONSIBILITY FOR THE WORK

A. Until final written acceptance of the Work, the Contractor shall have the charge and care of the Work. The Contractor shall take every necessary precaution against injury or damage to the Work by action of the elements, or from any other cause, whether arising from the execution of the non-execution of the Work.

B. Except as provided in Article 2.9, the Contractor shall bear all losses resulting from or due to the amount or the character of the Work or because the nature of the environment in or on which the Work is done is different from that which was estimated or expected, or due to bad weather or other causes.

C. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the Work occasioned by any cause before its completion and final acceptance, and shall bear the expense thereof, except damage to the Work due to war, whether or not declared, civil war, insurrection, rebellion or revolution, or to any act or condition incident to any of the foregoing, to "Acts of God" (limited to hurricane, tornado, cyclone and earthquake as classified by the United States Weather Bureau for the particular locality and for the particular season of the year, and in addition thereto, damages resulting directly from flooding from any of the aforementioned "Acts of God"). The repair of such damages shall be done by the Contractor and paid for at the respective Contract unit prices for the quantity and items of Work involved. In any case in which the estimate for replacing such Work or repairing such damage caused by war, whether or not declared, civil war, insurrection, rebellion or revolution, or to any act or condition incident to the foregoing, or an "Act of God" combined with any previously authorized Extra Work results in a change of such magnitude as to be incompatible with competitive bid status, the City reserves the right to terminate the Contract and to call for new bids and award a new Contract for such Work. In the event a Contract is terminated for such reason, the City will pay the Contractor such sum as may be due for Work performed up to the date of the "Act of God," or of damage directly due to war, whether or not declared, civil war, insurrection, rebellion or revolution, or to any act or condition incident to any of the foregoing and will also take over and pay for any material stored
at the site of the Work provided said material was intended to be and could have been incorporated into the Work; the City will also take over and pay for any material which was being especially fabricated for incorporation into the Work, provided, however, that as a condition precedent to the City's liability for such material, the Contractor is legally liable therefore and the material was intended to be and could have been incorporated in the Work.

D. Issuance of an estimate of any part of the Work done will not be construed as final acceptance of any Work completed up to that time.

E. Should the Contractor fail to take prompt action whenever conditions make it necessary, the City will make emergency repairs or cause the same to be made, with the stipulation that the costs for such repairs shall be charged against the Contractor and deducted from moneys due the Contractor.

F. In case of suspension of Work from any cause whatever, the Contractor shall be responsible for the Contract and shall take such precautions as may be necessary to prevent damage to the Work, and shall erect any necessary temporary structures, signs, or other facilities, at no additional cost to the City.

5.22 CONFLICT OF INTEREST

A. It is understood and agreed that no gift, loan, or other thing of value has been or shall be given to any employee, agent, or officer of the City in connection with the award or performance of the Contract. Also no employment shall be given to and no renting, leasing, or purchasing of equipment, supplies, or materials shall be arranged or made with or through any employee, agent, or office of the City by the Contractor.

B. No board member, officer or employee of the City, officer or employee of any independent authority, political subdivision of the Commonwealth of Massachusetts, officer, employee or elected official or any city, county, or town authority within the Commonwealth of Massachusetts, during his/her tenure and for 1 year thereafter shall have any interest, direct or indirect, in this Contract or the proceeds thereof.

C. No member of or delegate to the Congress of the United States shall be admitted to any share or part of this Contract or to any benefit arising therefrom.

5.23 PERSONAL LIABILITY OF CITY OFFICIALS

A. In carrying out any of the provisions of the Contract Documents, or in exercising any power or authority granted to them by or within the scope of the Contract, there shall be no liability upon the Director, Engineer, or their authorized representatives, either personally or as officials of the City, it being understood that in all such matters they act solely as agents and representatives of the City.

5.24 NO WAIVER OF LEGAL RIGHTS

A. The City shall not be precluded or stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the Work and payment therefore, from showing the true amount and character of the Work provided and materials furnished by the Contractor, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor that the Work or materials do not in fact conform to the Contract. The City shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate and payment in accordance therewith, from recovering from the Contractor or the Contractor's Sureties, or both, such damage as it may sustain by reason of the Contractor's failure to comply with the terms of the Contract. Neither the acceptance by the City, or any representative of the City, nor any payment for or acceptance of the whole or any part of the Work, nor any extension of time, nor any possession taken by the City, shall operate as a waiver of any portion of the Contract or of any power herein reserved, or of any right to damages. A waiver of any breach of the Contract shall not be held to be a waiver of any other or subsequent breach. Any remedy provided in the Contract shall be taken and construed as cumulative, that is, in addition to each and every other remedy herein provided; and the City shall also be entitled as of right to writ of injunction against any breach of any of the provisions of the Contract.

5.25 LABOR, LODGING, BOARD, MAXIMUM HOURS OF EMPLOYMENT, KEEPING OF PAYROLL RECORDS
GENERAL CONDITIONS
0052002 - 25

ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

A. Every employee in public work shall lodge, board, and trade where and with whom the employee elects; and no person or person's agents or employees under contract with the City for the doing of public work, shall directly or indirectly require as a condition of employment therein, that the employee shall lodge, board, or trade at a particular place or with a particular person (Chapter 149, Section 25 of the General Laws of the Commonwealth).

B. No laborer, workman, mechanic, foreman, or inspector working within this Commonwealth, in the employ of the Contractor, subcontractor, or other person doing or contracting to do the whole or a part of the Work contemplated by the Contract, shall be required or permitted to work more than 8 hours in any one day or more than 48 hours in any one week, except in cases of emergency. The City or the Contractor or any subcontractor may employ laborers, workmen, mechanics, foremen, and inspectors for more than 8 hours in any day in the work to be done or under the Contract when, in the opinion of the Director of the Department of Labor and Workforce Development, public necessity so requires. (Chapter 149, Section 34 of the General Laws of the Commonwealth, as amended.)

C. Upon request of the Engineer or the Massachusetts Department of Labor and Industries, the Contractor shall furnish certified copies of any or all payrolls for the Contract, showing the name, address, and occupational classification of each employee on said Works, and the hours worked by, and the wages paid to each such employee. Such payroll shall also include the rates paid for rented trucks or rental equipment of any kind used on the Work. This requirement shall also apply to the work of any subcontractor, having a subcontract for any of the Work performed on the Contract. Such records shall be kept in such manner as the Director of the Department of Labor and Workforce Development shall prescribe, and shall be open to inspection by the Engineer or any authorized representative of the Department of Labor and Workforce Development at any reasonable time and as often as may be necessary.

D. In case the Work covered by the Contract is financed from federal funds, the above provisions relative to the hours of employment shall be subject to such revision and amendment as are required by the rules and regulations controlling the expenditures of such federal funds.

5.26 EQUAL OPPORTUNITY CLAUSE

During the performance of the Contract, the Contractor agrees as follows:

A. The Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, religion, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

B. The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants shall receive consideration for employment, without regard to race, creed, color, religion, sex, or national origin.

C. The Contractor shall send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the said labor union or workers' representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

D. The Contractor shall comply with all provisions of Executive Order 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

E. The Contractor shall furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will
permit access to his books, records, and accounts of investigation to ascertain compliance with such rules, regulations, and orders.

F. In the event of the Contractor's noncompliance with the nondiscrimination clauses of the Contract or with any of the said rules, regulations, or orders, the Contract may be cancelled, terminated, or suspended in whole or in part; and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended, or by rules, regulations, or orders of the Secretary of Labor, or as otherwise provided by law.

G. The Contractor shall include the portion of the sentence immediately preceding paragraph "A" and the provisions of paragraphs "A" through "G" in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, as amended, so that such provision shall be binding upon each subcontractor or vendor. The Contractor shall take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance. Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

H. Applicable Massachusetts and Federal Anti-Discrimination Requirements are contained in the Supplementary Conditions.

5.27 REQUIREMENTS OF CHAPTER 30, SECTION 39R OF THE GENERAL LAWS OF THE COMMONWEALTH OF MASSACHUSETTS

A. The words defined below shall have the meaning stated whenever they appear in this subsection:

1. "Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to Section. 39M of Chapter 30 of the General Laws of the Commonwealth.

2. "Contract" means any contract awarded or executed pursuant to Section 39M of Chapter 30 of the General Laws of the Commonwealth.

3. "Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

4. "Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of this person's residence or principal office and who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

5. "Audit", when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.
6. “Accountant's Report”, when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he/she has made and sets forth his/her opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefore shall be stated. An accountant's report shall include as a part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the Contractor.

7. “Management”, when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the Contractor.

8. Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

B. Subsection A.2 hereof notwithstanding, every agreement or contract awarded or executed pursuant to Section 39M of Chapter 30 of the General Laws of the Commonwealth shall provide that:

1. The Contractor shall make, and keep for at least 6 years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the Contractor, and

2. Until the expiration of 6 years after final payment, the awarding authority, office of inspector general, and the deputy commissioner of capital planning and operations shall have the right to examine any books, documents, papers or records of the Contractor or his/her subcontractors that directly pertain to, and involve transactions relating to, the Contractor or his/her subcontractors, and

3. If the agreement is a contract as defined herein, the Contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his/her description the date of the change and reasons therefore, and shall accompany said description with a letter from the Contractor's independent certified public accounting approving or otherwise commenting on the changes, and

4. If the agreement is a contract as defined herein, the Contractor has filed a statement of management on internal accounting controls as set forth in paragraph "C" below prior to the execution of the contract, and

5. If the agreement is a contract as defined herein, the Contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in paragraph "D" below.

C. Every Contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the Contractor and its subsidiaries reasonably assures that:

1. Transactions are executed in accordance with management's general and specific authorization.

2. Transactions are recorded as necessary:
   a. To permit preparation of financial statements in conformity with generally accepted accounting principles, and
   b. To maintain accountability for assets;
3. Access to assets is permitted only in accordance with management's
general or specific authorization; and

4. The recorded accountability for assets is compared with the existing assets at reasonable intervals and
appropriate action was taken with respect to any difference.

   Every Contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by
an independent certified public accountant, stating that he/she has examined the statement of management
on internal accounting controls, and expressing an opinion as to:

5. Whether the representation of management in response to this paragraph and paragraph "B" above are
consistent with the result of management's evaluation of the system of internal accounting controls; and

6. Whether such representations of management are, in addition, reasonable with respect to
transactions and assets in amounts which would be material when measured in relation to the
applicant's financial statements.

D. Every Contractor awarded a contract by the Commonwealth or by any political subdivision thereof shall annually file
with the awarding authority during the term of the contract a financial statement prepared by an independent certified
public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of
final payment. All statements shall be accompanied by an accountant's report.

The office of inspector general, the deputy commissioner for capital planning and operations and any other
awarding authority shall enforce the provisions of this section. The deputy commissioner of capital planning and
operations may after providing an opportunity for the inspector general and other interested parties to commend,
pronounce pursuant to the provisions of Chapter 30A of the General Laws of the Commonwealth such rules,
regulations and guidelines may be applicable to all awarding authorities. A Contractor's failure to satisfy any of the
requirements of this section may be grounds for disqualification pursuant to Section 44C of Chapter 149 of
the General Laws of the Commonwealth.

Note: The record retention aspects of this subsection apply to all contracts awarded by the City regardless of value. The
requirements relative to the internal auditing and management controls, including the filing of an annual statement, apply
to contracts awarded with a value greater than $100,000.

END OF ARTICLE 5
6.0 ARTICLE 6 - PROSECUTION AND PROGRESS

6.1 SUBLETTING OR ASSIGNMENT OF CONTRACT

A. The Contractor shall give personal attention to the fulfillment of the Contract and shall keep the Work under control.

The Contractor shall not sublet, sell, transfer, assign, or otherwise dispose of the Contract or any portion thereof, or of the Contractor's right, title, or interest therein, without written consent of the City. If consent is given, the Contractor shall be permitted to sublet a portion thereof, but shall provide with the Contractor's own organization, Work amounting to not less than 10 percent of the original total Contract amount, except that any items designated in the Contract as Filed Sub-Bid Classes of Work shall be provided by Filed Sub-Bid Subcontractors and the amount of any such Filed Sub-Bid Classes of Work provided by Filed Sub-Bid Subcontractors may be deducted from the total amount in computing the amount of Work required to be provided by the Contractor's own organization. No subcontracts, or transfer of contract, shall in any case release the Contractor from liability under the Contract and bonds.

1. The provisions of Chapter 149, Section 44A through Section 441, inclusive, of the General Laws of the Commonwealth of Massachusetts with respect to sub-bidders on buildings will apply when so indicated in the Notice to Bidders.

C. Consent to sublet any part of the Work shall not be construed to be an approval of the said subcontract or of any of its terms, but shall operate only as an approval of the making of a subcontract between the Contractor and subcontractor.

D. A subcontractor (vendor, or supplier) will be recognized only in the capacity of an employee or agent of the Contractor, and the subcontractor's removal may be required as in the case of an employee.

E. As soon as practicable after execution of the Contract, the Contractor shall submit to the City applications for approval of subcontractors for any part of the Work it is proposed to sublet. In addition to stating the name and address of the proposed subcontractor, each application shall give the items, or any portions thereof, proposed to be sublet by item number and description, and the total value of the Work proposed to be sublet based on the primary contract unit prices where established, or, where not established, on the approved breakdown estimate of a lump sum price required under Article 7.6 and not on the amount of the subcontract. The application shall also show pertinent information in order to enable the City to ascertain whether the proposed subcontractor is reliable and able to perform the work.

The Contractor shall direct the attention of subcontractors to the requirements of:

Article 5.4 regarding insurance requirements, the prevailing wage rates as determined by the Division of Occupational Safety of the Department of Labor and Workforce Development, and the provisions of Articles 525 and 5.26. Chapter 30, Section 39L, of the General Laws of the Commonwealth, requires under "1" above that the Commonwealth and every county, city, town, district, board, commission shall not enter into a contract for such Work with, and shall not approve as a subcontractor furnishing labor and materials for a part of any such Work, a foreign corporation which has not filed with the City a certificate of the State Secretary stating that such corporation has complied with Sections 3 and 5 of Chapter 181 and the date of such compliance. Chapter 156d Section 15.01, requires foreign corporations to appoint the Secretary of the Commonwealth as an attorney for service of process,

G. The Contractor shall direct the attention of subcontractors and all suppliers of material to the requirements of Article 3.9.
6.2 PROSECUTION OF WORK

A. The Contractor shall commence Work within 15 calendar days from the date of the mailing of the executed Contract by the City to the Contractor, unless otherwise directed in writing by the City. The Contractor shall complete the Work within the days specified.

B. Should the prosecution of the Work for any reason be discontinued, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations.

C. If in the City's judgment it is necessary at any time, the Contractor shall when directed, employ such forces and equipment for one or more additional shifts as will be required to insure the proper and timely completion of the Work.

D. The Contractor shall not provide work at any time when conditions are unsuitable for its execution, safety, and permanence. This provision shall not be interpreted as constituting any waiver, release or lessening of the Contractor's obligation to bring the Work to entire completion within the Contract time stipulated therefore.

E. The Contractor shall not receive any additional compensation for the requirements of this Article.

6.3 RESERVED

6.4 LIMITATIONS OF OPERATIONS

A. The Contractor shall conduct the Work at all times in such a manner and in such sequence as will assure the least interference with vehicular, marine, and pedestrian traffic, operations of railroads, and occupant and consumer entrance to and exit from adjacent buildings and property.

6.5 CHARACTER OF WORKMEN, METHODS AND EQUIPMENT

A. The Contractor shall at all times employ sufficient labor and equipment to prosecute the several classes of work to full completion in the manner and time required by the Contract Documents.

B. The Contractor shall provide all cutting, fitting, and patching of the work that may be required to make its several parts fit together properly, and shall not endanger any work by cutting, excavating, or otherwise altering the work in any part thereof.

C. The Contractor shall employ only competent persons and subcontractors to do the Work. In addition, the Contractor shall hire persons, who, in the opinion of the Engineer are well qualified to direct, advise or perform certain specialized types of work as described in the Specifications.

D. All workmen shall have sufficient skill and experience to perform the Work assigned to them. Workmen engaged in special work or skilled work shall have sufficient experience in such work and in the operations of the equipment required to perform all work properly and satisfactorily.

E. Any person employed by the Contractor or by any subcontractor who, in the Engineer's judgment, does not perform the work in a proper and skilled manner or is intemperate or disorderly or otherwise unsatisfactory or not employed in accordance with the provisions of Article 5.25, shall at the written request of the Engineer, be removed by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the Work without the approval of the Engineer.
F. Should the Contractor fail to take the necessary action to remove such person or persons as required above, or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work, the Engineer may suspend the Work by written notice until such orders are complied with.

G. The Contractor shall employee engineers registered in the Commonwealth of Massachusetts, qualified superintendents, foremen, and other supervisory employees to plan all Work operations and to represent the Contractor at all of the several parts of the Work and they shall be present at all times while the Work entrusted to them is in progress and shall be informed thoroughly regarding the Work.

H. All equipment used on the Work shall be of sufficient size and in such mechanical condition as to meet the requirements of the Work and to produce a satisfactory quality of work. Equipment used on any portion of the Work shall be such that no injury to private or public property will result from its use.

I. When methods and equipment to be used by the Contractor in accomplishing the construction are not prescribed in the Contract, the Contractor may use any methods or equipment that demonstrate to the satisfaction of the Engineer the ability to accomplish the Work in conformity with the requirements of the Contract.

J. When the Contract Documents specify the methods and equipment by which the construction shall be performed, such methods and equipment shall be used unless otherwise authorized in writing by the Engineer. If the Contractor desires to use a method or type of equipment other than that specified, such approval should be requested in writing from the Engineer. The request shall include a full description of the methods and equipment proposed to be used as an explanation of the reasons for desiring to make the change. If written approval is given, it will be on the condition that the Contractor shall be fully responsible for producing construction work in conformity with the Contract requirements. If after trial use of the substituted methods or equipment, the Engineer determines that the Work produced does not meet Contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining construction with the specified methods and equipment. The Contractor shall remove the deficient Work and replace it with Work of specified quality, or take such other corrective action as the Engineer may direct. No changes will be made in basis of payment for the construction items involved nor in Contract time as a result of authorizing a change in methods or equipment under these provisions.

6.6 DELAY AND SUSPENSION OF WORK

A. The Engineer has the authority to delay the commencement of the Work and delay or suspend any portion thereof, for such period or periods as it may be deemed necessary, because of conditions beyond the control of the City or the Contractor, for the failure of the Contractor to correct conditions unsafe for the general public; for failure to carry out provisions of the Contract; for failure to carry out orders; for causes and conditions considered unsuitable for the prosecution of the Work; for acts of third persons not a party to the Contract; or for any other cause, condition, or reason deemed to be in the public interest.

B. Upon receipt of written order of the Engineer, the Contractor shall immediately delay the commencement of the Work or delay or suspend any portion thereof in accordance with said order. Work shall not be suspended or delayed without prior written approval or order of the Engineer. The work shall be resumed when conditions warrant deficiencies have been corrected and the conditions of the Contract satisfied as ordered or approved in writing by the Engineer. The Contractor's attention is also directed to the requirements of Article 5.21 and the public safety and convenience requirements of Sections of Division 1, General Requirements, that shall govern during any period of temporary or partial suspension of work.

6.7 CLAIM FOR DELAY OR SUSPENSION OF WORK

A. The Contractor shall have no claim for damages of any kind due to any delay in commencement of the Work or any delay or suspension of any portion thereof, except as hereinafter provided.
1. Attention is directed to Section 390 of Chapter 30 of the General Laws of the Commonwealth which requires that every contract subject to the provisions of Section 39M of Chapter 30 contain the following provisions "a" and "b" in their entirety and, in the event of suspension, delay, interruption, or failure to act by the City increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the Contractor for payment for an increase in the cost of his performance as provisions "a" and "b" give the Contractor against the City, but nothing in provisions "a" and "b" shall in any change, modify, or alter any other rights which the Contractor or the subcontractor may have against each other.

a. The City may order the Contractor in writing to suspend, delay, or interrupt all or any part of the Work for such period of time as it may determine to be appropriate for the convenience of the City; provided, however, that if there is a suspension, delay, or interruption for 15 days or more or due to a failure of the City to act within the time specified in the Contract, the City will make an adjustment in the Contract price for any increase in the cost of the Contract but shall not include any profit to the Contractor on such increases; and provided further, that the City will not make any adjustment in the Contract price under this provision for any suspension, delay, interruption, or failure to act to the extent that such is due to any cause for which this Contract provides for an equitable adjustment of the Contract price under any other Contract provision.

b. The Contractor shall submit the amount of a claim under provision "a" to the City in writing as soon as practicable after the end of the suspension, delay, interruption, or failure to act and, in any event, not later than the date of final payment under the Contract and, except for costs due to a suspension order, the City shall not approve any costs in the claim incurred more than 20 days before the Contractor notified the City in writing of the act or failure to act involved in the claim.

6.8 DETERMINATION AND EXTENSION OF CONTRACT TIME FOR COMPLETION

A. The Contractor shall complete, entirely, and in an acceptable manner, the Work required under the Contract within the time stated in the Bid Form, except that the Contract time for completion shall be adjusted as follows:

1. If the Contract is not awarded as contemplated by the Instructions to Bidders, then the number of days allowed for the completion of the Work will be computed from the date of mailing of the executed Contract to the Contractor or the date on which the Contractor was directed to commence Work whichever is later. If the Contract specifies a specific calendar date for completion and the Contract is not awarded as contemplated by the Instructions to Bidders, then the Contractor will be entitled to an extension of time equivalent to the number of days elapsed from 60 days (45 days if Federal funds are involved) after the opening of bids up to and including the day of mailing of the executed Contract by the City or the date on which the Contractor was directed to commence Work whichever is later.

2. In case commencement of Work is delayed or any part thereof is delayed or suspended by the City (except for unsuitable weather, winter months, or reasons caused by the fault or neglect of the Contractor), the Contractor will be granted an extension of time in which to complete the Work or any portion of the Work required under the Contract equivalent to the duration of the delay less a reasonable period of time within which the Contractor could have done necessary preliminary work.

3. When delay occurs due to reasonable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to "Acts of God," to war, whether or not declared, civil war, insurrection, rebellion or revolution, or to any act or condition incident to any of the foregoing, acts of the Government, acts of the state or any political subdivision thereof, acts of other contracting parties over whose acts the Contractor has no control, fires, floods, epidemics, abnormal tides, (not including spring tides), severe coastal storms accompanied by high winds or abnormal tides, freezing of streams and harbors, abnormal time of winter freezing or spring thawing, interference from recreational boat traffic, use of beaches and recreational facilities for recreational purposes during the summer season, abnormal ship docking and berthing, unanticipated use
of wharves and storage sheds, strikes except those caused by improper acts or omissions of the Contractor, extraordinary delays in delivery of materials caused by strikes, lockouts, wrecks, freight embargoes, the time for completion of the Work shall be extended as determined by the Engineer to be equitable.

4. An "Act of God" as used in this Article is understood to imply an earthquake, flood, cyclone, or other cataclysmic phenomenon of nature beyond the power of the Contractor to foresee or make preparation in defense of. A rain, windstorm or other natural phenomenon of normal intensity, based on United States Weather Bureau reports, for the particular locality and for the particular season of the year in which the Work is being prosecuted, shall not be construed as an "Act of God" and no extension of time will be granted for delays resulting therefrom. Within the scope of acts of the Government, consideration will be given to properly documented evidence that the Contractor has been delayed in obtaining any material or class of labor because of any assignment of preference ratings by the Federal Government or its agencies to other contracts.

5. In case the Work is delayed by public or private utility owners or municipal departments, see Article 3.5.

6. Each Extra Work Order or Change Order issued will include a statement of additional time, if any, that is agreed upon by the Contractor and the Engineer required for the completion of the Contract by reason of this Extra Work Order or Change Order, and no other time allowance due to the performance of the Work covered by such Extra Work Order or Change Order will be allowed.

B. An extension of time will not be granted for any delay or any suspension of the Work due to the fault of the Contractor, nor if a written request for an extension of time on account of delay due to any of the aforesaid causes is not filed within 15 days of the date of the commencement of the delay nor if the request is based on any claim that the Contract period as originally established was inadequate.

C. Contract period has been carefully considered and has been established for reasons of importance to the City. This time limit will be enforced.

D. The probable slow-down or curtailment of Work during inclement weather and winter months has been taken into consideration in determining the total time required to complete the Contract; hence no extension of time will be allowed due to this reason.

1. No extension of time will be allowed for winter conditions and weather conditions, except as described in Article 6.8.A.3.

6.9 FAILURE TO COMPLETE WORK ON TIME

A. On or before the expiration of the calendar days stated in Article 6.2 appearing herein before completion, or the date to which the time of completion will have been extended under the provisions of Article 6.8, the Work shall have been performed in accordance with the terms of the Contract. The time in which the various portions and whole of the Contract are to be provided and the Work is to be completed is an essential part of the Contract. The Contractor shall be responsible for and shall compensate the City in full for all costs incurred by the City due to the failure of the Contractor to complete all the work specified within the period of time as specified in Article 6.2; and for the case of the failure of the Contractor to complete the entire work within the time fixed in the Contract or any extension thereof.

B. In case the Work has not been substantially and physically completed by the time stipulated in the Contract Specification (or by the date in which the completion time may have been extended in accordance with Article 6.8), the Contractor shall pay to the City a designated sum per day for the entire period of overrun in accordance with the following Schedule of deductions unless a different amount is stated in the Supplementary Conditions.
### SCHEDULE OF DEDUCTIONS

<table>
<thead>
<tr>
<th>FOR MORE THAN</th>
<th>TO AND INCLUDING</th>
<th>CHARGES PER CALENDAR DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>$25,000</td>
<td>$60</td>
</tr>
<tr>
<td>$25,001</td>
<td>$50,000</td>
<td>$150</td>
</tr>
<tr>
<td>$50,001</td>
<td>$100,000</td>
<td>$225</td>
</tr>
<tr>
<td>$100,001</td>
<td>$500,000</td>
<td>$300</td>
</tr>
<tr>
<td>$500,001</td>
<td>$1,000,000</td>
<td>$450</td>
</tr>
<tr>
<td>$1,000,001</td>
<td>$2,000,000</td>
<td>$600</td>
</tr>
<tr>
<td>$2,000,001</td>
<td>$3,000,000</td>
<td>$900</td>
</tr>
<tr>
<td>$3,000,001</td>
<td>$3,500,000</td>
<td>$1,050</td>
</tr>
<tr>
<td>$3,500,001</td>
<td>$4,000,000</td>
<td>$1,200</td>
</tr>
<tr>
<td>$4,000,001</td>
<td>$4,500,000</td>
<td>$1,350</td>
</tr>
<tr>
<td>$4,500,001</td>
<td>$5,000,000</td>
<td>$1,500</td>
</tr>
<tr>
<td>$5,000,001</td>
<td></td>
<td>$2,000</td>
</tr>
</tbody>
</table>

C. Whatever the sum of money may become due and payable to the City by the Contractor under this Article may be retained out of money belonging to the Contractor in the hands and possession of the City. This Article shall be construed and treated by the parties to the Contract not as imposing a penalty upon the Contractor for failing fully to complete the Work as agreed on or before the time specified in the Contract Specification (as it may have been extended in accordance with Article 6.8), but as liquidated damages to compensate the City for all additional costs incurred by the City because of the failure of the Contractor fully to complete said Work on or before the date of completion specified in the Contract Specification (as it may have been extended).

D. Permitting the Contractor to continue and finish the Work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall not operate as a waiver on the part of the City of any of its rights under the Contract.

### 6.10 TERMINATION OF CONTRACT

A. If the Contractor shall be adjudged bankrupt, or make a general assignment for the benefit of creditors, or if a receiver shall be appointed of the Contractor's property, or if the work to be done under the Contract shall be abandoned, or if the Contract or any part thereof shall be sublet without the previous written consent of the City, or if the Contract or any claim thereunder shall be assigned by the Contractor otherwise than herein specified, or at any time the Engineer certifies in writing to the City that the Work, or any part thereof, is unnecessarily or unreasonably delayed, or that the Contractor has violated any of the provisions of the Contract, the City may, by written notice, instruct the Contractor to discontinue the Work, or any part thereof, and thereupon the Contractor shall discontinue such Work or such part thereof, as the City may designate, and the City will require the Surety or Sureties to complete the Contract.

B. If the Engineer determines that the rate of progress as reflected by the Contractor's CPM submitted and approved in accordance with the requirements specified in the Sections of Division 1, General Requirements, is not satisfactory, the City, instead of notifying the Contractor to discontinue the Work or any part thereof, may notify the Contractor from time to time to increase the force, equipment, and plant, or any of them, employed on the whole or any part of the Work, stating the amount of increase required; and unless the Contractor shall, within 5 working days after such notice, increase such force, equipment, and plant to the extent required therein, and maintain and employ the same from day to day until the completion of the Work or such part thereof or until the conditions as to the rate of progress shall, in the Engineer's judgment, be fulfilled; or unless the Contractor submits and receives approval of a revised CPM indicating the Work being
completed on time, the City may employ and direct the labors of such additional force, equipment, and plant as may, in the Engineer's judgment, be necessary to insure the completion of the Work or such part thereof within the time specified, or at the earliest possible date thereafter, and charge the expense thereof to the Contractor. Neither the notice from the City to the Contractor, to increase the force, equipment, or plant, nor the employment of additional force, equipment, or plant by the City shall be held to prevent a subsequent notice from the City to the Contractor to discontinue Work under the provisions of the preceding portion of this Article.

C. The Engineer may exercise the rights under this paragraph to rectify adverse conditions described in Article 3.10 and Article 4.4, and/or notify the Contractor’s bonding company to take the necessary appropriate action to remedy the situation. It shall be understood that when the City exercises its rights hereinbefore described, the breach of Contract by the Contractor does not itself constitute termination unless stipulated by the City. The Contractor shall, as directed by the Engineer, continue other works of the Contract.

D. All expenses charged under this Article will be deducted and paid by the City out of any moneys then due or to become due the Contractor under the Contract, or any part thereof, and in such accounting, the City will not be held to obtain the lowest figures for the Work of completing the Contract or any part thereof, or for insuring its proper completion, but all sums actually paid therefore shall be charged to the Contractor. In case the expenses so charges are less than the sum which would have been payable under the Contract if the same had been completed by the Contractor, the Contractor will be entitled to receive the difference; and in case such expenses shall exceed the said sum, the Contractor shall pay the amount of the excess to the City upon completion of the Work without further demand being made therefore.

6.11 TERMINATION FOR CONVENIENCE

A. If the City determines that it is in the public interest to do so, the City may notify the Contractor to discontinue all work, or any part thereof. Such notice shall be given to the Contractor in writing and thereupon the Contractor shall discontinue such work, or such part thereof, as the City may designate.

B. If the City notifies the Contractor to discontinue all work, or any part thereof, the City shall pay and the Contractor shall accept, as full payment for all work done and materials provided, the following sums:

1. For all completed items of work for which there are unit prices provided in the Contract.
   a. The original contract unit prices.

2. For all work on partially completed items.
   a. A sum agreed to by the Contractor and the Engineer; or
   b. The sum of items i through vi.
      i. The actual cost for direct labor, materials (less salvage value, if any) and use of equipment plus 10 percent of this total for overhead; and
      The actual cost for Worker's Compensation and Employer's Liability Insurance, Health, Welfare and Pension Benefits, Social Security Deduction, and Employment Security Benefits; and
      iii. Six percent of the total of i and ii for profit; and
      iv. The estimated proportionate cost of surety bonds; and
      v. The actual cost to the Contractor for work performed by a subcontractor plus 10 percent of such cost.
vi. No allowance will be made for general superintendence and the use of small tools and manual equipment.

3.

For costs of settlement as:

a. Reasonable and necessary accounting, legal, clerical and other costs of work discontinuance; and reasonable and necessary storage, transportation and other costs incurred for the preservation, protection or disposition of the discontinued work.

b. When requested by the City, the Contractor shall furnish itemized statements of the cost of the work performed and shall give the City access to all accounts, bills and vouchers relating thereto and unless the Contractor, when requested, shall furnish such itemized statements and access to all accounts, bills and vouchers, he shall not be entitled to payment for the work for which such information is sought by the City.

c. The Contractor shall not be paid and the Contractor shall not have any claims for loss of anticipated profits, for loss of expected reimbursement or for any increased expenses resulting directly or indirectly from the discontinuance of any or all work or from unbalanced allocations, among the Contract items, of overhead expense on the part of the Bidder and subsequent loss of expected reimbursement therefore or for any other cause.

d. The Contractor shall incorporate the provisions of this Article and provisions in its Contracts with each of its subcontractors.

6.12 CLAIM FOR INEFFICIENCIES

A. Contractor shall have no claim for inefficiencies of any kind due to items including, but not limited to, the work, operations or schedule of this Contract or adjacent contracts, except as hereinafter provided.

1. The cost of the work as related to inefficiencies shall be included with all other costs as associated with the Extra Work as authorized by the Extra Work Order and included in the Change Order.

2. Additional claims for inefficiencies shall be brought by the Contractor within 30 days of the start of the work as authorized by the Extra Work Order.

a. Inefficiency claims brought by the Contractor after the 30 day period will be rejected by the City and the Engineer.

END OF ARTICLE 6
7.0 ARTICLE 7 - MEASUREMENT AND PAYMENT

7.1 MEASUREMENT OF QUANTITIES

A. Quantities of various items of work shall be determined, for purposes of payment, by the Engineer, OPM and by the Contractor. Measurements will be made according to United States standard units of measurement.

B. Method of measurement and computations to be used in determination of quantities of material furnished and of work provided under the Contract will be those methods generally recognized as conforming to good engineering practice.

C. The Contractor shall provide assistance to the Engineer, as requested by the Engineer, for the purpose of the measurement of quantities, at no additional cost to the City.

7.2 SCOPE OF PAYMENTS

A. The City will pay and the Contractor shall receive and accept the compensation as provided in the Schedule of Bid Items, in full payment for furnishing all materials, labor, tools and equipment, and for performing all work contemplated and embraced under the Contract; also for all loss or damage arising out of the nature of the Work, or from the action of the elements (except as specified in Article 5.21), or from any unforeseen difficulties or obstructions which may arise or be encountered during the prosecution of the Work (except as set forth in Article 2.9) until its final approval by the City, and for all risks of every description connected with the prosecution of the Work; also for all expenses incurred by or in consequence of the suspension or discontinuance of the said prosecution of the Work (except as provided in Article 6.7), and for any infringement of patent, trademark or copyright, and for completing the Work in an acceptable manner according to the Contract Documents.

B. Payment of any current estimate or any retainage percentage shall in no way constitute an acknowledgement of the acceptance of the Work or in no way or degree prejudice or affect the obligation of the Contractor, at his own cost and expense, to repair, correct, renew or replace any defects and imperfections in the construction of, or in the strength of, or quality of materials used in or about the construction of the Work under Contract and its appurtenances, as well as damages due or attributable to such defects; which defects, imperfections or damages shall have been discovered on or before the expiration of the guaranty period specified in Article 2.8. The Engineer shall be the sole judge of such defects, imperfections, or damages and the Contractor shall be liable to the City for failure to correct the same as provided herein. Also, see Article 5.24.

C. If the requirements of the Measurement and Payment Part or Article in the Contract Specifications relating to any price in the Schedule of Bid Items requires that said price cover and be considered compensation for certain work or material essential to the item, this same work or material will not also be measured or paid for under any other pay item which may appear elsewhere in the Contract Specifications.

D. Except as specifically provided otherwise, no separate payment will be made for any work in fulfillment of the requirements specified in the Sections of Division 1, General Requirements, and all costs thereof shall be included in the various prices bid or the pay items shown in the Schedule of Bid Items.

7.3 COMPENSATION FOR ALTERED QUANTITIES

A. When the accepted quantities of Work vary from the estimated quantities set forth in the Contract, and whether or not there have been any changes to the Contract Drawings, the Contractor shall accept as payment in full, so far as Contract items are concern, payment at the original Contract prices for the
accepted quantities of work done. No allowance or other adjustment except as provided in Article 2.5 shall be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor resulting either directly from such alterations or indirectly from unbalanced allocation among the Contract items of overhead expense on the part of the Contractor and subsequent loss of expected reimbursements therefore or from any other cause except the said payment for the actual quantity done at the original Contract unit price.

B. Alteration of the Contract Drawings or of the character of work involving Supplemental Agreements or Extra Work Orders as provided in Article 2.2 and 2.3 will be paid for at the prices for such items set forth therein. If prices cannot be agreed upon, the Contractor shall proceed with the performance of the work on a force account basis in accordance with the Article 7.4.B.

7.4 RESERVED

7.5 OMITTED ITEMS

A. Should any item or items of Contract Work be determined unnecessary for the proper completion of the Work, the City may, upon written notice to the Contractor, eliminate such item or items from the Contract and allowance will not be made for such items so eliminated in making final payment to the Contractor, except for such actual work as shall be done and materials purchased, including the cost of moving in and out the special equipment necessary for work on the eliminated item or items, prior to notification of the elimination of such item or items.

7.6 PARTIAL PAYMENTS

A. Monthly, the Engineer will make an estimate in writing of the total amount of the work done to the date of such estimate and the value thereof, including advance payments on products/materials stored or on hand but not yet incorporated in the Work which may be made as provided in Article 7.7. The City will retain the following from these payments:

1. Five percent of the approved amount of the payment to secure satisfactory performance of the Contract Work.

2. An amount sufficient to cover claims it has against the Contractor.

3. An amount sufficient to cover all demands for direct payment filed by subcontractors under Section 39F of Chapter 30 of the General Laws of the Commonwealth.

4. Five percent of the value of all items to be planted in the ground.

The City will pay monthly to the Contractor while carrying on the Work the balance not retained as hereinbefore provided. No such estimates or payment shall be required to be made when, in the Engineer’s judgment, the Work is not proceeding in accordance with the provisions of the Contract, or when in the Engineer’s judgment the total value of the Work done since the last estimate amounts to less than $500.00.

B. The City may, at its option, after 50 percent of the Work has been completed and (1) if the Work is proceeding in accordance with the approved CPM Construction Plan submitted under the requirements specified in the Sections of Division 1, General Requirements, and (2) is being performed in accordance with the Contract Documents, not retain the 5 percent to secure satisfactory performance of the Contract Work as provided in Article 7.6.A on any subsequent payments. However, if the City does not retain these monies, it will reimpose
this 5 percent retainage on all subsequent payments should the Contractor fail to maintain progress in
correction with the Contract and approved schedule or fail to execute the Work as required by the Contract
Documents. Retainages withheld under Articles 7.6.A.2 and 7.6.A.3 will remain in effect throughout the
Contract Work period as detailed therein. Retainage withheld under Article 7.6.A.4 for plantings will be
retained until Final Acceptance (see Article 7.9).

C. Partial payments will be made on lump sum contracts and on lump sum items of a contract if the Contractor
requests partial payment of such an item, in accordance with a schedule of the quantities and unit prices for
the major components of a lump sum contract or of the lump sum items of a contract to be submitted by the
Contractor and approved by the Engineer prior to making partial payments for such contract or for such items.

1. For lump sum contracts, this schedule of major components shall approximate the activities shown
on the CPM Construction Plan required under the Sections of Division 1, General Requirements.

2. Each component part shall be considered as including all its concomitance so that the total cost
listed for the components is the contract cost for the item.

3. Approval of the schedule by the Engineer shall not be considered as a guarantee to the Contractor
that the quantities shown on the schedule are the approximate quantities actually included in the lump
sum item.

4. The schedule is only for the purpose of estimating partial payments and it shall not affect the
Contract terms in any way.

D. The Contractor shall certify in writing by means of a Certification of Work that the work for which payment is
included in the estimate in question has in fact been done. The Certification of Work form shall be developed
by the Contractor and approved by the Engineer. The Certification of Work form shall be completed and
signed by an authorized representative of the Contractor and it shall be submitted to the City with each payment
request.

E. Whenever the Work is substantially complete, the City may, if it considers the amount retained to be in excess
of the amount adequate for its protection, at its discretion, release to the Contractor all or a portion of such
excess amount and may cause the Contractor to be paid such portion of the retainage as it deems prudent.

F. When the first partial payment estimate is prepared, the Contractor shall submit to the Engineer a cash
drawdown forecast indicating the estimated amount of each partial payment by month, projected through
completion of the project. The Contractor shall, with each succeeding partial payment estimate, submit updated
cash drawdown forecasts to the Engineer. The forecast is for the purpose of estimating cash requirements.

G. The Contractor shall develop a Statement of Payment to Subcontractor Form and
the Engineer shall approve the form. The Statement of Payment to Subcontractor Form shall be completed
and signed by an authorized representative of the Contractor and it shall be submitted to the City with each
payment request.

7.7 RESERVED

7.8 SEMI-FINAL ESTIMATE

A. A semi-final estimate may be made, at the discretion of the City, under the following conditions:
1. If, after final inspection has been made, there are any payments or Extra Work items that are still in dispute between the Contractor and the City, either as to the quantity or value of work provided thereunder, such items or claims may be excluded from the final estimate, and payment for such disputed items may be deferred until such time as agreement has been reached between the Contractor and the City or until such claim has been adjudicated. In such case, a semi-final estimate shall be prepared within a period of 65 days after substantial completion of the Contract Work covering the value of Work provided and retained percentage on items of the Contract that are not in dispute and with disputed items or claims excluded but subject to deduction and retention of a sum sufficient to satisfy any and all outstanding claims or liens that have been duly filed by subcontractors and material men against the Contractor, or to cover amount of such claims or liens that may have been paid by the City directly to others for the Contractor's account (see Article 5.17), and subject to deduction and retention from such payment any other amounts to be deducted and retained in accordance with the terms of the Contract. The existence of a dispute between the Contractor and the City as to any payment item or items shall not be considered a valid reason for delaying preparation of a semi-final estimate as provided herein.

2. In the event the Contract has been substantially completed and the Contract has been opened for operation or occupancy as directed in writing by the City, but final acceptance of the Work is subject to delay because of minor uncompleted items which do not impair the usefulness of the Contract, a semi-final estimate shall also be prepared within a like period of 65 days after the Contract has been substantially completed and opened for operation or occupancy. Such semi-final estimate shall include an estimate of the value of all Work provided in accordance with the terms of the Contract, including the amount of retained percentage withheld by the City from previous periodic payments, but excluding (a) the same deductions and retainage sufficient to cover subcontractors' and materialmen's claims and other amounts to be deducted and retained in accordance with the terms of the Contract as provided by the first paragraph of this Article; (b) an amount equal to the estimated value of the work remaining to be performed; and (c) any items or claims for Extra Work, or parts thereof, that may be in dispute; and payment for such excluded items or portions thereof, may be deferred until such remaining work has been satisfactorily completed, or in the case of disputed items or claims until such time as agreement has been reached thereon or such claims have been adjudicated.

7.9 FINAL ACCEPTANCE AND FINAL PAYMENT

A. When all of the physical work covered by the Contract has been substantially completed (see Article 3.11), the City will inform the Contractor in writing of the date of such final acceptance. Upon said date the Contractor's responsibility shall cease except as provided in his Bond(s) and as provided in Articles 2.8 and 5.24.

B. The Engineer shall, as soon as practicable after the satisfactory completion of the Contract, make a final estimate of the amount of Work done thereunder and the value of such Work. Within 65 days from and after the date the Work has been accepted by the Engineer, the City will forward to the Contractor a copy of the final estimate or semi-final estimate, as stipulated in Section 39G of Chapter 30 of the General Laws of the Commonwealth, which will include an agreement form for the Contractor's acceptance. After such acceptance has been filed with the Engineer, payments of the entire sum will be made, so found to be due thereunder after deducting therefrom all previous payments and all amounts to be kept and all amounts to be retained under the provisions of the Contract. All prior partial estimates and payments will be subject to correction in the final estimate and payment. If within 6 months from the date the final estimate is forwarded to the Contractor, the Contractor has not filed a valid, as determined by the Engineer, written reason(s) for not accepting the
final estimate, the final estimate will be considered acceptable to the Contractor and payment of final estimate made.

C. Acceptance by the Contractor of the final payment shall operate as and will be a release to the City and every member, agent and employee thereof, from all claims and liability to the Contractor for anything done or furnished for, or relating to, the Work, or for any act or neglect of the City or of any person relating to or affecting the Work, except the claim against the City for the remainder if any there be, of the amounts kept or retained to satisfy liens or claims pending against the Contractor.

END OF ARTICLE 7
END OF GENERAL CONDITIONS
EQUAl EMPLOYMENT OPPORTUNITY (EEO)

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER NO. 11246)

1. As used in these specifications:
   a. "Covered Area" means the geographical area described in the solicitation from which this Contract resulted;
   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
   c. Employer Identification Number" means the Federal Social Security Number used on the employer's quarterly Federal tax return, US Treasury Department Form 941;
   d. "Minority" includes:
      i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
      ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race);
      iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. If the Contractor is participating (pursuant to 41 CFR § 60-4.5) in a hometown plan approved by the US Department of Labor in the covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals and timetables) shall be in accordance with that plan for those trades which have unions participating in the plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such hometown plan. Each contractor or subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO Clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved plan does not excuse any covered contractor's or subcontractor's failure to make good faith efforts to achieve the plan goals and timetables.

3. The Contractor shall implement the specific affirmative action standards provided in paragraphs (7)(a) through (p) of these specifications. The goals set forth in the solicitation from which this Contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should be reasonably able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in geographical areas where they do not have a federal or federally
assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs Office or from Federal Procurement Contracting Officers. The Contractor is expected to make substantially uniform progress toward its goal in each craft during the period specified.

4. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement to refer either minorities or women shall excuse the Contractor’s obligations under these specifications, Executive Order No. 11246, or the regulation promulgated pursuant thereto.

5. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

6. The Contractor shall take specific affirmative action to ensure equal employment opportunity. The evaluation of the Contractor’s compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor’s employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor’s obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notice to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations’ responses.

c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor’s efforts to meet its obligations.

e. Develop on-the-job opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor’s employment needs, especially those
programs funded or approved by the Department of Labor. The Contractor shall provide
notice of these programs to the sources compiled under (7)(b) above.

f. Disseminate the Contractor’s EEO policy by providing notice of the policy to unions and
training programs and requesting their cooperation in assisting the Contractor in meeting
its EEO obligations; by including it in any policy manual and collective bargaining
agreement; by publicizing it in the company newspaper, annual report, etc.; by specific
review of the policy with all management personnel and with all minority and female
employees at least once a year; and by posting the Company EEO policy on bulletin boards
accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the Company’s EEO policy and affirmative action obligations
under these specifications with all employees having responsibility for hiring, assignment,
layoff, termination or other employment decisions including specific review of these items
with on-site supervisory personnel such as superintendents, general foreman, etc., prior to
the initiation of construction work at any job site. A written record shall be made and
maintained identifying the time and place of these meetings, persons attending, subject
matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the
news media, specifically including minority and female news media, and providing written
notification to and discussing the Contractor's EEO policy with other contractors and
subcontractors with whom the Contractor does or anticipates doing business.

i. Direct recruitment efforts, both oral and written, to minority, female, and community
organizations, to schools with minority and female students and to minority and female
recruitment and training organizations serving the Contractor’s recruitment area and
employment needs. Not later than one month prior to the date for the acceptance of
applications for apprenticeship or other training by any recruitment source, the Contractor
shall send written notice to organizations such as the above, describing the openings,
screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and
women and, where reasonable, provide after school, summer and vacation employment to
minority and female youth both on the site and in other areas of the Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so
under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female
personnel for promotional opportunities and encourage these employees to seek or
prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments, and other personnel
practices do not have a discriminatory effect by continually monitoring all personnel and
employment related activities to ensure that the EEO policy and the Contractor’s
obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are non-segregated except that separate
or single-user toilet and necessary changing facilities shall be provided to assure privacy
between sexes.
o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors’ adherence to and performance under the Contractor’s EEO policies and affirmative action obligations.

7. Contractors are encouraged to participate in voluntary associations that assist in fulfilling one or more of their affirmative action obligations set forth in paragraphs (7)(a) through (p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under paragraphs (7)(a) through (p) of these specifications, provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor’s minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor’s and failure of such a group to fulfill an obligation shall not be a defense for the Contractor’s noncompliance.

8. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (even though the Contractor has achieved its goal for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

9. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

10. The Contractor shall not enter into any subcontract with any person or firm debarred from government contracts pursuant to Executive Order No. 11246.

11. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the equal opportunity clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order No. 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order No. 11246, as amended.

12. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph (7) of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR § 60-4.8.

13. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the Company EEO policy is being carried out, to submit reports relating to the provisions
hereof as may be required by the government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and location at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the extent that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

14. Nothing herein provided shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).
NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE
EQUAL EMPLOYMENT OPPORTUNITY
(EXECUTIVE ORDER NO. 11246)

(1) The Offeror’s or Bidder’s attention is called to the “equal opportunity clause” and the “standard federal equal employment specifications” set forth herein.

(2)(a) The goals and the timetables for minority and female participation, expressed in percentage terms for the Contractor’s aggregate work force in each trade on all construction work in the covered area, are as follows:

<table>
<thead>
<tr>
<th>Timetables and Goals for Minority Participation in Each Trade</th>
<th>Goals for Female Participation in Each Trade</th>
<th>Goals for Minority Participation in Each Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>See the following:</td>
<td>Goals for Each Year</td>
<td>Goals for Each Year</td>
</tr>
<tr>
<td>The Commonwealth of Massachusetts</td>
<td>6.9%</td>
<td>18%</td>
</tr>
<tr>
<td>Supplemental Equal Employment Opportunity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-Discrimination and Affirmative Action Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goals for Each Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>See the following:</td>
<td>Goals for Each Year</td>
<td>Goals for Each Year</td>
</tr>
<tr>
<td>The Commonwealth of Massachusetts</td>
<td>6.9%</td>
<td>18%</td>
</tr>
<tr>
<td>Supplemental Equal Employment Opportunity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-Discrimination and Affirmative Action Program</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(2)(b) These goals are applicable to all the Contractor’s construction work (whether or not it is federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and non federally involved construction.

(2)(c) The Contractor’s compliance with the Executive Order and the regulations at 41 CFR § 60-4 shall be based on its implementation of the equal opportunity clause, specific affirmative action obligations required by the specifications set forth at 41 CFR § 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employee or trainees from contractor to contractor or from project to project for the sole purpose of meeting the Contractor’s goals shall be a violation of the Contract, the Executive Order, and the regulations at 41 CFR § 60-4. Compliance with the goals will be measured against the total work hours performs.

(3) The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

(4) As used in this Notice, and in the Contract resulting from this solicitation, the “covered area” is *** FILL IN *** *** (see Notice to Bidders)(See also, Definition in EEO) ***.
THE COMMONWEALTH OF MASSACHUSETTS

SUPPLEMENTAL EQUAL EMPLOYMENT OPPORTUNITY
ANTI-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM


II. During the performance of this Contract, the Contractor and all of (his) subcontractors (hereinafter collectively referred to as the Contractor), for himself, his assignees, and successors in interest, agree as follows:

1. In connection with the performance of Work under this Contract, the Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, national origin, age or sex. The aforesaid provision shall include, but not be limited to, the following: employment upgrading, demotion, or transfer; recruitment advertising, recruitment layoff; termination; rates of pay or other forms of compensation, conditions or privileges of employment; and selection for apprenticeship. The Contractor shall post hereafter in conspicuous places, available for employees and applicants for employment, notices to be provided by the Commission setting forth the provisions of the Fair Employment Practices Law of the Commonwealth (M.G.L. Chapter 151B).

2. In connection with the performance of Work under this Contract, the Contractor, shall undertake in good faith affirmative action measures designed to eliminate any discriminatory barriers in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, age or sex, and to eliminate and remedy any effects of such discrimination in the past. Such affirmative action shall entail positive and aggressive measures to ensure equal opportunity in the areas of hiring, upgrading, demotion or transfer, recruitment, layoff or termination, rate of compensation, and in service or apprenticeship training programs. This affirmative action shall include all action required to guarantee equal employment opportunity for all persons, regardless of race, color, religious creed, national origin, age, or sex. A purpose of this provision is to ensure to the fullest extent possible an adequate supply of skilled tradesmen for this and future Commonwealth public construction projects.

III. 1. As part of his obligation of remedial action under the foregoing section, the Contractor shall maintain on this project a not less than *** FILL IN *** percent ratio of minority employee man hours to total man hours in each job category, including but not limited to bricklayers, carpenters, cement masons, electricians, ironworkers, operating engineers, and those "classes of work enumerated in Section 44F of Chapter 149 of the General Laws of the Commonwealth.

2. In the hiring of minority journeymen, apprentices, trainees and advanced trainees, the Contractor shall rely on referrals from a multi employer affirmative action program approved by the Commission, traditional referral methods utilized by the construction industry, and referrals from agencies, not more than three in number at any one time, designated by the Liaison Committee or the Commission.
IV. 1. At the discretion of the Commission there may be established for the life of this Contract a body to be known as the Liaison Committee. The Liaison Committee shall be composed of one representative each from the agency or agencies administering this project, herein after called the administrating agency, the Commission and such other representatives as may be designated by the Commission in conjunction with the administrating agency.

2. The Contractor (or his agent, if any, designated by him the on-site equal opportunity officer) shall recognize the Liaison Committee as an affirmative action body, and shall establish a continuing working relationship with the Liaison Committee, consulting with the Liaison Committee on all matters related to minority recruitment, referral, employment and training.

3. The Contractor shall prepare projected manning tables on a quarterly basis. These shall be broken down into projections, by week, of workers required in each trade. Copies shall be furnished one week in advance of the commencement of the period covered, and also when updated, to the Commission and Liaison Committee.

4. Records of employment referral orders, prepared by the Contractor, shall be made available to the Commission and to the Liaison Committee on request.

5. The Contractor shall prepare weekly reports in a form approved by the Commission of hours worked in each trade by each employee, identified as minority or non-minority. Copies of these shall be provided at the end of each such week to the Commission and to the Liaison Committee.

V. If the Contractor shall use any subcontractor on any work performed under this Contract, he shall take affirmative action to negotiate with qualified minority subcontractors. This affirmative shall cover both pre-bid and post-bid periods. It shall include notification to the Office of Minority Business Assistance (within the Executive Office of Communities and Development) or its designee, when bids are in preparation, of all products, work or services for which the Contractor intends to negotiate bids.

VI. In the employment of journeymen, apprentices, trainees and advances trainees, the Contractor shall give preference, first, to citizens of the Commonwealth who have served in the Armed Forces of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work to which the employment relates, and, secondly, to citizens of the Commonwealth generally, and, if such cannot be obtained in sufficient numbers, then to citizens of the United States.

VII. A designee of the Commission and a designee of the Liaison Committee shall each have right of access to the construction site.

VIII. Compliance with Requirements

The Contractor shall comply with the provisions of Executive Order No. 74, as amended by Executive Order No. 116 dated May 1, 1975, and of Chapter 151B as amended, of the Massachusetts General Laws, both of which are herein incorporated by reference and made a part of this Contract.

IX. Non-Discrimination

The Contractor, in the performance of all work after award, and prior to completion of the contract work, will not discriminate on grounds of race, color, religious creed, national origin, age or sex in
X. Solicitation for Sub-Contracts, and for the Procurement of Materials and Equipment

In all solicitation either by competitive bidding or negotiation made by the Contractor either for work to be performed under a subcontract or for the procurement of materials or equipment each potential subcontractor or supplier shall be notified in writing by the Contractor of the Contractor’s obligations under this Contract relative to non-discrimination and affirmative action.

XI. Bidders Certification Requirement

For Bidders certification requirements, please refer to the Form for Bid included in the Proposal Form for this Contract.

XII. Contractor’s Certifications

The Contractor’s Certification Form must be signed by all successful low Bidder(s) prior to award by the contracting agency.

XIII. Compliance – Information, Reports and Sanctions

1. The Contractor will provide all information and reports required by the administering agency or the Commission on instructions issued by either of them and will permit access to its facilities and any books, records, accounts and other sources of information which may be determined by the Commission to affect the employment of personnel. This provision shall apply only to information pertinent to the Commonwealth’s supplementary affirmative action contract requirements. Where information required is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the administering agency or the Commission as appropriate and shall set forth what efforts he has made to obtain the information.

2. Whenever the administering agency, the Commission, or the Liaison Committee believes the General Contractor or any subcontractor may not be operating in compliance with the terms of this Section, the Commission directly, or through its designated agent, shall conduct an appropriate investigation, and may confer with the parties, to determine if such Contractor is operating in compliance with the terms of this Section. If the Commission or its agent finds the General Contractor or any subcontractor not in compliance, it shall make a preliminary report on non-compliance, and notify such Contractor in writing of such steps as will in the judgment of the Commission or its agent bring such Contractor into compliance. In the event that such Contractor fails or refuses to fully perform such steps, the Commission shall make a final report of non-compliance, and recommend to the administering agency the imposition of one or more of the sanctions listed below. If, however, the Commission believes the General Contractor or any subcontractor has taken or is taking every possible measure to achieve compliance, it shall not make a final report of non-compliance. Within fourteen days of the receipt of the recommendations of the Commission, the administering agency shall move to impose one or more of the following sanctions, as it may deem appropriate to attain full and effective enforcement:

(a) The recovery by the administering agency from the General Contractor of 1/100 of 1% of the Contract award price or $1000 whichever sum is greater, in the nature of liquidated damages or, if a subcontractor is in non-compliance, the recovery by the administering agency from the General Contractor, to be assessed by the General

EQUAL EMPLOYMENT OPPORTUNITY
005203 - 9
Contractor as a back charge against the subcontractor, of 1/10 of 1% of the subcontract price, or $400 whichever sum is greater, in the nature of liquidated damages, for each week that such party fails or refuses to comply;

(b) The suspension of any payment or part thereof due under the Contract until such time as the General Contractor or any subcontractor is able to demonstrate his compliance with the terms of the Contract;

(c) The termination, or cancellation, of the Contract, in whole or in part, unless the General Contractor or any subcontractor is able to demonstrate within a specified time his compliance with the terms of the Contract;

(d) The denial to the General Contractor or any subcontractor of the right to participate in any future contracts awarded by the administering agency for a period of up to three years.

3. If at any time after the imposition of one or more of the above sanctions a Contractor is able to demonstrate that he is in compliance with this Section, he may request the administering agency, in consultation with the Commission to suspend sanctions conditionally, pending a final determination by the Commission as to whether the Contractor is in compliance. Upon final determination of the Commission, the administering agency, based on the recommendation of the Commission, shall either lift the sanctions or reimpose them.

4. Sanctions enumerated under Section XIII-2 shall not be imposed by the administering agency except after an adjudicatory proceeding, as that term is used M.G.L. c. 30A, has been conducted. No investigation by the Commission or its agent shall be initiated without prior notice to the Contractor.

XIV. Severability

The provisions of this section are severable, and if any of those provisions shall be held unconstitutional by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

XV. Goals

Minority Manpower Utilization (MMU) percent is *** FILL IN *** for participation in each trade for each year. *** COORDINATE WITH THE COMMISSION. ***

XVI. Contractor’s Certification

A Contractor will not be eligible for award of a Contract unless such Contractor has submitted the following certification, which is deemed a part of the resulting Contract [SEE 004100 CONTRACT CERTIFICATIONS & SUBMISSIONS]

XVII. Subcontractor’s Certification

Prior to the award of any subcontract, regardless of tier, the prospective subcontractor must execute and submit to the Prime Contractor the following certification, which will be deemed a part of the resulting subcontract Contract [SEE 004100 CONTRACT CERTIFICATIONS & SUBMISSIONS]
In order to ensure that the said Subcontractor's Certification becomes a part of all subcontracts under the Prime Contract, no subcontract shall be executed until an authorized representative of the state agency (agencies) administering this project has determined, in writing, that the said certification has been incorporated in such subcontract, regardless of tier. Any subcontract executed without such written approval shall be void.
INSTRUCTIONS TO BIDDERS
For
AFFIRMATIVE ACTION ISSUES
for Public Works and Construction Projects

Office of Equal Opportunity & Contract Compliance
133 William Street, Room 208
New Bedford, Massachusetts 02740
ph: 508-979-1446 / fax: 508-991-6148
Revised April 2007
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA.01</td>
<td>Definitions</td>
<td>3-4</td>
</tr>
<tr>
<td>AA.02</td>
<td>Statement of Policy</td>
<td>5</td>
</tr>
<tr>
<td>AA.03</td>
<td>City of NB Ordinances – Synopsis</td>
<td>6</td>
</tr>
<tr>
<td>AA.04</td>
<td>Contractor’s Agreements under 11246</td>
<td>6-7</td>
</tr>
<tr>
<td>AA.05</td>
<td>Dept. of Labor, C.F.R. Parts 60-1, 60-6</td>
<td>7-8</td>
</tr>
<tr>
<td></td>
<td>Government Contractors, Affirmative Action Requirements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Segregated Facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- A.A. Compliance Program</td>
<td></td>
</tr>
<tr>
<td>AA.06</td>
<td>Section 503 of the Rehabilitation Act of 1973</td>
<td>8</td>
</tr>
<tr>
<td>AA.07</td>
<td>MBE/WBE Policy Requirement</td>
<td>8-9</td>
</tr>
<tr>
<td>AA.08</td>
<td>Contractor’s EEO/Records Monitor</td>
<td>9</td>
</tr>
<tr>
<td>AA.09</td>
<td>Bidder’s Eligibility</td>
<td>9</td>
</tr>
<tr>
<td>AA.10</td>
<td>Bid Submission Requirements</td>
<td>9-10</td>
</tr>
<tr>
<td>AA.11</td>
<td>Bid Approval or Disapproval (by EEO)</td>
<td>10</td>
</tr>
<tr>
<td>AA.12</td>
<td>Steps to Ensure a Responsive Bid</td>
<td>10-11</td>
</tr>
<tr>
<td>AA.13</td>
<td>Bid Award or Rejection</td>
<td>11</td>
</tr>
<tr>
<td>AA.14</td>
<td>Awarded Contractors Obligations</td>
<td>11-12</td>
</tr>
<tr>
<td></td>
<td>- Minimum Minority/Female Work Hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Apprentices/Trainees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Reports Required During Life of Project</td>
<td></td>
</tr>
<tr>
<td>AA.15</td>
<td>Recruitment/Referral Responsibilities</td>
<td>12-13</td>
</tr>
<tr>
<td>AA.16</td>
<td>Subcontracts</td>
<td>13</td>
</tr>
<tr>
<td>AA.17</td>
<td>Wage Rates</td>
<td>13-14</td>
</tr>
<tr>
<td>AA.18</td>
<td>Access to Compliance Info. &amp; Reports</td>
<td>14</td>
</tr>
<tr>
<td>AA.19</td>
<td>Noncompliance</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>- Investigation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Reports</td>
<td></td>
</tr>
</tbody>
</table>
AA.20 Sanctions 15
AA.21 Appeal of Sanctions 15
AA.22 Severability 15
Appendix A Bid Submission Documents
AA.01: Definitions

relevant to the requirements set forth in this bidding document

Construction Bidding Statutes*

Public Works Projects
Governed under Massachusetts General Laws, ch. 30, sec. 39M.
Includes all municipal contracts for construction, reconstruction, alteration, remodeling, and/or repair/s estimated to cost more than $5,000 which does not include work on a building. Includes the construction and repair of roads, bridges, water mains, sewers, and the like, as well as improvement to public land (i.e.: operation of a municipal landfill, removal of waste materials, grading, erosion control, and other forms of improvement and maintenance.

Also governs contracts of $5,000 - $25,000 for construction, reconstruction, installation, demolition, maintenance, or repair work on a building.

Building Projects
Governed under Massachusetts General Laws, Ch. 149, sec. 44.
Includes all contracts for the construction, reconstruction, installation, demolition, maintenance, or repair of a building at an estimated cost of more than $25,000.

Lowest Eligible & Responsible Bidder*
Massachusetts G.L. c. 30, sec. 39M; c. 149, sec. 44A state that the contract be awarded to the lowest eligible and responsible bidder.

Eligible means the bidder meets all the requirement set forth in the bidding documents.

Responsible means the bidder possesses the skill, ability, and integrity to complete the job.

Reasonable Accommodations
Any change in work environment or the way job duties are customarily performed that enables individuals with disabilities to perform the essential functions of the job in issue, or that ensures equal opportunity for individuals with disabilities with respect to the application process or the enjoyment of benefits and privileges of employment.

Administering Agency
The agency that administers the state, state-assisted, or federally assisted contract awarded by the contracting agency

Contracting Agency
The agency that directly awards the contract

Contractor
Any general contractor and all subcontractors

* This information is taken directly from "Designing and Constructing Municipal Facilities: Legal Requirements; Recommended Practices; Sources of Assistance" Published by, William Francis Galvin, Secretary of the Commonwealth, Office of the Inspector General, Oct. 1989.
Minors Business Enterprise

As defined by the Massachusetts State Office of Minority/Women Business Assistance (SOMWBA). In summary, an MBE/WBE is a business at least fifty-one percent (51%) owned or controlled by minority/women group members, or an individual contractor or professional who is a minority/women group member (as defined by SOMWBA).

Minority refers to:

**Native American**
A person having origin in any of the original people of North America, who is recognized as American Indian by a tribe or tribal organization or is recognized as such within his/her community

**Asian**
A person having origin in any of the original people of the Far East, Southeast Asia, Indian Subcontinent, Korea, Philippines, and Samoa

**Black**
A person having origin in any of the black racial groups of Africa

**Cape Verdean**
A person having origin in any of the original people of the Cape Verde Islands

**Eskimo / Aleut**
A person having origin in any of the original people of Northern Canada, Greenland, Alaska, and East Siberia

**Hispanic**
A person of Spanish descent and culture having origin in Mexico, the Island of the Caribbean, Central America or South America
AA.02: Statement of Policy

MINORITY/WOMAN BUSINESS ENTERPRISE PROGRAM

It is the policy of the government of the United States of America, the Commonwealth of Massachusetts and the City of New Bedford, that no person shall be discriminated against in any manner whatsoever, on the grounds of race, color, age, national origin, disability, religion, or sex.

Under this policy, the minority and woman business enterprises shall have the maximum practicable opportunity to participate in federally assisted projects, and shall not be excluded from such participation, nor denied the benefits of or be subjected to discrimination under any program or activity receiving federal assistance.

The City of New Bedford unequivocally ascribes to said policies as the recipient of Federal and state financial assistance, in connection with its activities, and may receive further Federal and State financial assistance in the future.

The City of New Bedford strongly affirms that it will not discriminate in any contractual procedure against any person because of race, color, age, national origin, disability, religion, or sex, or any other condition that is a bona fide qualification. This policy shall be administered at all levels with a positive, aggressive and supportive attitude by all department heads.

It is the responsibility of all department heads and employees to take affirmative steps to implement this policy to ensure equality of opportunity in conducting the affairs of the City of New Bedford, including notifying those persons and businesses doing business with the City of New Bedford, that contracts for goods and services and construction, shall be made without, reference to race, color, age, national origin, disability, religion or sex.

This Minority/Woman Business Enterprise Program sets forth the administrative standards for the further implementation of the City of New Bedford’s policy for the utilization of minority and female contractor, subcontractors, and suppliers.

Each department shall ensure that all solicitation in advertisements includes a statement of the City’s affirmative action policy, in an approved format.

The city’s Equal Opportunity Officer shall be responsible for ensuring that all aspects of the MBE/WBE program are initiated and undertaken. By virtue of the delegation of this responsibility and authority to direct the program, the Contract Compliance Officer will report directly to the Mayor on equal opportunity matters. The Equal Opportunity Officer shall be responsible for the development, administration, and monitoring of all activities necessary to ensure the accomplishment and success of this program.

NOW, THEREFORE IT IS HEREBY RESOLVED that the following Minority/Woman Business Enterprise Program is instituted for and in behalf of the City of New Bedford.

[Signature]

Mayor Jonathan P. Mitchell

[Date]

Revised 2007
City of New Bedford
133 William Street
New Bedford, MA 02740

EEO/AA POLICY STATEMENT

City of New Bedford has a statutory mandate under law to guarantee equal treatment for all who seek access to its services or opportunities for employment and advancement. No discrimination will be tolerated on the basis of race, creed, political affiliation, color, sex, national origin, age, or handicap. The ultimate goal is for personnel of this organization to reflect the proportions of minority, female, and handicapped persons in the populations they serve.

City of New Bedford will meet its legal, moral, social, and economic responsibilities for Equal Employment Opportunity/Affirmative Action as authorized and required by all pertinent state and federal legislation, executive orders and rules and regulations, including the following:

1. Title II of the Civil Rights Act of 1964 (42 USC §2000e et seq.), which prohibits discrimination in employment on the basis of race, color, religion, sex, or national origin; and

2. The Age Discrimination in Employment Act of 1967 (29 USC §621 et seq.), which prohibits discrimination in employment on the basis of age with regard to those individuals who are at least 40 years of age, but less than 65 years of age; and

3. Section 504 of the Rehabilitation Act of 1973 (29 USC §794), and the regulations promulgated pursuant thereto (45 CFR Part 84), which prohibit discrimination against qualified handicapped individuals on the basis of handicap and requires employers to make reasonable accommodations to known physical or mental limitations of otherwise qualified handicapped applications and employees; and

4. M.G.L. c. 151B §4 (1), as amended by Chapter 533, 1983, which prohibits discrimination in employment on the basis of race, color, religious creed, national origin, ancestry, age or handicap,

In addition, the Provider agrees to be familiar with and abide by:

* Massachusetts Executive Order 524
* Massachusetts Executive Order 526
* Equal Pay Act of 1963
* Massachusetts Architectural Barriers Board Act
* Federal Executive Orders 11246 and 11375 as amended.
All employees, unions, sub contractors and vendors must make genuine and consistent efforts:

1. To ensure equal employment opportunities for present and future employees, and

2. To implement affirmative action, as legally required, to remedy the effects of past employment discrimination and social inequalities.

The responsibility for implementing and monitoring this policy has been delegated to:

_____________________________
EEO Contract Compliance Officer
Name and Title of Employee

Furthermore, City of New Bedford

prohibits that any employee, or applicant, be subjected to coercion, intimidation, interference or discrimination for filing a complaint or assisting in an investigation under this program. No portion of this Equal Employment Opportunity/Affirmative Action Policy shall be construed as conflicting with any existing or future judicial or legislative mandate where a constriction consistent with that mandate is reasonable.

________________________________________
Signature of Chief Executive

Mayor
Title of Chief Executive

2/18/12
Date
AA.03: City of New Bedford Ordinances - Synopsis

See Appendix A for complete City Ordinances relevant to this bid document

(1) Residency Requirements for Certain City-Supported Construction Projects, Chap. 10, Article II.

(a) shall apply to all general and subcontractors of public works projects which have a projected cost of more than $100,000.00

(b) fifty (50) percent of the total employee man-hours in each trade must be performed by residents of the City of New Bedford (excluding the employer’s foreman or supervisor and two other key employees.)*

** Contact the N.B. EEO Dept. for further assistance in this matter.

(c) resident is defined as someone having his/her true, fixed, and permanent home and principal establishment in the City of New Bedford, for a minimum of six (6) months prior to the contract bid opening date.

(2) Contractor Qualifications and Sanctions, a.k.a. The Responsible Employer Plan, Chap. 10-77. ** see letter attached

(a) shall apply to all bidders and subcontractors for projects subject to MGL c. 149

(b) not applicable to construction projects where the low general bid was less than $100,000; to subcontracts bid for less then $25,000; or to re-bids for which the City receives fewer than three (3) qualified bidders in the original bid

(c) must pay appropriate lawful prevailing wage rates to employees

(d) must maintain or participate in a bona fide apprentice training program for each apprenticeable trade represented in the workforce

(e) must furnish hospitalization and medical benefits and maintain appropriate accident insurance coverage

(f) must classify all employees as employees rather than independent contractors, and treat accordingly regarding workers’ compensation, unemployment taxes, social security taxes and income tax withholding.

AA.04: Contractors Agreements under Executive Order 11246, as Amended by Executive Order 11375

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure EQUAL EMPLOYMENT OPPORTUNITY

005203 - 21
that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment of compensation; and selection of training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers’ representative of the contractor’s commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order No. 11246 of Sept. 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascerta

(6) In the event of the contractor’s noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order, unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of Sept. 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

AA.05: Dept. of Labor, 41 Code of Federal Regulations Parts 60-1, 60-6 - Government Contractors, Affirmative Action Requirements, Executive Order 11246

(1) Segregated Facilities. The contractor hereby certifies that it does not and will not maintain or provide any facilities for its employees in a segregated manner, or permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. Further, the contractor shall obtain a similar certification of nonsegregated facilities prior to the award of

EQUAL EMPLOYMENT OPPORTUNITY 005203 - 22
any contract or subcontract, which is subject to Executive Order 11246, and shall provide a copy thereof to the Association. This clause prohibits segregation on the basis of race, color, religion, national origin, or sex, and applies to all contracts regardless of the amount thereof. The term "facilities" includes, but is not limited to, waiting rooms, work areas, restaurants and other eating areas, time clock, parking lots, drinking fountains, recreation or entertainment areas, transportation, employer-provided housing, washrooms, locker rooms or other storage or dressing areas.

(2) Affirmative Action Compliance Program. The contractor certifies that it has developed a written affirmative action compliance program for each of its establishments consistent with the rules and regulations published by the Department of Labor in 41 CFR Chapter 60, and agrees to require a similar certification from each of its nonexempt subcontractors. Such an affirmative action program shall contain a set of specific and result-oriented procedures, the objective of which shall be the achievement of equal employment opportunity. An acceptable affirmative action program must include an analysis of areas within which the contractor is deficient in the utilization of minority groups and women and further, goals and timetables to which the contractor’s good faith efforts must be directed to correct any deficiencies and, thus, to achieve prompt and full utilization of minorities and women, at all levels and in all segments of his work force where deficiencies exist. The contractor’s affirmative action plan shall be summarized and updated annually and the program summary shall be submitted to the Office of Federal Contract Compliance Programs (OFCCP) on the anniversary date of the contractor’s affirmative action program.

(3) Contractor’s Compliance with Exec. Order and 41 CFR Par 60-4. The contractor’s compliance with E.O. 11246 and 41 C.F.R. Part 60-4, shall be based on its implementation of the Equal Opportunity clause, specific affirmative action obligations required by the specifications set forth in 41 C.F.R. 60-4.3, and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed.

AA.06: Section 503 of the Rehabilitation Act of 1973
(Dept. of Labor, 41 Code of Federal Regulations, Parts 60-250 and 60-741, Affirmative Action & Nondiscrimination Obligations of Contractors and Subcontractors Regarding Individuals with Disabilities, Disabled Veterans, and Veterans of Vietnam Era)

Parties holding a Government contract or subcontract in excess of $10,000 must take affirmative action to employ and advance in employment-qualified individuals with disabilities. Contractors are required to use effective practices to recruit qualified individuals with disabilities.

Applicants with disabilities must be provided a reasonable accommodation if they are qualified with respect to the application process (e.g.: if they present themselves at the correct location and time to fill out an application).

AA.07: MBE / WBE Policy (for the life of the project)

(1) Eleven (11) percent of the work on this project shall be performed by Minority Business Enterprises (MBEs) and five (5) percent of the work shall be performed by Women Business Enterprises (WBEs) for a total of 16% overall. Four (4%) percent of all Airport projects shall be performed by Disadvantaged Business Enterprises (DBE). Proven documentation of nonavailability of either one of these entities provides that the available businesses may be awarded no less than 16% of the total contract dollar value for most City projects and 4% of Airport projects.
(2) The Bidder must submit with the bid the necessary certification setting forth the bidder’s compliance with the MBE/WBE contractors or the DBE contractors when required. FAILURE TO SUBMIT THESE CERTIFICATIONS AT THE TIME OF THE BID MAY RESULT IN THE BID BEING CONSIDERED NONRESPONSIVE.

(3) If it is determined that one or more of the MBE/WBE or DBE contractors, as submitted by the Contractor on the EEO forms, is not SOMWBA certified or certified by the Local Government Unit, in accordance with the provision of Executive Order 237, the bidder shall have five (5) working days following notification to either find a certified MBE/WBE/DBE contractor to perform work equal to or greater than that of the uncertified contractor, or to submit a waiver request.

(4) The contractor shall not enter into any subcontract with any person or firm debarred from government contracts, pursuant to Executive Order 11246.

AA.08: Workforce Utilization (for the life of the project)

(1) Minimum percentages for employment (workforce utilization) on the project are at 18% minority and 6.9% female participation. The employment percentages shall apply to the contractor and to all subcontractors, regardless of tier, for all on-site work.

A single goal for minorities and a separate goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the contractor has achieved its goals for women generally, the contractor may be in violation of the Exec. Order if a specific minority group of women is under-utilized.)

(3) The contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

AA.09: Contractor’s EEO / Records Monitor

The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof, as may be required by the Government, and to keep records which shall at least include, for each employee, the name, address, telephone numbers, social security number, race, sex, status, (e.g.: mechanic, apprentice, trainee, helper, or laborer) dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents.

AA.10: Bidder’s Eligibility

The lowest responsible and eligible bidder shall mean the General Bidder whose bid is the lowest of those bidders demonstrating possession of the skill, ability and integrity necessary for the faithful
performance of the work, and (a) who shall certify that he/she is able to furnish labor that can work in harmony with other labor employed on the work;

(b) who shall certify that he/she will comply with the minority workforce goal (18%) the woman workforce goal (6.9%) and, for projects $100,000+, NB residency goal of 50%; the insurance that all subcontractors and/or sub-subcontractors are also in compliance with workforce utilization goals; including compliance with the minority business goal (11%) and woman business goal (5%), for a total of 16% (or 4.0% for Airport projects) of the total dollar amount of the contract, and will certify that it will meet all applicable City Ordinances in accordance with this contract provision.

AA.11: Bid Submission Requirements

(1) Required bid forms that must be completed, signed, and submitted with the bid at the time of the bid opening, are as follows:

(a) Certificate of Understanding; Certification of Compliance w/ Exec. Order 11246

(b) Schedule of Participation for MBE/WBE or DBE as required

(c) Letter of Intent (for each MBE/WBE/DBE participation)

(d) MBE/WBE/DBE Contractor Identification Statement (for each MBE/WBE/DBE)

(e) Bidder’s Certification (to be completed by both the General Contractor and each MBE/WBE/DBE)

(f) If applicable, a completed and signed MBE/WBE/DBE Unavailability Certification in the event that the work listed on the Schedule is not sufficient to fulfill the requirement for MBE/WBE/DBE Participation. This certification must include a statement by the bidder of the reasons why it believes it is in compliance with this provision, and a list of the names, addresses, telephone numbers and reason given for unavailability of the Minority/Women Contractor contacted by the bidder with respect to the performance of work under the contract.

(2) The successful bidder will also be required to submit, prior to award, its estimates of labor (permanent and trainee) and material required to carry out its work under the contract, for review by the City, so as to establish maximum feasible goals for the utilization of City residents and business concerns. These goals, and the basis for monitoring and reporting progress toward meeting them, will be established by mutual agreement, with the assistance of the City’s Contract Compliance Officer, and discussed in the Pre-Construction or Pre-Award Conference.

AA.12: Bid Approval or Disapproval

(1) Failure to submit any of the required MBE/WBE/DBE forms and percentages at the time of the bid, will have the Bid/Proposal eliminated. Failure to meet the required percentages, or to fully complete any of the submitted paperwork, at the time of the bid opening, the bidder will have five (5) days, from the date of the bid opening, to comply with the requirements. Failure to meet these requirements within the five days will have the Bid/Proposal disapproved by the Office of Equal Opportunity.

(2) Each bidder, as part of its bid submission, must agree to contract with minority and woman owned businesses, as defined by the State Office of Minority and Woman Business Assistance (SOMWBA) and the City of New Bedford’s affirmative action policies. The amount of participation reserved for such enterprises shall not be less than
16% of the total bid amount, of which at least 11% of the total bid amount applies to minority businesses. The balance 5% is applied to women-owned businesses. Proven documentation of non-availability of either one of these entities provides that the available business may be awarded no less than 16% of the total contract dollar value.

(3) If the general bidder is either an MBE or WBE and is responsible for 100% of the project work, the 16% is fulfilled. If said MBE/WBE contractor is a joint venture, the MBE/WBE must be responsible for at least 51% of the project.

(4) The general contractor must submit, as part of its bid and as a condition of contract approval, signed Letters of Intent with all subcontractors and material suppliers listed on the participation schedule. Sub-bidders must submit the participation schedule with their bid and a participation schedule if they intend to sub-sub work.

AA.13: Steps to Ensure a Responsive Bid

The total price for work to be performed by Minority/Woman or Disadvantaged Contractors, as indicated in each bidder’s bid submission, is required to be sufficient to fulfill the MBE/WBE/DBE requirements, unless the bidder shall demonstrate to the satisfaction of the Awarding Authority that:

(1) it has made every possible effort to contact and negotiate with Minority/Women or Disadvantaged Contractors in an attempt to subcontract work, including every possible effort to select the portions of the work proposed to be subcontracted in order to meet the requirements;

(2) it was unable, notwithstanding such efforts, to achieve the stated requirement because Minority/Woman or Disadvantaged Contractors were not qualified or were unavailable.

(any proven nonavailability of MBE/WBE/DBE must make up the difference to still fulfill the 16% goals with the available MBE or WBE or 4.0% DBE. If neither category is available to fulfill the goal, it must have a SOMWBA statement as to no business listed);

(3) it included in its Schedule of Participation such proposed agreements as could be made with such efforts;

(4) the general contractor is an MBE or WBE and said contractor is performing 16% of work or the general contractor is a DBE and is performing 4.0% of the work and therefore, will be deemed as fulfilling the affirmative action bidding requirements;

(5) for contractors under $50,000, that can demonstrate all work will be completed under the contractor’s own workforce, the contractor must be able to demonstrate how this will be accomplished and submit, at the time of the bid a statement requesting a waiver of the 16% MBE/WBE or 4.0% DBE participation goal. Employment percentages must still be met.

AA.14: Bid Award or Rejection

(1) The Awarding Authority will responsible for awarding or rejecting any bid, with the approval/disapproval of the Office of Equal Opportunity & Contract Compliance in its decision. The Awarding Authority also reserves the right to reject any or all bids, or to accept any other than
the lowest bidder, should it be deemed to be in the best interest of the City of New Bedford, Massachusetts, to do so.

(2) The Awarding Authority shall reject, as non-responsive, any bid, which it determines, fails to comply with the applicable requirements of this contract provision. Nothing, herein, shall relieve any bidder or any contractor performing any work under the contract, from any of the terms, conditions, or requirements of the contract.

AA.15: Awarded Contractor’s Obligations

(1) The Contractor shall specifically ensure that the company’s EEO policy and affirmative action obligations under this contract provision, is reviewed with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decision, including specific review of these terms with on-site supervisory personnel, prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(2) Minority/Woman Work Hours must be maintained for the life of this project (at a minimum ratio of 18% minority work hours and 6.9% woman work hours to total work hours in each job category, including, but not limited to bricklayers, carpenters, cement masons, electricians, ironworkers, operating engineers, and those classes of work identified in Section 44C of M.G.L. ch. 149). (Please note the City of New Bedford’s Residency Ordinance requiring 50% City of New Bedford residents on projects of $100,000+)

(3) Apprentices and Trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability, in order for the apprentices and trainees to be counted toward the minority/woman work hour percentage goals.

(4) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the contractor has a collective bargaining agreement to refer either minorities or women, shall excuse the contractor’s obligation under these specifications, Exec. Order 11246, or the regulations promulgated pursuant thereto.

(5) In the employment of journeymen, apprentices, teamsters and laborers, the Contractor shall give preference first, to citizens of the Commonwealth who have served in the armed forces of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work which the employment relates, and secondly, to citizens of the City of New Bedford, and if such cannot be obtained in sufficient numbers, the Commonwealth generally, then to citizens of the United States.

(6) Reports to Be Submitted to the Office of Equal Opportunity & Contract Compliance include:

(a) Licensing Statutes: Every contractor and subcontractor must submit, before starting work, a plan by which he/she will satisfy the requirements of licensing statutes, including the following, where applicable: MGL Ch. 149, Sec. 6 (painters); Ch. 146, Sec. 53 (hoisting engineers); Ch. 149, Sections 6B-6F (asbestos abatement workers, supervisors & contractors); Ch. 146, Sec. 3 & 3B (plumbers & gas fitters); Ch. 141, Sec. 1 (electricians); Ch. 14, Sec. 84 (pipefitters & sprinkler fitters); and Ch. 143, Sec. 94 (construction supervisor).
(b) **Work Hour Reports:** The contractor and each subcontractor shall prepare weekly reports in an approved form, of the hours worked in each trade by each employee, identified as minority or non-minority, and/or female, and/or resident. Copies of these shall be provided at the end of each such week to the City’s Office of Equal Opportunity & Contract Compliance.

(c) **Projected Manning Tables:** The contractor shall prepare projected manning tables on a quarterly basis. These shall be broken down into projections, by week, of workers required in each trade. Copies shall be furnished one week in advance of the commencement of the period covered, and also when updated, to the City. A copy of the certified payroll will be submitted with these reports.

(d) **Billing Reports:** The contractor shall prepare and submit monthly billing reports of amounts paid to MBEs, WBEs and/or DBEs each monthly billing period, as well as the record of final payment accompanied by canceled checks.

(e) **Payroll Reports:** Every contractor and subcontractor shall submit weekly payroll reports to the City, indicating the following information for each employee and/or independent contractor employed on the project; name, address, hours worked, occupational classification, wages, and fringe benefit payments, if any. Said reports shall be signed by the employer or his authorized agent under the penalties of perjury (see MGL Ch. 149, Section 27B).

**AA.16 Recruitment/Referral Responsibilities**

(1) In the hiring of minority/woman journeymen, apprentices, teamsters, and laborers, the contractor shall rely on referrals from a multi-employer affirmative action program approved by the City, traditional referral method utilized by the construction industry, and referrals from agencies, not more than three in number at any one time, designated by the City’s Equal Opportunity Officer.

(2) Records of employment referral orders, prepared by the contractor, shall be made available to the awarding authority.

(3) The contractor will maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization, and of what action was taken with respect to each such individual.

(4) If such individual was sent to the union hiring hall for referral, and was not referred back to the contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the contractor may have taken.

(5) The contractor will document and maintain a record of all solicitations of offers for subcontractors from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractors' associations and groups.

(6) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin, and maintain a record thereof.
AA.17: Subcontracts

(1) The Contractor receiving the award of the contract shall be required to obtain from each of its subcontractors (filed or non-filed) and submit to the Authority prior to the performance of any work under said subcontract, a certification by said subcontractor, regardless of tier, that it will comply with the minority and women work hours/employee ratio and specific affirmative action steps, and to submit this information to the Office of Equal Opportunity, prior to the subcontractor’s performance on the project.

(2) In order to ensure that the said subcontractor’s certification becomes a part of all subcontracts under the prime contract, no subcontract shall be executed until an authorized representative of the Authority administering this project has determined, in writing, that the said certification has been incorporated in such subcontract, regardless of tier. Any subcontract executed without such written approval shall be void.

(3) Whenever the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000, the contract provisions listed in this Instructions to Bidders for Affirmative Action Issues, and the applicable goals for minority and female participation and which is set forth in the solicitation form which the contract resulted.

(4) Noncompliance of a subcontractor in compliance with these provisions, will result in the contractor taking such action, with respect to any subcontract or purchase order, as the administering agency may direct, as a means of enforcing such equal opportunity provisions; provided that, in the event a contractor becomes involved in, or is threatened with litigation with a subcontractor or vendor, as a result of such direction, the contractor may request the United States, the State of Massachusetts or the City of New Bedford, to enter into such litigation to protect the interests of the U.S., the State or the City.

AA.18: Wage Rates

(1) Attention is called to Labor Standards provisions regarding conditions of employment, including State and Federal Wage Rates, the Davis-Bacon Act, the Copeland Anti-Kickback Act, and the Contract Work Hours and Safety Standards Act. Where Federal and State wage rates differ, the higher rates shall be used as a minimum.

(2) The rate per hour of the wages to be paid to mechanics, apprentices, teamsters, chauffeurs, and laborers employed on the work shall be not less then the rate of wages in Minimum Wage Rates as determined by the Commissioner of Labor and Industries, as required by M.G.L. Chapter 149, Sections 26 & 27-27h. This schedule shall be in place for said employees during the life of this contract.

(3) Contractor shall keep posted on the site, a legible copy of said schedule. Keep on file wage rates and classifications of labor employed on this work, in order that they may be available for inspection by the Administrator, the Office of Equal Opportunity, or the Architect.

(4) Apprentices employed pursuant to this determination of wage rates must be registered and approved by the State Apprenticeship Council, wherever rates for journeymen or apprentices are not listed.

(5) Pay reserve police officers employed on this work the prevailing rate of wages paid to regular police officers, as required by M.G.L. Chap. 149, Sec. 34B, as amended. Such police officers shall
be covered by Workmen’s Compensation Insurance and Employer’s Liability Insurance by the Contractor.

(6) Noncompliance by the contractor or any subcontractor will result in the City’s Contract Compliance Office and/or Legal Office, to consult with the Department of Labor and Industries, and will result in the contractor or subcontractor receiving notification of such, and subsequently must respond to the City of New Bedford within five (5) business days.

**AA.19: Access to Compliance Information & Reports**

(1) The contractor will provide all information and reports, required by the administering agency or the City of instructions issued by either of them, and will permit access to its facilities and any books, records, accounts, and other sources of information pertinent to the City’s affirmative action contract requirements.

(2) Where the information required is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to the administering agency or the City, and shall set forth what efforts he/she has made to obtain the information.

**AA.20: Noncompliance**

(1) Investigation

Whenever the administering agency or the City believe the general contractor or any subcontract may not be operating in compliance with the terms of this provision, the City directly or through it designated agent, shall conduct an appropriate investigation, and may confer with the parties, to determine if such contractor is operating in compliance with the terms of this contract provision. If noncompliance is found, then a preliminary report on noncompliance will be made, and the City or its agent will notify such contractor, in writing, of such steps as will, in the judgment of the city or its agent, bring such contractor into compliance.

(2) Report of Noncompliance

In the event that such contractor fails or refuses to fully perform such affirmative action steps, the City shall make a final report of non-compliance, and recommend to the administering agency, the imposition of one or more of the sanctions identified in these provisions. Within fourteen (14) days of the receipt of the recommendations of the City, the administering agency shall move to impose one or more of the following sanctions as it may deem appropriate to attain full and effective enforcement.

(3) Any disagreement between the City and a contractor or subcontractor shall be submitted for a hearing pursuant to the provisions of Chapter 30A. The City shall impose one or more of the following sanctions, as it may deem appropriate, to attain full and effective enforcement.

**AA.21: Sanctions**

(1) The recovery by the administering agency from the general contractor of 1/100 of 1% of the contract award price, or $1,000.00, whichever sum is greater, in the nature of liquidated damages, or if a subcontractor is in non-compliance, the recovery by the administering agency from the general contractor, a back charge against the subcontractor, of 1/10 of 1% of the
subcontract price or $400.00, whichever sum is greater, in the nature of liquidated damages, for each week that such party fails or refuses to comply.

(2) The suspension of any payment or part thereof, due under the contract, until such as the general contractor or any subcontractor is able to demonstrate his/her compliance with the terms of the preceding sections of the contract.

(3) The termination of employment of the contractor and taking possession of the site and finishing the work by whatever method he/she may deem expedient, upon giving the contractor and his/her surety, if any, seven days written notice.

(4) The termination or cancellation of the contract, in whole or in part.

(5) The denial to the general contractor and any subcontractor of the right to participate in any future contract awarded by the administering agency for a period of up to three years.

(6) Other sanctions to be applied, as stipulated in the City of New Bedford Ordinances (Residency and Responsible Employer Plan ordinances) and other local, state, and federal laws and regulations, as applicable.

AA.22: Appeal of Sanctions

If, at any time after imposition of one or more of the sanctions listed in these provisions, the contractor or subcontractor is able to demonstrate that it is in compliance with the EEO/AA program, the contractor or subcontractor may request the administering or contracting agency, in consultation with the City’s Office of Equal Opportunity, to conditionally suspend the sanction, pending final determination by the investigating officer, whether the contractor is in compliance. Upon final determination by the investigating office, the administering or contracting agency, based on the investigating officer’s recommendation, shall either lift the sanctions or impose them.

Sanctions shall not be imposed by the contracting agency or administering agency except after an adjudicatory proceeding, as defined by M.G.L. Chapter 30A, has been conducted. No investigation by the Office of Equal Opportunity shall be initiated without prior notice to the contractor or the subcontractor.

AA.23: Severability

The provisions of this section are severable, and if any of these provisions shall be held unconstitutional by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

[PLEASE SEE 004100 BID CERTIFICATIONS & SUBMISSIONS FOR EEO BID SUBMISSION FORMS]
**NOTICE REGARDING RESPONSIBLE EMPLOYER ORDINANCE (REO)**

**CITY OF NEW BEDFORD**

DATE: July 1, 2014

TO: ALL POTENTIAL BIDDERS

FROM: OFFICE OF PROCUREMENT


The City is temporarily suspending the enforcement of these sections because of the above referenced legal precedent. However, the City believes that the ultimate goals reflected in the REO are important and the City encourages voluntary compliance with the spirit of these provisions. Moreover, the City will monitor all contractors who are awarded contracts to determine whether they are making a good faith effort to abide by the spirit of these provisions. Moving forward, the City is particularly interested in ensuring that the hiring and training of the local workforce is a top priority on all City projects. The City is willing to work closely with all successful bidders by assisting them in identifying viable well-trained workers who are residents of the City of New Bedford.

The sections listed below will not be enforced at this time. All other sections of the City Ordinance will be strictly enforced.

Section 10-76:

In order to assist the unemployment rate, to assist the problem of businesses leaving the region, to decrease the number of businesses filing bankruptcy, to combat the recession in the region, to assist the problem caused by the reduction of local aid from the commonwealth and to assist in preventing the depletion of the tax base, all general and subcontractors constructing or rehabilitating public works projects which have a projected cost of more than one hundred thousand dollars ($100,000.00) and are funded in full or in part with federal, state, or city funds, shall have the worker hours on a craft by craft basis performed by residents of the City of New Bedford, who shall comprise at least fifty (50) percent of the total employee man-hours in each trade, excluding the employer’s foreman or supervisor and two (2) other key employees.

Section 10-76 (4):

Any person who provides false information regarding his or her residence shall be penalized three hundred dollars ($300.00): Any contractor or subcontractor who violates the provisions of this section shall be penalized three hundred dollars ($300.00) per day for each and every day the ordinance is in violation. Said penalty shall be levied and withheld from payments due the contractor or subcontractor.
Section 10-77 (a)(3):

The bidder and all subcontractors under the bidder must maintain or participate in a bona fide apprentice training program, as defined by M.G.L.A. c. 23, §§ 11H and 11I, for each apprenticeable trade or occupation represented in their workforce that is approved by the division of apprentice training of the
CONTRACTOR IMMIGRATION CERTIFICATION

As evidenced by the signature of the Contractor’s Authorized signatory below, the Contractor certifies under the pains and penalties of perjury that the Contractor shall not knowingly use undocumented workers in connection with the performance of any City contract; that pursuant to federal and state requirements, the Contractor shall verify the immigration status of all workers assigned to such contracts without engaging in unlawful discrimination; and that the Contractor shall not knowingly or recklessly alter, falsify, or accept altered or falsified documents from any such worker(s). The Contractor understands and agrees that breach of any of these terms during the period of each contract may be regarded as a material breach, subjecting the Contractor to sanctions, including but not limited to monetary penalties, withholding of payments, contract suspension or termination.

____________________________
Contractor Authorized Signature

__________________________
Printed Name

__________________________
Date

Title________________________ Telephone:_________________

Fax:________________________ Email:________________
OSHA CERTIFICATION REQUIREMENT

Effective July 1, 2006, all employees of a contractor to be employed on public building and public works worksites must have successfully completed at least a 10 hour course in construction safety and health approved by OSHA at the time the employee begins work.

I, ___________________________, as ___________________________, of the
(Print Name) (Position with the entity submitting bid)

joint venture/corporation/partnership or other legal entity submitting this bid for a public works project falling under §39M of Chapter 30 of the Massachusetts General Laws and Chapter 149 of the same, do hereby certify that any and all employees found on my worksite for this project have, or will have by the start of their work on the project, successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that was at least 10 hours in duration.

A copy of the OSHA completion cards for each employee must be submitted to the City of New Bedford before work on this project is to begin and must be supplemented as new employees are hired or contracted to work on this project.

_____________________________, as
Signature
_____________________________, of
Position
_____________________________, on
Company/Corporation/Joint Venture/Partnership/Etc.

__________________________
Date
CONTRACTOR’S EEO CERTIFICATION

(Name of Contractor)

Certifies that:

1. It intends to use the following listed construction trades in the Work under the Contract

   (Name of Trades)

   and

2. will comply with the minority manpower ratio and specific affirmative action steps contained herein; and

3. will obtain from each of its subcontractors and submit to the contracting or administering agency prior to the award of any subcontract under this Contract the subcontractor certification required by these Bid considerations.

   (Signature of Authorized Representative of the Contractor)
SUBCONTRACTOR’S EEO CERTIFICATION

______________________________

(Name of Subcontractor)

Certifies that:

1. It intends to use the following listed construction trades in the work under the subcontract ____________________________

2. will comply with the minority manpower ratio and specific affirmative action steps contained herein; and

3. will obtain from each of the subcontractors prior to the award of any subcontract under this subcontract the subcontractor certification required by these Bid considerations.

______________________________

(Signature of Authorized Representative of the Subcontractor)
THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates
As determined by the Director under the provisions of the
Massachusetts General Laws, Chapter 149, Sections 26 to 27H

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

ROSA LIN ACOSTA
Secretary

WILLIAM D MCKINNEY
Director

Awarding Authority: City of New Bedford
Contract Number: 18300505
City/Town: NEW BEDFORD
Description of Work: Elizabeth Carter Brooks School Window, Door & Boiler Replacement  Filed Sub- Trades: Windows

Job Location: 212 Nemasket Street, New Bedford, MA

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

• This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the “Wage Request Number” on all pages of this schedule.

• An Awarding Authority must request an updated wage schedule from the Department of Labor Standards (“DLS”) if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.

• The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.

• All apprentices working on the project are required to be registered with the Massachusetts Department of Labor Standards, Division of Apprentice Standards (DLS/DAS). Apprentice must keep his/her apprentice identification card on his/her person during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. Any apprentice not registered with DLS/DAS regardless of whether or not they are registered with any other federal, state, local, or private agency must be paid the journeyworker's rate for the trade.

• The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule. Awarding authorities are required to request these updates no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, awarding authorities must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. Contractors are required to obtain the wage schedules from awarding authorities, and to pay no less than these rates to covered workers. The annual update requirement is not applicable to 27F “rental of equipment” contracts.

• Every contractor or subcontractor which performs construction work on the project is required to submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee’s name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. A sample of a payroll reporting form may be obtained at http://www.mass.gov/dols/pw.

• Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.

• Employees not receiving the prevailing wage rate set forth on the wage schedule may report the violation to the Fair Labor Division of the office of the Attorney General at (617) 727-3465.

• Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and

Issue Date: 10/30/2018  Wage Request Number: 20181030-061
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2 AXLE) DRIVER - EQUIPMENT</td>
<td>12/01/2016</td>
<td>$32.15</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$53.95</td>
</tr>
<tr>
<td>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3 AXLE) DRIVER - EQUIPMENT</td>
<td>12/01/2016</td>
<td>$32.22</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$54.02</td>
</tr>
<tr>
<td>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4 &amp; 5 AXLE) DRIVER - EQUIPMENT</td>
<td>12/01/2016</td>
<td>$32.34</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$54.14</td>
</tr>
<tr>
<td>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADS/SUBMERSIBLE PILOT</td>
<td>08/01/2018</td>
<td>$97.80</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$128.85</td>
</tr>
<tr>
<td>PILE DRIVER LOCAL 56 (ZONE 2)</td>
<td>08/01/2019</td>
<td>$102.78</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$133.83</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- PILE DRIVER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIR TRACK OPERATOR</td>
<td>06/01/2018</td>
<td>$34.00</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.72</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$34.84</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.56</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$35.71</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.43</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$36.57</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.29</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$37.46</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.18</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$38.35</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.07</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$39.27</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.99</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$40.18</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.90</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASBESTOS WORKER (PIPES &amp; TANKS)</td>
<td>06/01/2018</td>
<td>$36.90</td>
<td>$11.50</td>
<td>$7.10</td>
<td>$0.00</td>
<td>$55.50</td>
</tr>
<tr>
<td>HEAT &amp; FROST INSULATORS LOCAL 6 (SOUTHERN MASS)</td>
<td>12/01/2018</td>
<td>$37.90</td>
<td>$11.50</td>
<td>$7.10</td>
<td>$0.00</td>
<td>$56.50</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$38.90</td>
<td>$11.50</td>
<td>$7.10</td>
<td>$0.00</td>
<td>$57.50</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$39.90</td>
<td>$11.50</td>
<td>$7.10</td>
<td>$0.00</td>
<td>$58.50</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$40.90</td>
<td>$11.50</td>
<td>$7.10</td>
<td>$0.00</td>
<td>$59.50</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$41.90</td>
<td>$11.50</td>
<td>$7.10</td>
<td>$0.00</td>
<td>$60.50</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASPHALT RAKER</td>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE</td>
<td>06/01/2018</td>
<td>$47.08</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.58</td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>12/01/2018</td>
<td>$48.23</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.73</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$49.33</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.83</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$50.48</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.98</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.58</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.08</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.73</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.23</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.33</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$81.48</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>----------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>---------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>BACKHOE/FRONT-END LOADER OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2018</td>
<td>$47.08</td>
<td>$11.00</td>
<td>$15.50</td>
<td>0.00</td>
<td>$73.58</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$48.23</td>
<td>$11.00</td>
<td>$15.50</td>
<td>0.00</td>
<td>$74.73</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$49.33</td>
<td>$11.00</td>
<td>$15.50</td>
<td>0.00</td>
<td>$75.83</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$50.48</td>
<td>$11.00</td>
<td>$15.50</td>
<td>0.00</td>
<td>$76.98</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.58</td>
<td>$11.00</td>
<td>$15.50</td>
<td>0.00</td>
<td>$78.08</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.73</td>
<td>$11.00</td>
<td>$15.50</td>
<td>0.00</td>
<td>$79.23</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>0.00</td>
<td>$80.33</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>0.00</td>
<td>$81.48</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BARCO-TYPE JUMPING TAMPER LABORERS - ZONE 2</td>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$61.40</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLOCK PAVER, RAMMER / CURB SETTER LABORERS - ZONE 2</td>
<td>06/01/2018</td>
<td>$34.00</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$55.72</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$34.84</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$56.56</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$35.71</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$57.43</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$36.57</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$58.29</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$37.46</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$59.18</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$38.35</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$60.07</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$39.27</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$60.99</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$40.18</td>
<td>$7.70</td>
<td>$14.02</td>
<td>0.00</td>
<td>$61.90</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOILER MAKER BOILERMAKERS LOCAL 29</td>
<td>03/01/2018</td>
<td>$43.57</td>
<td>$7.07</td>
<td>$17.46</td>
<td>0.00</td>
<td>$68.10</td>
</tr>
<tr>
<td></td>
<td>01/01/2019</td>
<td>$44.71</td>
<td>$7.07</td>
<td>$17.72</td>
<td>0.00</td>
<td>$69.50</td>
</tr>
<tr>
<td></td>
<td>01/01/2020</td>
<td>$46.10</td>
<td>$7.07</td>
<td>$17.98</td>
<td>0.00</td>
<td>$71.15</td>
</tr>
</tbody>
</table>
### Apprenticeship - BOILERMAKER - Local 29

#### Effective Date - 03/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>$28.32</td>
<td>$7.07</td>
<td>$11.37</td>
<td>$0.00</td>
<td>$46.76</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>$28.32</td>
<td>$7.07</td>
<td>$11.37</td>
<td>$0.00</td>
<td>$46.76</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$30.50</td>
<td>$7.07</td>
<td>$12.23</td>
<td>$0.00</td>
<td>$49.80</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$32.68</td>
<td>$7.07</td>
<td>$13.11</td>
<td>$0.00</td>
<td>$52.86</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$34.86</td>
<td>$7.07</td>
<td>$13.97</td>
<td>$0.00</td>
<td>$55.90</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>85</td>
<td>$37.03</td>
<td>$7.07</td>
<td>$14.86</td>
<td>$0.00</td>
<td>$58.96</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$39.21</td>
<td>$7.07</td>
<td>$15.72</td>
<td>$0.00</td>
<td>$62.00</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>95</td>
<td>$41.39</td>
<td>$7.07</td>
<td>$16.61</td>
<td>$0.00</td>
<td>$65.07</td>
<td></td>
</tr>
</tbody>
</table>

#### Effective Date - 01/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>$29.06</td>
<td>$7.07</td>
<td>$11.52</td>
<td>$0.00</td>
<td>$47.65</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>$29.06</td>
<td>$7.07</td>
<td>$11.52</td>
<td>$0.00</td>
<td>$47.65</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$31.30</td>
<td>$7.07</td>
<td>$12.40</td>
<td>$0.00</td>
<td>$50.77</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$33.53</td>
<td>$7.07</td>
<td>$13.30</td>
<td>$0.00</td>
<td>$53.90</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$35.77</td>
<td>$7.07</td>
<td>$14.18</td>
<td>$0.00</td>
<td>$57.02</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>85</td>
<td>$38.00</td>
<td>$7.07</td>
<td>$15.07</td>
<td>$0.00</td>
<td>$60.14</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$40.24</td>
<td>$7.07</td>
<td>$15.95</td>
<td>$0.00</td>
<td>$63.26</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>95</td>
<td>$42.47</td>
<td>$7.07</td>
<td>$16.84</td>
<td>$0.00</td>
<td>$66.38</td>
<td></td>
</tr>
</tbody>
</table>

### Notes:
- Apprentice to Journeyworker Ratio: 1:4

**BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING)**

**BRICKLAYERS LOCAL 3 (NEW BEDFORD)**

**Issue Date:** 10/30/2018  
**Wage Request Number:** 20181030-061  
**Page 4 of 41**
### BRICK/PLASTER/CEMENT MASON - Local 3 New Bedford

**Apprentice -** BRICK/PLASTER/CEMENT MASON - Local 3 New Bedford  
**Effective Date -** 08/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$26.46</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$57.87</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$31.75</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$63.16</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$37.04</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$68.45</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$42.33</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$73.74</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$47.62</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$79.03</td>
</tr>
</tbody>
</table>

**Effective Date -** 02/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$26.78</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$58.19</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$32.13</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$63.54</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$37.49</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$68.90</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$42.84</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$48.20</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$79.61</td>
</tr>
</tbody>
</table>

**Notes:**  
Apprentice to Journeyworker Ratio: 1:5

**BULLDOZER/GRADER/SCAPER OPERATING ENGINEERS LOCAL 4**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

**CAISSON & UNDERPINNING BOTTOM MAN LABORERS - FOUNDATION AND MARINE**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$39.10</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$62.20</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$40.05</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$63.15</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$41.05</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.15</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$42.05</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$65.15</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$43.04</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$66.14</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$44.02</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$67.12</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$45.04</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$68.14</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$46.05</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$69.15</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAISSON &amp; UNDERPINNING LABORER</td>
<td>06/01/2018</td>
<td>$37.95</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$61.05</td>
</tr>
<tr>
<td>LABORERS - FOUNDATION AND MARINE</td>
<td>12/01/2018</td>
<td>$38.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$62.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$39.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$40.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$41.89</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.99</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$42.87</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$65.97</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$43.89</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$66.99</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$44.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$68.00</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAISSON &amp; UNDERPINNING TOP MAN</td>
<td>06/01/2018</td>
<td>$37.95</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$61.05</td>
</tr>
<tr>
<td>LABORERS - FOUNDATION AND MARINE</td>
<td>12/01/2018</td>
<td>$38.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$62.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$39.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$40.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$41.89</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.99</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$42.87</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$65.97</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$43.89</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$66.99</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$44.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$68.00</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARBIDE CORE DRILL OPERATOR</td>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARPENTER</td>
<td>09/01/2018</td>
<td>$41.32</td>
<td>$9.90</td>
<td>$17.50</td>
<td>$0.00</td>
<td>$68.72</td>
</tr>
<tr>
<td>CARPENTERS -ZONE 2 (Eastern Massachusetts)</td>
<td>03/01/2019</td>
<td>$42.35</td>
<td>$9.90</td>
<td>$17.50</td>
<td>$0.00</td>
<td>$69.75</td>
</tr>
</tbody>
</table>
### Classification: Carpenter - Zone 2 Eastern MA

#### Apprentice - Effective Date: 09/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>75</th>
<th>80</th>
<th>80</th>
<th>90</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$20.66</td>
<td>$24.79</td>
<td>$28.92</td>
<td>$30.99</td>
<td>$33.06</td>
<td>$33.06</td>
<td>$37.19</td>
<td>$37.19</td>
</tr>
<tr>
<td>2</td>
<td>$21.18</td>
<td>$25.41</td>
<td>$29.65</td>
<td>$31.76</td>
<td>$33.88</td>
<td>$33.88</td>
<td>$38.12</td>
<td>$38.12</td>
</tr>
<tr>
<td>3</td>
<td>$21.63</td>
<td>$25.94</td>
<td>$29.93</td>
<td>$32.13</td>
<td>$34.34</td>
<td>$34.34</td>
<td>$38.37</td>
<td>$38.37</td>
</tr>
<tr>
<td>4</td>
<td>$22.08</td>
<td>$26.39</td>
<td>$30.39</td>
<td>$32.59</td>
<td>$34.80</td>
<td>$34.80</td>
<td>$38.83</td>
<td>$38.83</td>
</tr>
<tr>
<td>5</td>
<td>$22.53</td>
<td>$26.84</td>
<td>$30.84</td>
<td>$33.04</td>
<td>$35.25</td>
<td>$35.25</td>
<td>$39.28</td>
<td>$39.28</td>
</tr>
<tr>
<td>6</td>
<td>$22.98</td>
<td>$27.29</td>
<td>$31.29</td>
<td>$33.49</td>
<td>$35.70</td>
<td>$35.70</td>
<td>$39.73</td>
<td>$39.73</td>
</tr>
</tbody>
</table>

#### Supplemental Unemployment

#### Effective Date: 03/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>75</th>
<th>80</th>
<th>80</th>
<th>90</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$21.18</td>
<td>$25.41</td>
<td>$29.65</td>
<td>$31.76</td>
<td>$33.88</td>
<td>$33.88</td>
<td>$38.12</td>
<td>$38.12</td>
</tr>
<tr>
<td>2</td>
<td>$23.27</td>
<td>$27.52</td>
<td>$31.72</td>
<td>$33.83</td>
<td>$36.04</td>
<td>$36.04</td>
<td>$40.60</td>
<td>$40.60</td>
</tr>
<tr>
<td>3</td>
<td>$25.36</td>
<td>$29.62</td>
<td>$33.82</td>
<td>$35.93</td>
<td>$38.14</td>
<td>$38.14</td>
<td>$42.69</td>
<td>$42.69</td>
</tr>
<tr>
<td>4</td>
<td>$27.45</td>
<td>$31.70</td>
<td>$35.90</td>
<td>$38.01</td>
<td>$40.22</td>
<td>$40.22</td>
<td>$44.78</td>
<td>$44.78</td>
</tr>
<tr>
<td>5</td>
<td>$29.55</td>
<td>$33.80</td>
<td>$38.00</td>
<td>$40.11</td>
<td>$42.32</td>
<td>$42.32</td>
<td>$46.88</td>
<td>$46.88</td>
</tr>
<tr>
<td>6</td>
<td>$31.65</td>
<td>$35.91</td>
<td>$39.11</td>
<td>$41.22</td>
<td>$43.43</td>
<td>$43.43</td>
<td>$47.99</td>
<td>$47.99</td>
</tr>
<tr>
<td>7</td>
<td>$33.75</td>
<td>$37.96</td>
<td>$42.16</td>
<td>$44.27</td>
<td>$46.47</td>
<td>$46.47</td>
<td>$51.03</td>
<td>$51.03</td>
</tr>
<tr>
<td>8</td>
<td>$35.85</td>
<td>$40.11</td>
<td>$44.31</td>
<td>$46.42</td>
<td>$48.63</td>
<td>$48.63</td>
<td>$53.19</td>
<td>$53.19</td>
</tr>
</tbody>
</table>

#### Supplemental Unemployment

### Notes:

- % Indentured After 10/1/17; 45/45/55/55/70/70/80/80
- Step 1&2 $30.22/ 3&4 $36.03/ 5&6 $52.86/ 7&8 $58.73
- Apprentice to Journeyworker Ratio:1:5

### Carpenter - Wood Frame

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpenter - Zone 2 (Wood Frame)</td>
<td>10/01/2018</td>
<td>$27.09</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$42.02</td>
</tr>
<tr>
<td></td>
<td>04/01/2019</td>
<td>$27.52</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$42.45</td>
</tr>
<tr>
<td></td>
<td>10/01/2019</td>
<td>$27.95</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$42.88</td>
</tr>
</tbody>
</table>

### Notes:

- All Aspects of New Wood Frame Work - As of 9/1/09 Carpentry work on wood-frame WEATHERIZATION projects shall be paid the WOOD FRAME CARPENTER rate.
### CARPENTER (Wood Frame) - Zone 2

#### Effective Date - 10/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>$16.25</td>
<td>$7.07</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$23.32</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$16.25</td>
<td>$7.07</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$23.32</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$17.61</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$32.54</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$18.96</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$33.89</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$20.32</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$35.25</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$21.67</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$36.60</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>$23.03</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$37.96</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$24.38</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$39.31</td>
</tr>
</tbody>
</table>

#### Effective Date - 04/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>$16.51</td>
<td>$7.07</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$23.58</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$16.51</td>
<td>$7.07</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$23.58</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$17.89</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$32.82</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$19.26</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$34.19</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$20.64</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$35.57</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$22.02</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$36.95</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>$23.39</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$38.32</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$24.77</td>
<td>$7.07</td>
<td>$7.86</td>
<td>$0.00</td>
<td>$39.70</td>
</tr>
</tbody>
</table>

**Notes:**

- % Indentured After 10/1/17; 45/45/55/55/70/70/80/80
- Step 1&2 $19.26/ 3&4 $26.72/ 5&6 $33.89/ 7&8 $36.60

**Apprentice to Journeyworker Ratio:** 1:5

---

**CEMENT MASONRY/PLASTERING**

**BRICKLAYERS LOCAL 3 (NEW BEDFORD)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Wage Rate</th>
<th>Health</th>
<th>Pension</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2018</td>
<td>$46.20</td>
<td>$12.42</td>
<td>$22.41</td>
<td>$0.30</td>
<td>$81.33</td>
</tr>
<tr>
<td>01/01/2019</td>
<td>$47.58</td>
<td>$12.42</td>
<td>$22.41</td>
<td>$0.30</td>
<td>$82.71</td>
</tr>
<tr>
<td>07/01/2019</td>
<td>$48.32</td>
<td>$12.42</td>
<td>$22.41</td>
<td>$0.30</td>
<td>$83.45</td>
</tr>
<tr>
<td>01/01/2020</td>
<td>$49.72</td>
<td>$12.42</td>
<td>$22.41</td>
<td>$0.30</td>
<td>$84.85</td>
</tr>
</tbody>
</table>
### CEMENT MASONRY/PLASTERING - Eastern Mass (New Bedford)

**Effective Date:** 07/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$23.10</td>
<td>$12.42</td>
<td>$15.41</td>
<td>$0.00</td>
<td>$50.93</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$27.72</td>
<td>$12.42</td>
<td>$17.41</td>
<td>$0.30</td>
<td>$57.85</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$30.03</td>
<td>$12.42</td>
<td>$18.41</td>
<td>$0.30</td>
<td>$61.16</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$32.34</td>
<td>$12.42</td>
<td>$19.41</td>
<td>$0.30</td>
<td>$64.47</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$34.65</td>
<td>$12.42</td>
<td>$20.41</td>
<td>$0.30</td>
<td>$67.78</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$36.96</td>
<td>$12.42</td>
<td>$21.41</td>
<td>$0.30</td>
<td>$71.09</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$41.58</td>
<td>$12.42</td>
<td>$22.41</td>
<td>$0.30</td>
<td>$76.71</td>
</tr>
</tbody>
</table>

**Effective Date:** 01/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$23.79</td>
<td>$12.42</td>
<td>$15.41</td>
<td>$0.00</td>
<td>$51.62</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$28.55</td>
<td>$12.42</td>
<td>$17.41</td>
<td>$0.30</td>
<td>$58.68</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$30.93</td>
<td>$12.42</td>
<td>$18.41</td>
<td>$0.30</td>
<td>$62.06</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$33.31</td>
<td>$12.42</td>
<td>$19.41</td>
<td>$0.30</td>
<td>$65.44</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$35.69</td>
<td>$12.42</td>
<td>$20.41</td>
<td>$0.30</td>
<td>$68.82</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$38.06</td>
<td>$12.42</td>
<td>$21.41</td>
<td>$0.30</td>
<td>$72.19</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$42.82</td>
<td>$12.42</td>
<td>$22.41</td>
<td>$0.30</td>
<td>$77.95</td>
</tr>
</tbody>
</table>

**Notes:**
Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

---

**Apprentice to Journeyworker Ratio:** 1:3

---

### CHAIN SAW OPERATOR

**Laborers - Zone 2**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

### CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES

**Operating Engineers Local 4**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$69.67</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$96.17</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$71.30</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$97.80</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$72.87</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$99.37</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$74.50</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$101.00</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$76.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$102.56</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$77.69</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$104.19</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$79.25</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$105.75</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$80.88</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$107.38</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"
### COMPRESSOR OPERATOR
**OPERATING ENGINEERS LOCAL 4**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$31.90</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$58.40</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$32.68</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$59.18</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$33.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$59.93</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$34.22</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$60.72</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$34.97</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$61.47</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$35.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$62.25</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$36.50</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$37.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$63.79</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

### DELEADER (BRIDGE)
**PAINTERS LOCAL 35 - ZONE 2**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2018</td>
<td>$50.01</td>
<td>$8.15</td>
<td>$20.15</td>
<td>$0.00</td>
<td>$78.31</td>
</tr>
<tr>
<td>01/01/2019</td>
<td>$50.36</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$79.36</td>
</tr>
<tr>
<td>07/01/2019</td>
<td>$51.46</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$80.46</td>
</tr>
<tr>
<td>01/01/2020</td>
<td>$52.56</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$81.56</td>
</tr>
<tr>
<td>07/01/2020</td>
<td>$53.66</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$82.66</td>
</tr>
<tr>
<td>01/01/2021</td>
<td>$54.76</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$83.76</td>
</tr>
</tbody>
</table>

### Apprentice - PAINTER Local 35 - BRIDGES/TANKS

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2018</td>
<td>$25.01</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$33.16</td>
</tr>
<tr>
<td>01/01/2019</td>
<td>$27.51</td>
<td>$8.15</td>
<td>$5.34</td>
<td>$0.00</td>
<td>$41.00</td>
</tr>
<tr>
<td>07/01/2019</td>
<td>$30.01</td>
<td>$8.15</td>
<td>$5.82</td>
<td>$0.00</td>
<td>$43.98</td>
</tr>
<tr>
<td>01/01/2020</td>
<td>$32.51</td>
<td>$8.15</td>
<td>$6.31</td>
<td>$0.00</td>
<td>$46.97</td>
</tr>
<tr>
<td>07/01/2020</td>
<td>$35.01</td>
<td>$8.15</td>
<td>$17.24</td>
<td>$0.00</td>
<td>$60.40</td>
</tr>
<tr>
<td>01/01/2021</td>
<td>$37.51</td>
<td>$8.15</td>
<td>$17.73</td>
<td>$0.00</td>
<td>$63.39</td>
</tr>
<tr>
<td>07/01/2021</td>
<td>$40.01</td>
<td>$8.15</td>
<td>$18.21</td>
<td>$0.00</td>
<td>$66.37</td>
</tr>
<tr>
<td>01/01/2022</td>
<td>$45.01</td>
<td>$8.15</td>
<td>$19.18</td>
<td>$0.00</td>
<td>$72.34</td>
</tr>
</tbody>
</table>

### Notes:

- Steps are 750 hrs.
- Apprentice to Journeyworker Ratio: 1:1
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEMO: ADZEMAN</td>
<td>06/01/2018</td>
<td>$38.15</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$61.05</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$39.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$62.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$40.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$41.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$64.00</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: BACKHOE/LOADER/HAMMER OPERATOR</td>
<td>06/01/2018</td>
<td>$39.15</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$62.05</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$40.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$41.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$64.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$42.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$65.00</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: BURNERS</td>
<td>06/01/2018</td>
<td>$38.90</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$61.80</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$39.85</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$62.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$40.85</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$63.75</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$41.85</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$64.75</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: CONCRETE CUTTER/SAWYER</td>
<td>06/01/2018</td>
<td>$39.15</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$62.05</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$40.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$41.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$64.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$42.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$65.00</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: JACKHAMMER OPERATOR</td>
<td>06/01/2018</td>
<td>$38.90</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$61.80</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$39.85</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$62.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$40.85</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$63.75</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$41.85</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$64.75</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: WRECKING LABORER</td>
<td>06/01/2018</td>
<td>$38.15</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$61.05</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$39.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$62.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$40.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$41.10</td>
<td>$7.70</td>
<td>$15.20</td>
<td>$0.00</td>
<td>$64.00</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIRECTIONAL DRILL MACHINE OPERATOR</td>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIVER</td>
<td>08/01/2018</td>
<td>$65.20</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$96.25</td>
</tr>
<tr>
<td>PILE DRIVER LOCAL 56 (ZONE 2)</td>
<td>08/01/2019</td>
<td>$68.52</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$99.57</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- PILE DRIVER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIVER TENDER</td>
<td>08/01/2018</td>
<td>$46.57</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$77.62</td>
</tr>
<tr>
<td>PILE DRIVER LOCAL 56 (ZON E 2)</td>
<td>08/01/2019</td>
<td>$48.94</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$79.99</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- PILE DRIVER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIVER TENDER (EFFLUENT)</td>
<td>08/01/2018</td>
<td>$69.86</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$100.91</td>
</tr>
<tr>
<td>PILE DRIVER LOCAL 56 (ZONE 2)</td>
<td>08/01/2019</td>
<td>$73.41</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$104.46</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- PILE DRIVER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental</td>
<td>Total Rate</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>----------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>DIVER/SLURRY (EFFLUENT)</td>
<td>08/01/2018</td>
<td>$97.80</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$128.85</td>
</tr>
<tr>
<td></td>
<td>08/01/2019</td>
<td>$102.78</td>
<td>$9.90</td>
<td>$21.15</td>
<td>$0.00</td>
<td>$133.83</td>
</tr>
<tr>
<td>PILE DRIVER LOCAL 56 (ZONE 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- PILE DRIVER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRICIAN</td>
<td>09/01/2018</td>
<td>$41.03</td>
<td>$9.65</td>
<td>$12.74</td>
<td>$0.00</td>
<td>$63.42</td>
</tr>
<tr>
<td></td>
<td>03/01/2019</td>
<td>$41.64</td>
<td>$9.90</td>
<td>$13.15</td>
<td>$0.00</td>
<td>$64.69</td>
</tr>
<tr>
<td></td>
<td>09/01/2019</td>
<td>$42.26</td>
<td>$10.15</td>
<td>$13.54</td>
<td>$0.00</td>
<td>$65.95</td>
</tr>
<tr>
<td></td>
<td>03/01/2020</td>
<td>$42.87</td>
<td>$10.40</td>
<td>$13.94</td>
<td>$0.00</td>
<td>$67.21</td>
</tr>
<tr>
<td>ELECTRICIANS LOCAL 223</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprentice - ELECTRICIAN - Local 223</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective Date - 09/01/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprentice - ELECTRICIAN - Local 223</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective Date - 03/01/2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprentice - ELECTRICIAN - Local 223</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes: Steps are 750 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprentice to Journeyworker Ratio:2:3***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELEVATOR CONSTRUCTOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELEVATOR CONSTRUCTORS LOCAL 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01/01/2018</td>
<td>$57.62</td>
<td>$15.43</td>
<td>$16.61</td>
<td>$0.00</td>
<td>$89.66</td>
<td></td>
</tr>
<tr>
<td>01/01/2019</td>
<td>$59.47</td>
<td>$15.58</td>
<td>$17.51</td>
<td>$0.00</td>
<td>$92.56</td>
<td></td>
</tr>
<tr>
<td>01/01/2020</td>
<td>$61.42</td>
<td>$15.73</td>
<td>$18.41</td>
<td>$0.00</td>
<td>$95.56</td>
<td></td>
</tr>
<tr>
<td>01/01/2021</td>
<td>$63.47</td>
<td>$15.88</td>
<td>$19.31</td>
<td>$0.00</td>
<td>$98.66</td>
<td></td>
</tr>
<tr>
<td>01/01/2022</td>
<td>$65.62</td>
<td>$16.03</td>
<td>$20.21</td>
<td>$0.00</td>
<td>$101.86</td>
<td></td>
</tr>
</tbody>
</table>

Issue Date: 10/30/2018  Wage Request Number: 20181030-061
### Apprentice - ELEVATOR CONSTRUCTOR - Local 4

#### Effective Date - 01/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$28.81</td>
<td>$15.43</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$44.24</td>
</tr>
<tr>
<td>2</td>
<td>$31.69</td>
<td>$15.43</td>
<td>$16.61</td>
<td>$0.00</td>
<td>$63.73</td>
</tr>
<tr>
<td>3</td>
<td>$37.45</td>
<td>$15.43</td>
<td>$16.61</td>
<td>$0.00</td>
<td>$69.49</td>
</tr>
<tr>
<td>4</td>
<td>$40.33</td>
<td>$15.43</td>
<td>$16.61</td>
<td>$0.00</td>
<td>$72.37</td>
</tr>
<tr>
<td>5</td>
<td>$46.10</td>
<td>$15.43</td>
<td>$16.61</td>
<td>$0.00</td>
<td>$78.14</td>
</tr>
</tbody>
</table>

#### Effective Date - 01/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$29.74</td>
<td>$15.58</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$45.32</td>
</tr>
<tr>
<td>2</td>
<td>$32.71</td>
<td>$15.58</td>
<td>$17.51</td>
<td>$0.00</td>
<td>$65.80</td>
</tr>
<tr>
<td>3</td>
<td>$38.66</td>
<td>$15.58</td>
<td>$17.51</td>
<td>$0.00</td>
<td>$71.75</td>
</tr>
<tr>
<td>4</td>
<td>$41.63</td>
<td>$15.58</td>
<td>$17.51</td>
<td>$0.00</td>
<td>$74.72</td>
</tr>
<tr>
<td>5</td>
<td>$47.58</td>
<td>$15.58</td>
<td>$17.51</td>
<td>$0.00</td>
<td>$80.67</td>
</tr>
</tbody>
</table>

**Notes:**

Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

---

**ELEVATOR CONSTRUCTOR HELPER**

**ELEVATOR CONSTRUCTORS LOCAL 4**

- 01/01/2018: $40.33, $15.43, $16.61, $0.00, $72.37
- 01/01/2019: $41.63, $15.58, $17.51, $0.00, $74.72
- 01/01/2020: $42.99, $15.73, $18.41, $0.00, $77.13
- 01/01/2021: $44.43, $15.88, $19.31, $0.00, $79.62
- 01/01/2022: $45.93, $16.03, $20.21, $0.00, $82.17

For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"

**FENCE & GUARD RAIL ERECTOR**

**LABORERS - ZONE 2**

- 06/01/2018: $33.50, $7.70, $14.02, $0.00, $55.22
- 12/01/2018: $34.34, $7.70, $14.02, $0.00, $56.06
- 06/01/2019: $35.21, $7.70, $14.02, $0.00, $56.93
- 12/01/2019: $36.07, $7.70, $14.02, $0.00, $57.79
- 06/01/2020: $36.96, $7.70, $14.02, $0.00, $58.68
- 12/01/2020: $37.85, $7.70, $14.02, $0.00, $59.57
- 06/01/2021: $38.77, $7.70, $14.02, $0.00, $60.49
- 12/01/2021: $39.68, $7.70, $14.02, $0.00, $61.40

For apprentice rates see "Apprentice- LABORER"

**FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY**

**OPERATING ENGINEERS LOCAL 4**

- 05/01/2018: $42.84, $10.50, $15.50, $0.00, $68.84

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

**FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY**

**OPERATING ENGINEERS LOCAL 4**

- 05/01/2018: $44.31, $10.50, $15.50, $0.00, $70.31

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

**FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY**

**OPERATING ENGINEERS LOCAL 4**

- 05/01/2018: $22.51, $10.50, $15.50, $0.00, $48.51

For apprentice rates see "Apprentice- OPERATING ENGINEERS"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE ALARM INSTALLER</td>
<td>09/01/2018</td>
<td>$41.03</td>
<td>$9.65</td>
<td>$12.74</td>
<td>$0.00</td>
<td>$63.42</td>
<td></td>
</tr>
<tr>
<td>ELETRICIANS LOCAL 223</td>
<td>03/01/2019</td>
<td>$41.64</td>
<td>$9.90</td>
<td>$13.15</td>
<td>$0.00</td>
<td>$64.69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>09/01/2019</td>
<td>$42.26</td>
<td>$10.15</td>
<td>$13.54</td>
<td>$0.00</td>
<td>$65.95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>03/01/2020</td>
<td>$42.87</td>
<td>$10.40</td>
<td>$13.94</td>
<td>$0.00</td>
<td>$67.21</td>
<td></td>
</tr>
<tr>
<td>FIRE ALARM REPAIR / MAINTENANCE</td>
<td>09/01/2018</td>
<td>$34.76</td>
<td>$9.65</td>
<td>$10.81</td>
<td>$0.00</td>
<td>$55.22</td>
<td></td>
</tr>
<tr>
<td>/ COMMISSIONING ELECTRICIANS</td>
<td>03/01/2019</td>
<td>$35.25</td>
<td>$9.90</td>
<td>$11.14</td>
<td>$0.00</td>
<td>$56.29</td>
<td></td>
</tr>
<tr>
<td>LOCAL 223</td>
<td>09/01/2019</td>
<td>$35.78</td>
<td>$10.15</td>
<td>$11.45</td>
<td>$0.00</td>
<td>$57.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>03/01/2020</td>
<td>$36.27</td>
<td>$10.40</td>
<td>$11.78</td>
<td>$0.00</td>
<td>$58.45</td>
<td></td>
</tr>
<tr>
<td>FIREMAN (ASST. ENGINEER)</td>
<td>06/01/2018</td>
<td>$38.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$65.33</td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>12/01/2018</td>
<td>$39.78</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$66.28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$40.69</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$67.19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$41.64</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$68.14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$42.55</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$69.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$43.50</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$70.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$44.41</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$70.91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$45.36</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$71.86</td>
<td></td>
</tr>
<tr>
<td>FLAGGER &amp; SIGNALER</td>
<td>06/01/2018</td>
<td>$21.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$43.22</td>
<td></td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$22.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$44.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$22.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$44.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$23.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$45.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$23.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$45.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$24.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$46.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$24.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$46.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$24.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$46.22</td>
<td></td>
</tr>
<tr>
<td>FLOORCOVERER</td>
<td>03/01/2016</td>
<td>$42.13</td>
<td>$9.80</td>
<td>$17.62</td>
<td>$0.00</td>
<td>$69.55</td>
<td></td>
</tr>
<tr>
<td>FLOORCOVERERS LOCAL 2168 ZONE 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Apprentice - FLOORCOVERER - Local 2168 Zone I

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$21.07</td>
<td>$9.80</td>
<td>$1.79</td>
<td>$0.00</td>
<td>$32.66</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$23.17</td>
<td>$9.80</td>
<td>$1.79</td>
<td>$0.00</td>
<td>$34.76</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$25.28</td>
<td>$9.80</td>
<td>$12.25</td>
<td>$0.00</td>
<td>$47.33</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$27.38</td>
<td>$9.80</td>
<td>$12.25</td>
<td>$0.00</td>
<td>$49.43</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$29.49</td>
<td>$9.80</td>
<td>$14.04</td>
<td>$0.00</td>
<td>$53.33</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$31.60</td>
<td>$9.80</td>
<td>$14.04</td>
<td>$0.00</td>
<td>$55.44</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$33.70</td>
<td>$9.80</td>
<td>$15.83</td>
<td>$0.00</td>
<td>$59.33</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
<td>$35.81</td>
<td>$9.80</td>
<td>$15.83</td>
<td>$0.00</td>
<td>$61.44</td>
</tr>
</tbody>
</table>

**Notes:** Steps are 750 hrs.
- % After 09/1/17: 45/45/55/70/80/80 (1500hr Steps)
- Step 1&2 $30.55/ 3&4 $36.49/ 5&6 $53.33/ 7&8 $59.33

Apprentice to Journeyworker Ratio: 1:1

---

### FORK LIFT/CHERRY PICKER

**OPERATING ENGINEERS LOCAL 4**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$47.08</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.58</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$48.23</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.73</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$49.33</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.83</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$50.48</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.98</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$51.58</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.08</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$52.73</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.23</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$53.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.33</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$54.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$81.48</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS"

### GENERATOR/LIGHTING PLANT/HEATERS

**OPERATING ENGINEERS LOCAL 4**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$31.90</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$58.40</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$32.68</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$59.18</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$33.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$59.93</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$34.22</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$60.72</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$34.97</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$61.47</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$35.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$62.25</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$36.50</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$37.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$63.79</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS"

### GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)

**GLAZIERS LOCAL 1333**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$37.18</td>
<td>$10.40</td>
<td>$9.35</td>
<td>$56.93</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$38.18</td>
<td>$10.60</td>
<td>$9.90</td>
<td>$58.68</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$39.18</td>
<td>$10.80</td>
<td>$10.45</td>
<td>$60.43</td>
</tr>
</tbody>
</table>
### GLAZIER - Local 1333

#### Apprentice - 06/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$18.59</td>
<td>$10.40</td>
<td>$1.60</td>
<td>$0.00</td>
<td>$30.59</td>
</tr>
<tr>
<td>2</td>
<td>56</td>
<td>$20.91</td>
<td>$10.40</td>
<td>$1.60</td>
<td>$0.00</td>
<td>$32.91</td>
</tr>
<tr>
<td>3</td>
<td>63</td>
<td>$23.24</td>
<td>$10.40</td>
<td>$2.10</td>
<td>$0.00</td>
<td>$35.74</td>
</tr>
<tr>
<td>4</td>
<td>69</td>
<td>$25.56</td>
<td>$10.40</td>
<td>$2.10</td>
<td>$0.00</td>
<td>$38.06</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$27.89</td>
<td>$10.40</td>
<td>$2.60</td>
<td>$0.00</td>
<td>$40.89</td>
</tr>
<tr>
<td>6</td>
<td>81</td>
<td>$30.21</td>
<td>$10.40</td>
<td>$2.60</td>
<td>$0.00</td>
<td>$43.21</td>
</tr>
<tr>
<td>7</td>
<td>88</td>
<td>$32.53</td>
<td>$10.40</td>
<td>$9.35</td>
<td>$0.00</td>
<td>$52.28</td>
</tr>
<tr>
<td>8</td>
<td>94</td>
<td>$34.86</td>
<td>$10.40</td>
<td>$9.35</td>
<td>$0.00</td>
<td>$54.61</td>
</tr>
</tbody>
</table>

#### Effective Date - 06/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$19.09</td>
<td>$10.60</td>
<td>$1.80</td>
<td>$0.00</td>
<td>$31.49</td>
</tr>
<tr>
<td>2</td>
<td>56</td>
<td>$21.48</td>
<td>$10.60</td>
<td>$1.80</td>
<td>$0.00</td>
<td>$33.88</td>
</tr>
<tr>
<td>3</td>
<td>63</td>
<td>$23.86</td>
<td>$10.60</td>
<td>$2.40</td>
<td>$0.00</td>
<td>$36.86</td>
</tr>
<tr>
<td>4</td>
<td>69</td>
<td>$26.25</td>
<td>$10.60</td>
<td>$2.40</td>
<td>$0.00</td>
<td>$39.25</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$28.64</td>
<td>$10.60</td>
<td>$2.90</td>
<td>$0.00</td>
<td>$42.14</td>
</tr>
<tr>
<td>6</td>
<td>81</td>
<td>$31.02</td>
<td>$10.60</td>
<td>$2.90</td>
<td>$0.00</td>
<td>$44.52</td>
</tr>
<tr>
<td>7</td>
<td>88</td>
<td>$33.41</td>
<td>$10.60</td>
<td>$9.90</td>
<td>$0.00</td>
<td>$53.91</td>
</tr>
<tr>
<td>8</td>
<td>94</td>
<td>$35.79</td>
<td>$10.60</td>
<td>$9.90</td>
<td>$0.00</td>
<td>$56.29</td>
</tr>
</tbody>
</table>

### Notes:

Apprentice to Journeyworker Ratio: 1:3

**HOISTING ENGINEER/CRANES/GRADALLS**

<table>
<thead>
<tr>
<th>Operating Engineers Local 4</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$47.08</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.58</td>
<td></td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$48.23</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.73</td>
<td></td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$49.33</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.83</td>
<td></td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$50.48</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.98</td>
<td></td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$51.58</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.08</td>
<td></td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$52.73</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.23</td>
<td></td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$53.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.33</td>
<td></td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$54.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$81.48</td>
<td></td>
</tr>
</tbody>
</table>
### Apprentice - OPERATING ENGINEERS - Local 4

**Effective Date:** 06/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>$25.89</td>
<td>$11.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$36.89</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$28.25</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$54.75</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$30.60</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$32.96</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$59.46</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$35.31</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$61.81</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$37.66</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$64.16</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>$40.02</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$66.52</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$42.37</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$68.87</td>
</tr>
</tbody>
</table>

**Effective Date:** 12/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>$26.53</td>
<td>$11.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$37.53</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$28.94</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$55.44</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$31.35</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$57.85</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$33.76</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$60.26</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$36.17</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$62.67</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$38.58</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$65.08</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>$41.00</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$67.50</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$43.41</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$69.91</td>
</tr>
</tbody>
</table>

**Notes:**

Apprentice to Journeyworker Ratio: 1:6

### HVAC (DUCTWORK)

**Sheetmetal Workers Local 17 - B**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/01/2018</td>
<td>$35.21</td>
<td>$12.20</td>
<td>$16.55</td>
<td>$1.92</td>
<td>$65.88</td>
</tr>
<tr>
<td>04/01/2019</td>
<td>$35.71</td>
<td>$12.20</td>
<td>$16.55</td>
<td>$1.92</td>
<td>$66.38</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- SHEET METAL WORKER"

### HVAC (ELECTRICAL CONTROLS)

**Electricians Local 223**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2018</td>
<td>$41.03</td>
<td>$9.65</td>
<td>$12.74</td>
<td>$0.00</td>
<td>$63.42</td>
</tr>
<tr>
<td>03/01/2019</td>
<td>$41.64</td>
<td>$9.90</td>
<td>$13.15</td>
<td>$0.00</td>
<td>$64.69</td>
</tr>
<tr>
<td>09/01/2019</td>
<td>$42.26</td>
<td>$10.15</td>
<td>$13.54</td>
<td>$0.00</td>
<td>$65.95</td>
</tr>
<tr>
<td>03/01/2020</td>
<td>$42.87</td>
<td>$10.40</td>
<td>$13.94</td>
<td>$0.00</td>
<td>$67.21</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- ELECTRICIAN"

### HVAC (TESTING AND BALANCING - AIR)

**Sheetmetal Workers Local 17 - B**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/01/2018</td>
<td>$35.21</td>
<td>$12.20</td>
<td>$16.55</td>
<td>$1.92</td>
<td>$65.88</td>
</tr>
<tr>
<td>04/01/2019</td>
<td>$35.71</td>
<td>$12.20</td>
<td>$16.55</td>
<td>$1.92</td>
<td>$66.38</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- SHEET METAL WORKER"

### HVAC (TESTING AND BALANCING - WATER)

**Plumbers & Pipefitters Local 51**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2018</td>
<td>$42.04</td>
<td>$10.00</td>
<td>$18.20</td>
<td>$0.00</td>
<td>$70.24</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

### HVAC MECHANIC

**Plumbers & Pipefitters Local 51**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2018</td>
<td>$42.04</td>
<td>$10.00</td>
<td>$18.20</td>
<td>$0.00</td>
<td>$70.24</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"
### HYDRAULIC DRILLS
**LABORERS - ZONE 2**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$34.00</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.72</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.84</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.56</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$35.71</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.43</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$36.57</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.29</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$37.46</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.18</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$38.35</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.07</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$39.27</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.99</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$40.18</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.90</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

### INSULATOR (PIPES & TANKS)
**HEAT & FROST INSULATORS LOCAL 6 (SOUTHERN MASS)**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2018</td>
<td>$44.40</td>
<td>$11.75</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.35</td>
</tr>
<tr>
<td>09/01/2019</td>
<td>$46.65</td>
<td>$11.75</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.60</td>
</tr>
</tbody>
</table>

### Apprentice - ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Southern MA

<table>
<thead>
<tr>
<th>Effective Date - 09/01/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date - 09/01/2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

**Notes:**
Steps are 1 year

Apprentice to Journeyworker Ratio: 1:4

### IRONWORKER/WELDER
**IRONWORKERS LOCAL 37**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/16/2018</td>
<td>$37.91</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$62.71</td>
</tr>
<tr>
<td>03/16/2019</td>
<td>$38.81</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$63.61</td>
</tr>
<tr>
<td>09/16/2019</td>
<td>$39.71</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$64.51</td>
</tr>
<tr>
<td>03/16/2020</td>
<td>$40.61</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$65.41</td>
</tr>
<tr>
<td>09/16/2020</td>
<td>$41.51</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$66.31</td>
</tr>
<tr>
<td>03/16/2021</td>
<td>$42.46</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$67.26</td>
</tr>
</tbody>
</table>
## Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - IRONWORKER - Local 37</td>
<td>09/16/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective Date -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
</tr>
<tr>
<td>1</td>
<td>70</td>
<td>$26.54</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$51.34</td>
</tr>
<tr>
<td>2</td>
<td>75</td>
<td>$28.43</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$53.23</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>$30.33</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$55.13</td>
</tr>
<tr>
<td>4</td>
<td>85</td>
<td>$32.22</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$57.02</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$34.12</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$58.92</td>
</tr>
<tr>
<td>6</td>
<td>95</td>
<td>$36.01</td>
<td>$7.70</td>
<td>$17.10</td>
<td>$0.00</td>
<td>$60.81</td>
</tr>
</tbody>
</table>

### Notes:

Apprentice to Journeyworker Ratio: 1:4

---

### JACKHAMMER & PAVING BREAKER OPERATOR

LABORERS - ZONE 2

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

---

### LABORER

LABORERS - ZONE 2

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.25</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$54.97</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.09</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.81</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$34.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.68</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$35.82</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.54</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$36.71</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.43</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$37.60</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.32</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$38.52</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.24</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$39.43</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.15</td>
</tr>
</tbody>
</table>
### Apprentice - LABORER - Zone 2

**Effective Date -** 06/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>$19.95</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$41.67</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>$23.28</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$45.00</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>$26.60</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$48.32</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>$29.93</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$51.65</td>
</tr>
</tbody>
</table>

**Effective Date -** 12/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>$20.45</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$42.17</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>$23.86</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$45.58</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>$27.27</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$48.99</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>$30.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$52.40</td>
</tr>
</tbody>
</table>

**Notes:**

Apprentice to Journeyworker Ratio: 1:5

**LABORER: CARPENTER TENDER**

LABORERS - ZONE 2

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.25</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$54.97</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.09</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.81</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$34.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.68</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$35.82</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.54</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$36.71</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.43</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$37.60</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.32</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$38.52</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.24</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$39.43</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.15</td>
</tr>
</tbody>
</table>

**LABORER: CEMENT FINISHER TENDER**

LABORERS - ZONE 2

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.25</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$54.97</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.09</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.81</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$34.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.68</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$35.82</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.54</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$36.71</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.43</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$37.60</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.32</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$38.52</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.24</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$39.43</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.15</td>
</tr>
</tbody>
</table>

**LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER**

LABORERS - ZONE 2

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.45</td>
<td>$7.70</td>
<td>$13.97</td>
<td>$0.00</td>
<td>$55.12</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.29</td>
<td>$7.70</td>
<td>$13.97</td>
<td>$0.00</td>
<td>$55.96</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$35.16</td>
<td>$7.70</td>
<td>$13.97</td>
<td>$0.00</td>
<td>$56.83</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$36.02</td>
<td>$7.70</td>
<td>$13.97</td>
<td>$0.00</td>
<td>$57.69</td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>LABORER: MASON TENDER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER".

| LABORER: MULTI-TRADE TENDER         |                |           |        |         |                           |            |
| LABORERS - ZONE 2                   | 06/01/2018     | $33.25    | $7.70  | $14.02  | $0.00                     | $54.97     |
| LABORERS - ZONE 2                   | 12/01/2018     | $34.09    | $7.70  | $14.02  | $0.00                     | $55.81     |
| LABORERS - ZONE 2                   | 06/01/2019     | $34.96    | $7.70  | $14.02  | $0.00                     | $56.68     |
| LABORERS - ZONE 2                   | 12/01/2019     | $35.82    | $7.70  | $14.02  | $0.00                     | $57.54     |
| LABORERS - ZONE 2                   | 06/01/2020     | $36.71    | $7.70  | $14.02  | $0.00                     | $58.43     |
| LABORERS - ZONE 2                   | 12/01/2020     | $37.60    | $7.70  | $14.02  | $0.00                     | $59.32     |
| LABORERS - ZONE 2                   | 06/01/2021     | $38.52    | $7.70  | $14.02  | $0.00                     | $60.24     |
| LABORERS - ZONE 2                   | 12/01/2021     | $39.43    | $7.70  | $14.02  | $0.00                     | $61.15     |

For apprentice rates see "Apprentice- LABORER".

| LABORER: TREE REMOVER               |                |           |        |         |                           |            |
| LABORERS - ZONE 2                   | 06/01/2018     | $33.25    | $7.70  | $14.02  | $0.00                     | $54.97     |
| LABORERS - ZONE 2                   | 12/01/2018     | $34.09    | $7.70  | $14.02  | $0.00                     | $55.81     |
| LABORERS - ZONE 2                   | 06/01/2019     | $34.96    | $7.70  | $14.02  | $0.00                     | $56.68     |
| LABORERS - ZONE 2                   | 12/01/2019     | $35.82    | $7.70  | $14.02  | $0.00                     | $57.54     |
| LABORERS - ZONE 2                   | 06/01/2020     | $36.71    | $7.70  | $14.02  | $0.00                     | $58.43     |
| LABORERS - ZONE 2                   | 12/01/2020     | $37.60    | $7.70  | $14.02  | $0.00                     | $59.32     |
| LABORERS - ZONE 2                   | 06/01/2021     | $38.52    | $7.70  | $14.02  | $0.00                     | $60.24     |
| LABORERS - ZONE 2                   | 12/01/2021     | $39.43    | $7.70  | $14.02  | $0.00                     | $61.15     |

This classification applies to all tree work associated with the removal of standing trees, and trimming and removal of branches and limbs when the work is not done for a utility company for the purpose of operation, maintenance or repair of utility company equipment. For apprentice rates see "Apprentice- LABORER".

| LASER BEAM OPERATOR                |                |           |        |         |                           |            |
| LABORERS - ZONE 2                   | 06/01/2018     | $33.50    | $7.70  | $14.02  | $0.00                     | $55.22     |
| LABORERS - ZONE 2                   | 12/01/2018     | $34.34    | $7.70  | $14.02  | $0.00                     | $56.06     |
| LABORERS - ZONE 2                   | 06/01/2019     | $35.21    | $7.70  | $14.02  | $0.00                     | $56.93     |
| LABORERS - ZONE 2                   | 12/01/2019     | $36.07    | $7.70  | $14.02  | $0.00                     | $57.79     |
| LABORERS - ZONE 2                   | 06/01/2020     | $36.96    | $7.70  | $14.02  | $0.00                     | $58.68     |
| LABORERS - ZONE 2                   | 12/01/2020     | $37.85    | $7.70  | $14.02  | $0.00                     | $59.57     |
| LABORERS - ZONE 2                   | 06/01/2021     | $38.77    | $7.70  | $14.02  | $0.00                     | $60.49     |
| LABORERS - ZONE 2                   | 12/01/2021     | $39.68    | $7.70  | $14.02  | $0.00                     | $61.40     |

For apprentice rates see "Apprentice- LABORER".

| MARBLE & TILE FINISHERS             |                |           |        |         |                           |            |
| BRICKLAYERS LOCAL 3 - MARBLE & TILE | 08/01/2018     | $40.40    | $10.75 | $18.97  | $0.00                     | $70.12     |
| BRICKLAYERS LOCAL 3 - MARBLE & TILE | 02/01/2019     | $40.91    | $10.75 | $18.97  | $0.00                     | $70.63     |
| BRICKLAYERS LOCAL 3 - MARBLE & TILE | 08/01/2019     | $41.99    | $10.75 | $19.11  | $0.00                     | $71.85     |
| BRICKLAYERS LOCAL 3 - MARBLE & TILE | 02/01/2020     | $42.50    | $10.75 | $19.11  | $0.00                     | $72.36     |
| BRICKLAYERS LOCAL 3 - MARBLE & TILE | 08/01/2020     | $43.58    | $10.75 | $19.26  | $0.00                     | $73.59     |
| BRICKLAYERS LOCAL 3 - MARBLE & TILE | 02/01/2021     | $44.09    | $10.75 | $19.26  | $0.00                     | $74.10     |
| BRICKLAYERS LOCAL 3 - MARBLE & TILE | 08/01/2021     | $45.21    | $10.75 | $19.42  | $0.00                     | $75.38     |
| BRICKLAYERS LOCAL 3 - MARBLE & TILE | 02/01/2022     | $45.68    | $10.75 | $19.42  | $0.00                     | $75.85     |
### Classification

**Apprentice -** MARBLE & TILE FINISHER - Local 3 Marble & Tile

**Effective Date -** 08/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$20.20</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$49.92</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$24.24</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$53.96</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$28.28</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$58.00</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$32.32</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$62.04</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$36.36</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$66.08</td>
<td></td>
</tr>
</tbody>
</table>

**Effective Date -** 02/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$20.46</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$50.18</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$24.55</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$54.27</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$28.64</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$58.36</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$32.73</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$62.45</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$36.82</td>
<td>$10.75</td>
<td>$18.97</td>
<td>$0.00</td>
<td>$66.54</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

Apprentice to Journeyworker Ratio: 1:3

MARBLE MASONSTILELAYERS & TERRAZZO MECH

**BRICKLAYERS LOCAL 3 - MARBLE & TILE**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2018</td>
<td>$52.95</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$84.36</td>
<td></td>
</tr>
<tr>
<td>02/01/2019</td>
<td>$53.57</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$84.98</td>
<td></td>
</tr>
<tr>
<td>08/01/2019</td>
<td>$54.92</td>
<td>$10.75</td>
<td>$20.80</td>
<td>$0.00</td>
<td>$86.47</td>
<td></td>
</tr>
<tr>
<td>02/01/2020</td>
<td>$55.55</td>
<td>$10.75</td>
<td>$20.80</td>
<td>$0.00</td>
<td>$87.10</td>
<td></td>
</tr>
<tr>
<td>08/01/2020</td>
<td>$56.90</td>
<td>$10.75</td>
<td>$20.95</td>
<td>$0.00</td>
<td>$88.60</td>
<td></td>
</tr>
<tr>
<td>02/01/2021</td>
<td>$57.54</td>
<td>$10.75</td>
<td>$20.95</td>
<td>$0.00</td>
<td>$89.24</td>
<td></td>
</tr>
<tr>
<td>08/01/2021</td>
<td>$58.94</td>
<td>$10.75</td>
<td>$21.11</td>
<td>$0.00</td>
<td>$90.80</td>
<td></td>
</tr>
<tr>
<td>02/01/2022</td>
<td>$59.51</td>
<td>$10.75</td>
<td>$21.11</td>
<td>$0.00</td>
<td>$91.37</td>
<td></td>
</tr>
</tbody>
</table>
### Classification

#### Marble-Tile-Terrazzo Mechanic - Local 3 Marble & Tile

**Apprentice -**  
**Effective Date -** 08/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$26.48</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$57.89</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$31.77</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$63.18</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$37.07</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$68.48</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$42.36</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$73.77</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$47.66</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$79.07</td>
</tr>
</tbody>
</table>

**Effective Date -** 02/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$26.79</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$58.20</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$32.14</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$63.55</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$37.50</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$68.91</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$42.86</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$74.27</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$48.21</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$79.62</td>
</tr>
</tbody>
</table>

**Notes:**  
Apprentice to Journeyworker Ratio: 1:5

---

**Mech. Sweeper Operator (On Const. Sites)**  
*Operating Engineers Local 4*

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

---

**Mechanics Maintenance**  
*Operating Engineers Local 4*

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

---

**Millwright (Zone 2)**  
*Millingwrights Local 1121 - Zone 2*

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/01/2018</td>
<td>$38.02</td>
<td>$9.90</td>
<td>$18.50</td>
<td>$0.00</td>
<td>$66.42</td>
</tr>
<tr>
<td>04/01/2019</td>
<td>$38.87</td>
<td>$9.90</td>
<td>$18.50</td>
<td>$0.00</td>
<td>$67.27</td>
</tr>
</tbody>
</table>
## Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apprentice - MILLWRIGHT - Local 1121 Zone 2</strong></td>
<td>10/01/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step</strong></td>
<td><strong>percent</strong></td>
<td><strong>Apprentice Base Wage</strong></td>
<td><strong>Health</strong></td>
<td><strong>Pension</strong></td>
<td><strong>Unemployment</strong></td>
<td><strong>Total Rate</strong></td>
</tr>
<tr>
<td>1</td>
<td>55</td>
<td>$20.91</td>
<td>$9.90</td>
<td>$5.31</td>
<td>$0.00</td>
<td>$36.12</td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>$24.71</td>
<td>$9.90</td>
<td>$15.13</td>
<td>$0.00</td>
<td>$49.74</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>$28.52</td>
<td>$9.90</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$54.52</td>
</tr>
<tr>
<td>4</td>
<td>85</td>
<td>$32.32</td>
<td>$9.90</td>
<td>$17.06</td>
<td>$0.00</td>
<td>$59.28</td>
</tr>
<tr>
<td><strong>Effective Date -</strong> 04/01/2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step</strong></td>
<td><strong>percent</strong></td>
<td><strong>Apprentice Base Wage</strong></td>
<td><strong>Health</strong></td>
<td><strong>Pension</strong></td>
<td><strong>Unemployment</strong></td>
<td><strong>Total Rate</strong></td>
</tr>
<tr>
<td>1</td>
<td>55</td>
<td>$21.38</td>
<td>$9.90</td>
<td>$5.31</td>
<td>$0.00</td>
<td>$36.59</td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>$25.27</td>
<td>$9.90</td>
<td>$15.13</td>
<td>$0.00</td>
<td>$50.30</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>$29.15</td>
<td>$9.90</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$55.15</td>
</tr>
<tr>
<td>4</td>
<td>85</td>
<td>$33.04</td>
<td>$9.90</td>
<td>$17.06</td>
<td>$0.00</td>
<td>$60.00</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 2,000 hours
- Apprentice to Journeyworker Ratio: 1:5

### MORTAR MIXER
**LABORERS - ZONE 2**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

### OILER (OTHER THAN TRUCK CRANES, GRADALLS)
**OPERATING ENGINEERS LOCAL 4**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$23.14</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$49.64</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$23.71</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$50.21</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$24.26</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$50.76</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$24.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$51.33</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$25.38</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$51.88</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$25.95</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$52.45</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$26.50</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$53.00</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$27.08</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$53.58</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

### OILER (TRUCK CRANES, GRADALLS)
**OPERATING ENGINEERS LOCAL 4**

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$27.40</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$53.90</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$28.07</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$54.57</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$28.72</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$29.39</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$55.89</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$30.04</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$56.54</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$30.72</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$57.22</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$31.36</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$57.86</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$32.04</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$58.54</td>
</tr>
</tbody>
</table>
### Classification

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.99</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

### OTHER POWER DRIVEN EQUIPMENT - CLASS II

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$73.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$74.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$75.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$76.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$77.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$78.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$79.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$80.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

### PAINTER (BRIDGES/TANKS)

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2018</td>
<td>$50.01</td>
<td>$8.15</td>
<td>$20.15</td>
<td>$0.00</td>
<td>$78.31</td>
</tr>
<tr>
<td>01/01/2019</td>
<td>$50.36</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$79.36</td>
</tr>
<tr>
<td>07/01/2019</td>
<td>$51.46</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$80.46</td>
</tr>
<tr>
<td>01/01/2020</td>
<td>$52.56</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$81.56</td>
</tr>
<tr>
<td>07/01/2020</td>
<td>$53.66</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$82.66</td>
</tr>
<tr>
<td>01/01/2021</td>
<td>$54.76</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$83.76</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2018</td>
<td>$25.01</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$33.16</td>
</tr>
<tr>
<td>01/01/2019</td>
<td>$27.51</td>
<td>$8.15</td>
<td>$5.34</td>
<td>$0.00</td>
<td>$41.00</td>
</tr>
<tr>
<td>07/01/2019</td>
<td>$30.01</td>
<td>$8.15</td>
<td>$5.82</td>
<td>$0.00</td>
<td>$43.98</td>
</tr>
<tr>
<td>01/01/2020</td>
<td>$32.51</td>
<td>$8.15</td>
<td>$6.31</td>
<td>$0.00</td>
<td>$46.97</td>
</tr>
<tr>
<td>07/01/2020</td>
<td>$35.01</td>
<td>$8.15</td>
<td>$17.24</td>
<td>$0.00</td>
<td>$60.40</td>
</tr>
<tr>
<td>01/01/2021</td>
<td>$37.51</td>
<td>$8.15</td>
<td>$17.73</td>
<td>$0.00</td>
<td>$63.39</td>
</tr>
<tr>
<td>07/01/2021</td>
<td>$40.01</td>
<td>$8.15</td>
<td>$18.21</td>
<td>$0.00</td>
<td>$66.37</td>
</tr>
<tr>
<td>01/01/2022</td>
<td>$45.01</td>
<td>$8.15</td>
<td>$19.18</td>
<td>$0.00</td>
<td>$72.34</td>
</tr>
</tbody>
</table>

### Notes:

- Steps are 750 hrs.

Apprentice to Journeyworker Ratio: 1:1

---

**Issue Date:** 10/30/2018  
**Wage Request Number:** 20181030-061
**Classifications**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painter (Spray or Sandblast, New) *</td>
<td>07/01/2018</td>
<td>$40.91</td>
<td>$8.15</td>
<td>$20.15</td>
<td>$0.00</td>
<td>$69.21</td>
</tr>
<tr>
<td></td>
<td>01/01/2019</td>
<td>$41.26</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$70.26</td>
</tr>
<tr>
<td></td>
<td>07/01/2019</td>
<td>$42.36</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$71.36</td>
</tr>
<tr>
<td></td>
<td>01/01/2020</td>
<td>$43.46</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$72.46</td>
</tr>
<tr>
<td></td>
<td>07/01/2020</td>
<td>$44.56</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$73.56</td>
</tr>
<tr>
<td></td>
<td>01/01/2021</td>
<td>$45.66</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$74.66</td>
</tr>
</tbody>
</table>

* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.

---

**Apprentice - Painter Local 35 Zone 2 - Spray/Sandblast - New**

**Effective Date - 07/01/2018**

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$20.46</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$28.61</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$22.50</td>
<td>$8.15</td>
<td>$5.34</td>
<td>$0.00</td>
<td>$35.99</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$24.55</td>
<td>$8.15</td>
<td>$5.82</td>
<td>$0.00</td>
<td>$38.52</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$26.59</td>
<td>$8.15</td>
<td>$6.31</td>
<td>$0.00</td>
<td>$41.05</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$28.64</td>
<td>$8.15</td>
<td>$17.24</td>
<td>$0.00</td>
<td>$54.03</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$30.68</td>
<td>$8.15</td>
<td>$17.73</td>
<td>$0.00</td>
<td>$56.56</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$32.73</td>
<td>$8.15</td>
<td>$18.21</td>
<td>$0.00</td>
<td>$59.99</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$36.82</td>
<td>$8.15</td>
<td>$19.18</td>
<td>$0.00</td>
<td>$64.15</td>
</tr>
</tbody>
</table>

**Effective Date - 01/01/2019**

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$20.63</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$28.78</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$22.69</td>
<td>$8.15</td>
<td>$5.64</td>
<td>$0.00</td>
<td>$36.48</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$24.75</td>
<td>$8.15</td>
<td>$6.15</td>
<td>$0.00</td>
<td>$39.06</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$26.82</td>
<td>$8.15</td>
<td>$6.66</td>
<td>$0.00</td>
<td>$41.63</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$28.88</td>
<td>$8.15</td>
<td>$17.78</td>
<td>$0.00</td>
<td>$54.81</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$30.96</td>
<td>$8.15</td>
<td>$18.29</td>
<td>$0.00</td>
<td>$57.39</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$33.01</td>
<td>$8.15</td>
<td>$18.80</td>
<td>$0.00</td>
<td>$59.96</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$37.13</td>
<td>$8.15</td>
<td>$19.83</td>
<td>$0.00</td>
<td>$65.11</td>
</tr>
</tbody>
</table>

**Notes:**

Steps are 750 hrs.

Apprentice to Journeyworker Ratio: 1:1

---

**PAINTER (Spray or Sandblast, Repaint)**

**Effective Date -**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2018</td>
<td>$38.97</td>
<td>$8.15</td>
<td>$20.15</td>
<td>$0.00</td>
<td>$67.27</td>
</tr>
<tr>
<td>01/01/2019</td>
<td>$39.32</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$68.32</td>
</tr>
<tr>
<td>07/01/2019</td>
<td>$40.42</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$69.42</td>
</tr>
<tr>
<td>01/01/2020</td>
<td>$41.52</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$70.52</td>
</tr>
<tr>
<td>07/01/2020</td>
<td>$42.62</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$71.62</td>
</tr>
<tr>
<td>01/01/2021</td>
<td>$43.72</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$72.72</td>
</tr>
</tbody>
</table>
### Classification

<table>
<thead>
<tr>
<th>Effective Date - PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effective Date -</strong> 07/01/2018</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$19.49</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$27.64</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$21.43</td>
<td>$8.15</td>
<td>$5.34</td>
<td>$0.00</td>
<td>$34.92</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$23.38</td>
<td>$8.15</td>
<td>$5.82</td>
<td>$0.00</td>
<td>$37.35</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$25.33</td>
<td>$8.15</td>
<td>$6.31</td>
<td>$0.00</td>
<td>$39.79</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$27.28</td>
<td>$8.15</td>
<td>$7.24</td>
<td>$0.00</td>
<td>$45.67</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$29.23</td>
<td>$8.15</td>
<td>$17.73</td>
<td>$0.00</td>
<td>$55.11</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$31.18</td>
<td>$8.15</td>
<td>$18.21</td>
<td>$0.00</td>
<td>$57.54</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$35.07</td>
<td>$8.15</td>
<td>$19.18</td>
<td>$0.00</td>
<td>$62.40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date - 01/01/2019</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$19.66</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$27.81</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$21.63</td>
<td>$8.15</td>
<td>$5.64</td>
<td>$0.00</td>
<td>$35.42</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$23.59</td>
<td>$8.15</td>
<td>$6.15</td>
<td>$0.00</td>
<td>$37.89</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$25.56</td>
<td>$8.15</td>
<td>$6.66</td>
<td>$0.00</td>
<td>$40.37</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$27.52</td>
<td>$8.15</td>
<td>$17.78</td>
<td>$0.00</td>
<td>$53.45</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$29.49</td>
<td>$8.15</td>
<td>$18.89</td>
<td>$0.00</td>
<td>$55.93</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$31.46</td>
<td>$8.15</td>
<td>$19.78</td>
<td>$0.00</td>
<td>$58.41</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$35.39</td>
<td>$8.15</td>
<td>$19.93</td>
<td>$0.00</td>
<td>$63.37</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 750 hrs.

Apprentice to Journeyworker Ratio: 1:1

**PAINTER (TRAFFIC MARKINGS)**

<table>
<thead>
<tr>
<th>LABORERS - ZONE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
</tr>
<tr>
<td>12/01/2018</td>
</tr>
<tr>
<td>06/01/2019</td>
</tr>
<tr>
<td>12/01/2019</td>
</tr>
<tr>
<td>06/01/2020</td>
</tr>
<tr>
<td>12/01/2020</td>
</tr>
<tr>
<td>06/01/2021</td>
</tr>
<tr>
<td>12/01/2021</td>
</tr>
</tbody>
</table>

For Apprentice rates see "Apprentice- LABORER"

**PAINTER / TAPER (BRUSH, NEW) * **

* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. **PAINTERS LOCAL 35 - ZONE 2**

<p>| 07/01/2018        | $39.51 | $8.15 | $20.15 | $0.00 | $67.81 |
| 01/01/2019        | $39.86 | $8.15 | $20.85 | $0.00 | $68.86 |
| 07/01/2019        | $40.96 | $8.15 | $20.85 | $0.00 | $69.96 |
| 01/01/2020        | $42.06 | $8.15 | $20.85 | $0.00 | $71.06 |
| 07/01/2020        | $43.16 | $8.15 | $20.85 | $0.00 | $72.16 |
| 01/01/2021        | $44.25 | $8.15 | $20.85 | $0.00 | $73.25 |</p>
<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$19.76</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$27.91</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$21.73</td>
<td>$8.15</td>
<td>$5.34</td>
<td>$0.00</td>
<td>$35.22</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$23.71</td>
<td>$8.15</td>
<td>$5.82</td>
<td>$0.00</td>
<td>$37.68</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$25.68</td>
<td>$8.15</td>
<td>$6.31</td>
<td>$0.00</td>
<td>$40.14</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$27.66</td>
<td>$8.15</td>
<td>$17.24</td>
<td>$0.00</td>
<td>$53.05</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$29.63</td>
<td>$8.15</td>
<td>$17.73</td>
<td>$0.00</td>
<td>$55.51</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$31.61</td>
<td>$8.15</td>
<td>$18.21</td>
<td>$0.00</td>
<td>$57.97</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$35.56</td>
<td>$8.15</td>
<td>$19.18</td>
<td>$0.00</td>
<td>$62.89</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$19.93</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$28.08</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$21.92</td>
<td>$8.15</td>
<td>$5.64</td>
<td>$0.00</td>
<td>$35.71</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$23.92</td>
<td>$8.15</td>
<td>$6.15</td>
<td>$0.00</td>
<td>$38.22</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$25.91</td>
<td>$8.15</td>
<td>$6.66</td>
<td>$0.00</td>
<td>$40.72</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$27.90</td>
<td>$8.15</td>
<td>$17.78</td>
<td>$0.00</td>
<td>$53.83</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$29.90</td>
<td>$8.15</td>
<td>$18.29</td>
<td>$0.00</td>
<td>$56.34</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$31.89</td>
<td>$8.15</td>
<td>$18.80</td>
<td>$0.00</td>
<td>$58.84</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$35.87</td>
<td>$8.15</td>
<td>$19.83</td>
<td>$0.00</td>
<td>$63.85</td>
</tr>
</tbody>
</table>

Notes:
- Steps are 750 hrs.

Apprentice to Journeyworker Ratio: 1:1

PAINTER / TAPER (BRUSH, REPAINT)

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2018</td>
<td>$37.57</td>
<td>$8.15</td>
<td>$20.15</td>
<td>$0.00</td>
<td>$65.87</td>
</tr>
<tr>
<td>01/01/2019</td>
<td>$37.92</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$66.92</td>
</tr>
<tr>
<td>07/01/2019</td>
<td>$39.02</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$68.02</td>
</tr>
<tr>
<td>01/01/2020</td>
<td>$40.12</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$69.12</td>
</tr>
<tr>
<td>07/01/2020</td>
<td>$41.22</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$70.22</td>
</tr>
<tr>
<td>01/01/2021</td>
<td>$42.32</td>
<td>$8.15</td>
<td>$20.85</td>
<td>$0.00</td>
<td>$71.32</td>
</tr>
</tbody>
</table>
### Apprentice -  PAINTER Local 35 Zone 2 - BRUSH REPAINT

**Effective Date:** 07/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$18.79</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$26.94</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$20.66</td>
<td>$8.15</td>
<td>$5.34</td>
<td>$0.00</td>
<td>$34.15</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$22.54</td>
<td>$8.15</td>
<td>$5.82</td>
<td>$0.00</td>
<td>$36.51</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$24.42</td>
<td>$8.15</td>
<td>$6.31</td>
<td>$0.00</td>
<td>$38.88</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$26.30</td>
<td>$8.15</td>
<td>$17.24</td>
<td>$0.00</td>
<td>$51.69</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$28.18</td>
<td>$8.15</td>
<td>$17.73</td>
<td>$0.00</td>
<td>$54.06</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$30.06</td>
<td>$8.15</td>
<td>$18.21</td>
<td>$0.00</td>
<td>$56.42</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$33.81</td>
<td>$8.15</td>
<td>$19.18</td>
<td>$0.00</td>
<td>$59.69</td>
</tr>
</tbody>
</table>

**Effective Date:** 01/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$18.96</td>
<td>$8.15</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$27.11</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$20.86</td>
<td>$8.15</td>
<td>$5.64</td>
<td>$0.00</td>
<td>$34.65</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$22.75</td>
<td>$8.15</td>
<td>$6.15</td>
<td>$0.00</td>
<td>$37.05</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$24.65</td>
<td>$8.15</td>
<td>$6.66</td>
<td>$0.00</td>
<td>$39.46</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$26.54</td>
<td>$8.15</td>
<td>$17.78</td>
<td>$0.00</td>
<td>$52.47</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$28.44</td>
<td>$8.15</td>
<td>$18.29</td>
<td>$0.00</td>
<td>$54.88</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$30.34</td>
<td>$8.15</td>
<td>$18.80</td>
<td>$0.00</td>
<td>$57.29</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$33.13</td>
<td>$8.15</td>
<td>$19.83</td>
<td>$0.00</td>
<td>$59.06</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 750 hrs.

### PANEL & PICKUP TRUCKS DRIVER

**Teamsters Joint Council No. 10 ZONE B**

**Effective Date:** 12/01/2012

| 1    | 00      | $30.28               | $9.07  | $8.00   | $0.00                     | $47.35     |

### PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK)

**Pile Driver Local 56 (Zone 2)**

**Effective Date:** 08/01/2018

| 1    | 00      | $42.93               | $9.90  | $21.15  | $0.00                     | $74.98     |

**Effective Date:** 08/01/2019

| 1    | 00      | $44.61               | $9.90  | $21.15  | $0.00                     | $76.66     |

### Pile Driver

**Pile Driver Local 56 (Zone 2)**

**Effective Date:** 08/01/2018

| 1    | 00      | $42.93               | $9.90  | $21.15  | $0.00                     | $74.98     |

**Effective Date:** 08/01/2019

| 1    | 00      | $44.61               | $9.90  | $21.15  | $0.00                     | $76.66     |

### Apprentice -  Pile Driver - Local 56 Zone 2

**Effective Date:** 08/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

**Notes:** Apprentice wages shall be no less than the following Steps:
- (Same as set in Zone 1)
- $54.34/2/$58.99/3/$63.65/4/$65.98/5/$68.31/6/$68.31/7/$72.96/8/$72.96

**Apprentice to Journeyworker Ratio:** 1:5
### PIPELAYER
**LABORERS - ZONE 2**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

### PLUMBER & PIPEFITTER
**PLUMBERS & PIPEFITTERS LOCAL 51**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2018</td>
<td>$42.04</td>
<td>$10.00</td>
<td>$18.20</td>
<td>$0.00</td>
<td>$70.24</td>
</tr>
</tbody>
</table>

---

### Apprentice - PLUMBER/PIPEFITTER - Local 51

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2018</td>
<td>$16.82</td>
<td>$10.00</td>
<td>$2.50</td>
<td>$0.00</td>
<td>$29.32</td>
</tr>
<tr>
<td>09/01/2018</td>
<td>$21.02</td>
<td>$10.00</td>
<td>$2.50</td>
<td>$0.00</td>
<td>$33.52</td>
</tr>
<tr>
<td>09/01/2018</td>
<td>$25.22</td>
<td>$10.00</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$43.07</td>
</tr>
<tr>
<td>09/01/2018</td>
<td>$29.43</td>
<td>$10.00</td>
<td>$12.56</td>
<td>$0.00</td>
<td>$51.99</td>
</tr>
<tr>
<td>09/01/2018</td>
<td>$33.63</td>
<td>$10.00</td>
<td>$15.70</td>
<td>$0.00</td>
<td>$59.33</td>
</tr>
</tbody>
</table>

Notes:
- Steps 2000hrs. Prior 9/1/05; 40/40/45/50/55/60/65/75/80/85

---

### Apprentice to Journeyworker Ratio: 1:3

---

### PNEUMATIC CONTROLS (TEMP.)
**PLUMBERS & PIPEFITTERS LOCAL 51**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2018</td>
<td>$42.04</td>
<td>$10.00</td>
<td>$18.20</td>
<td>$0.00</td>
<td>$70.24</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

### PNEUMATIC DRILL/TOOL OPERATOR
**LABORERS - ZONE 2**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

### POWDERMAN & BLASTER
**LABORERS - ZONE 2**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$34.25</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.97</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$35.09</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.81</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$35.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.68</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$36.82</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.54</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$37.71</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.43</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$38.60</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.32</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$39.52</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.24</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$40.43</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$62.15</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER SHOVEL/DERRICK/TRENCHING MACHINE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2018</td>
<td>$47.08</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.58</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$48.23</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.73</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$49.33</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.83</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$50.48</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.98</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.58</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.08</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.73</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.23</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.33</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$81.48</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUMP OPERATOR (CONCRETE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2018</td>
<td>$47.08</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.58</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$48.23</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.73</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$49.33</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.83</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$50.48</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.98</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.58</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.08</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.73</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.23</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.33</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$81.48</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUMP OPERATOR (DEWATERING, OTHER)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2018</td>
<td>$31.90</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$58.40</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$32.68</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$59.18</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$33.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$59.93</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$34.22</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$60.72</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$34.97</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$61.47</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$35.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$62.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$36.50</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$37.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$63.79</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>READY-MIX CONCRETE DRIVER</td>
<td>06/01/2008</td>
<td>$19.00</td>
<td>$5.10</td>
<td>$4.21</td>
<td>$0.00</td>
<td>$28.31</td>
</tr>
<tr>
<td>TEAMSTERS LOCAL 59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECLAIMERS</td>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIDE-ON MOTORIZED BUGGY OPERATOR</td>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td>LABORERS - ZONE 2</td>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental</td>
<td>Total Rate</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>ROLLER/SPREADER/MULCHING MACHINE</td>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

<table>
<thead>
<tr>
<th>ROOFER (Inc.Roofers Waterproofng &amp;Roofer Damproofg)</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROOFERS LOCAL 33</td>
<td>08/01/2018</td>
<td>$42.36</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$69.61</td>
</tr>
<tr>
<td></td>
<td>02/01/2019</td>
<td>$43.51</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$70.76</td>
</tr>
</tbody>
</table>

**Apprentice - ROOFER - Local 33**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>08/01/2018</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
<td>$21.18</td>
<td>$11.35</td>
<td>$3.69</td>
<td>$0.00</td>
<td>$36.22</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$25.42</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$52.67</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$27.53</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$54.78</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$31.77</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$59.02</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$36.01</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$63.26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>02/01/2019</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
<td>$21.76</td>
<td>$11.35</td>
<td>$3.69</td>
<td>$0.00</td>
<td>$36.80</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$26.11</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$53.36</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$28.28</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$55.53</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$32.63</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$59.88</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$36.98</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$64.23</td>
</tr>
</tbody>
</table>

Notes: **1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1**
Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs. (Hot Pitch Mechanics’ receive $1.00 hr. above ROOFER)

**Apprentice to Journeyworker Ratio:**

<table>
<thead>
<tr>
<th>ROOFER SLATE / TILE / PRECAST CONCRETE</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROOFERS LOCAL 33</td>
<td>08/01/2018</td>
<td>$42.61</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$69.86</td>
</tr>
<tr>
<td></td>
<td>02/01/2019</td>
<td>$43.76</td>
<td>$11.35</td>
<td>$15.90</td>
<td>$0.00</td>
<td>$71.01</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- ROOFER"

<table>
<thead>
<tr>
<th>SHEETMETAL WORKER</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHEETMETAL WORKERS LOCAL 17 - B</td>
<td>10/01/2018</td>
<td>$35.21</td>
<td>$12.20</td>
<td>$16.55</td>
<td>$1.92</td>
<td>$65.88</td>
</tr>
<tr>
<td></td>
<td>04/01/2019</td>
<td>$35.71</td>
<td>$12.20</td>
<td>$16.55</td>
<td>$1.92</td>
<td>$66.38</td>
</tr>
<tr>
<td>Step</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------------------</td>
<td>--------</td>
<td>---------</td>
<td>---------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>$14.08</td>
<td>$12.20</td>
<td>$4.02</td>
<td>$0.93</td>
<td>$31.23</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$15.84</td>
<td>$12.20</td>
<td>$4.52</td>
<td>$1.00</td>
<td>$33.56</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$17.61</td>
<td>$12.20</td>
<td>$10.48</td>
<td>$1.23</td>
<td>$41.52</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$19.37</td>
<td>$12.20</td>
<td>$10.48</td>
<td>$1.29</td>
<td>$43.34</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$21.13</td>
<td>$12.20</td>
<td>$13.37</td>
<td>$1.41</td>
<td>$48.11</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$22.89</td>
<td>$12.20</td>
<td>$13.61</td>
<td>$1.47</td>
<td>$50.17</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$24.65</td>
<td>$12.20</td>
<td>$13.85</td>
<td>$1.53</td>
<td>$52.23</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>$26.41</td>
<td>$12.20</td>
<td>$14.10</td>
<td>$1.59</td>
<td>$54.30</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>$28.17</td>
<td>$12.20</td>
<td>$14.34</td>
<td>$1.65</td>
<td>$56.36</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>$29.93</td>
<td>$12.20</td>
<td>$14.58</td>
<td>$1.71</td>
<td>$58.42</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$14.28</td>
<td>$12.20</td>
<td>$4.02</td>
<td>$0.93</td>
<td>$31.43</td>
</tr>
<tr>
<td>2</td>
<td>$16.07</td>
<td>$12.20</td>
<td>$4.52</td>
<td>$1.00</td>
<td>$33.79</td>
</tr>
<tr>
<td>3</td>
<td>$17.86</td>
<td>$12.20</td>
<td>$10.48</td>
<td>$1.23</td>
<td>$41.77</td>
</tr>
<tr>
<td>4</td>
<td>$19.64</td>
<td>$12.20</td>
<td>$10.48</td>
<td>$1.29</td>
<td>$43.61</td>
</tr>
<tr>
<td>5</td>
<td>$21.43</td>
<td>$12.20</td>
<td>$13.52</td>
<td>$1.41</td>
<td>$48.56</td>
</tr>
<tr>
<td>6</td>
<td>$23.21</td>
<td>$12.20</td>
<td>$13.78</td>
<td>$1.47</td>
<td>$50.66</td>
</tr>
<tr>
<td>7</td>
<td>$25.00</td>
<td>$12.20</td>
<td>$14.03</td>
<td>$1.53</td>
<td>$52.76</td>
</tr>
<tr>
<td>8</td>
<td>$26.78</td>
<td>$12.20</td>
<td>$14.28</td>
<td>$1.59</td>
<td>$54.85</td>
</tr>
<tr>
<td>9</td>
<td>$28.57</td>
<td>$12.20</td>
<td>$14.54</td>
<td>$1.66</td>
<td>$56.97</td>
</tr>
<tr>
<td>10</td>
<td>$30.35</td>
<td>$12.20</td>
<td>$14.79</td>
<td>$1.71</td>
<td>$59.05</td>
</tr>
</tbody>
</table>

Notes:

Apprentice to Journeyworker Ratio: 1:3

SIGN ERECTOR
PAINTERS LOCAL 35 - ZONE 2

06/01/2013 $25.81 $7.07 $0.00 $39.93
## Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - SIGN ERECTOR - Local 35 Zone 2</td>
<td>06/01/2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Effective Date - 06/01/2013

<table>
<thead>
<tr>
<th>Step</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$12.91</td>
<td>$7.07</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$19.98</td>
</tr>
<tr>
<td>2</td>
<td>$14.20</td>
<td>$7.07</td>
<td>$2.45</td>
<td>$0.00</td>
<td>$23.72</td>
</tr>
<tr>
<td>3</td>
<td>$15.49</td>
<td>$7.07</td>
<td>$2.45</td>
<td>$0.00</td>
<td>$25.01</td>
</tr>
<tr>
<td>4</td>
<td>$16.78</td>
<td>$7.07</td>
<td>$2.45</td>
<td>$0.00</td>
<td>$26.30</td>
</tr>
<tr>
<td>5</td>
<td>$18.07</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$32.19</td>
</tr>
<tr>
<td>6</td>
<td>$19.36</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$33.48</td>
</tr>
<tr>
<td>7</td>
<td>$20.65</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$34.77</td>
</tr>
<tr>
<td>8</td>
<td>$21.94</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$36.06</td>
</tr>
<tr>
<td>9</td>
<td>$23.23</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$37.35</td>
</tr>
</tbody>
</table>

### Notes:
- Steps are 4 mos.
- Apprentice to Journeyworker Ratio: 1:1

### Specialized Earth Moving Equipment < 35 Tons

<table>
<thead>
<tr>
<th>Classification</th>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIALIZED EARTH MOVING EQUIP &lt; 35 TONS</td>
<td>12/01/2016</td>
<td>$32.44</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$54.24</td>
</tr>
</tbody>
</table>

### Specialized Earth Moving Equipment > 35 Tons

<table>
<thead>
<tr>
<th>Classification</th>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIALIZED EARTH MOVING EQUIP &gt; 35 TONS</td>
<td>12/01/2016</td>
<td>$32.73</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$54.53</td>
</tr>
</tbody>
</table>

### Sprinkler Fitter

<table>
<thead>
<tr>
<th>Classification</th>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPRINKLER FITTER</td>
<td>10/01/2018</td>
<td>$52.68</td>
<td>$9.12</td>
<td>$18.90</td>
<td>$80.70</td>
</tr>
<tr>
<td></td>
<td>01/01/2019</td>
<td>$52.18</td>
<td>$9.47</td>
<td>$19.10</td>
<td>$80.75</td>
</tr>
<tr>
<td></td>
<td>03/01/2019</td>
<td>$53.53</td>
<td>$9.47</td>
<td>$19.10</td>
<td>$82.10</td>
</tr>
<tr>
<td></td>
<td>10/01/2019</td>
<td>$54.88</td>
<td>$9.47</td>
<td>$19.10</td>
<td>$83.45</td>
</tr>
<tr>
<td></td>
<td>03/01/2020</td>
<td>$56.23</td>
<td>$9.47</td>
<td>$19.10</td>
<td>$84.80</td>
</tr>
<tr>
<td></td>
<td>10/01/2020</td>
<td>$57.58</td>
<td>$9.47</td>
<td>$19.10</td>
<td>$86.15</td>
</tr>
<tr>
<td></td>
<td>03/01/2021</td>
<td>$58.93</td>
<td>$9.47</td>
<td>$19.10</td>
<td>$87.50</td>
</tr>
</tbody>
</table>
### SPRINKLER FITTER - Local 550 (Section B) Zone 2

**Classification**: Apprentice - SPRINKLER FITTER - Local 550 (Section B) Zone 2

**Effective Date**:
- 10/01/2018
- 01/01/2019

#### Apprentice Base Wage Table

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>$18.44</td>
<td>$9.12</td>
<td>$8.90</td>
<td>$0.00</td>
<td>$36.46</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>$21.07</td>
<td>$9.12</td>
<td>$8.90</td>
<td>$0.00</td>
<td>$39.09</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>$23.71</td>
<td>$9.12</td>
<td>$8.90</td>
<td>$0.00</td>
<td>$41.73</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>$26.34</td>
<td>$9.12</td>
<td>$8.90</td>
<td>$0.00</td>
<td>$44.36</td>
</tr>
<tr>
<td>5</td>
<td>55</td>
<td>$28.97</td>
<td>$9.12</td>
<td>$8.90</td>
<td>$0.00</td>
<td>$46.99</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>$31.61</td>
<td>$9.12</td>
<td>$10.40</td>
<td>$0.00</td>
<td>$51.13</td>
</tr>
<tr>
<td>7</td>
<td>65</td>
<td>$34.24</td>
<td>$9.12</td>
<td>$10.40</td>
<td>$0.00</td>
<td>$53.76</td>
</tr>
<tr>
<td>8</td>
<td>70</td>
<td>$36.88</td>
<td>$9.12</td>
<td>$10.40</td>
<td>$0.00</td>
<td>$56.40</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
<td>$39.51</td>
<td>$9.12</td>
<td>$10.40</td>
<td>$0.00</td>
<td>$59.03</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>$42.14</td>
<td>$9.12</td>
<td>$10.40</td>
<td>$0.00</td>
<td>$61.66</td>
</tr>
</tbody>
</table>

#### Effective Date - 01/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>$18.26</td>
<td>$9.47</td>
<td>$9.10</td>
<td>$0.00</td>
<td>$36.83</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>$20.87</td>
<td>$9.47</td>
<td>$9.10</td>
<td>$0.00</td>
<td>$39.44</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>$23.48</td>
<td>$9.47</td>
<td>$9.10</td>
<td>$0.00</td>
<td>$42.05</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>$26.09</td>
<td>$9.47</td>
<td>$9.10</td>
<td>$0.00</td>
<td>$44.66</td>
</tr>
<tr>
<td>5</td>
<td>55</td>
<td>$28.70</td>
<td>$9.47</td>
<td>$9.10</td>
<td>$0.00</td>
<td>$47.27</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>$31.31</td>
<td>$9.47</td>
<td>$10.60</td>
<td>$0.00</td>
<td>$51.38</td>
</tr>
<tr>
<td>7</td>
<td>65</td>
<td>$33.92</td>
<td>$9.47</td>
<td>$10.60</td>
<td>$0.00</td>
<td>$53.99</td>
</tr>
<tr>
<td>8</td>
<td>70</td>
<td>$36.53</td>
<td>$9.47</td>
<td>$10.60</td>
<td>$0.00</td>
<td>$56.60</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
<td>$39.14</td>
<td>$9.47</td>
<td>$10.60</td>
<td>$0.00</td>
<td>$59.21</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>$41.74</td>
<td>$9.47</td>
<td>$10.60</td>
<td>$0.00</td>
<td>$61.81</td>
</tr>
</tbody>
</table>

**Notes:**
- Apprentice entered prior 9/30/10: 40/45/50/55/60/65/70/75/80/85
- Steps are 850 hours
- Apprentice to Journeyworker Ratio: 1:3

### STEAM BOILER OPERATOR

**Classification**: OPERATING ENGINEERS LOCAL 4

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEERS"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELECOMMUNICATION TECHNICIAN ELECTRICIANS LOCAL 223</td>
<td>09/01/2018</td>
<td>$34.76</td>
<td>$9.65</td>
<td>$10.81</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td></td>
<td>03/01/2019</td>
<td>$35.25</td>
<td>$9.90</td>
<td>$11.14</td>
<td>$0.00</td>
<td>$56.29</td>
</tr>
<tr>
<td></td>
<td>09/01/2019</td>
<td>$35.78</td>
<td>$10.15</td>
<td>$11.45</td>
<td>$0.00</td>
<td>$57.38</td>
</tr>
<tr>
<td></td>
<td>03/01/2020</td>
<td>$36.27</td>
<td>$10.40</td>
<td>$11.78</td>
<td>$0.00</td>
<td>$58.45</td>
</tr>
<tr>
<td>Apprentice - TELECOMMUNICATION TECHNICIAN - Local 223</td>
<td>09/01/2018</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Effective Date - 09/01/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Notes: See Electrician Apprentice Wages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps are 750hrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telecom Apprentice Wages shall be the same as the Electrician Apprentice Wages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprentice to Journeyworker Ratio:2:3***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TERRAZZO FINISHERS BRICKLAYERS LOCAL 3 - MARBLE &amp; TILE</td>
<td>08/01/2018</td>
<td>$51.85</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$83.26</td>
</tr>
<tr>
<td></td>
<td>02/01/2019</td>
<td>$52.49</td>
<td>$10.75</td>
<td>$20.66</td>
<td>$0.00</td>
<td>$83.90</td>
</tr>
<tr>
<td></td>
<td>08/01/2019</td>
<td>$53.84</td>
<td>$10.75</td>
<td>$20.80</td>
<td>$0.00</td>
<td>$85.39</td>
</tr>
<tr>
<td></td>
<td>02/01/2020</td>
<td>$54.48</td>
<td>$10.75</td>
<td>$20.80</td>
<td>$0.00</td>
<td>$86.03</td>
</tr>
<tr>
<td></td>
<td>08/01/2020</td>
<td>$55.83</td>
<td>$10.75</td>
<td>$20.95</td>
<td>$0.00</td>
<td>$87.53</td>
</tr>
<tr>
<td></td>
<td>02/01/2021</td>
<td>$56.47</td>
<td>$10.75</td>
<td>$20.95</td>
<td>$0.00</td>
<td>$88.17</td>
</tr>
<tr>
<td></td>
<td>08/01/2021</td>
<td>$57.87</td>
<td>$10.75</td>
<td>$21.11</td>
<td>$0.00</td>
<td>$89.73</td>
</tr>
<tr>
<td></td>
<td>02/01/2022</td>
<td>$58.46</td>
<td>$10.75</td>
<td>$21.11</td>
<td>$0.00</td>
<td>$90.32</td>
</tr>
</tbody>
</table>
### Apprentice - TERRAZZO FINISHER - Local 3 Marble & Tile

**Effective Date:** 08/01/2018

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$25.93</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$56.71</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$31.11</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$61.89</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$36.30</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$67.08</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$41.48</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$72.26</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$46.67</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$77.45</td>
</tr>
</tbody>
</table>

**Effective Date:** 02/01/2019

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$26.25</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$57.03</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$31.49</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$62.27</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$36.74</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$67.52</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$41.99</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$72.77</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$47.24</td>
<td>$10.75</td>
<td>$20.03</td>
<td>$0.00</td>
<td>$78.02</td>
</tr>
</tbody>
</table>

**Notes:**

Apprentice to Journeyworker Ratio: 1:3

---

**TEST BORING DRILLER**

LABORERS - FOUNDATION AND MARINE

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$39.35</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$62.45</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$40.30</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$63.40</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$41.30</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.40</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$42.30</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$65.40</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$43.29</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$66.39</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$44.27</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$67.37</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$45.29</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$68.39</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$46.30</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$69.40</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

---

**TEST BORING DRILLER HELPER**

LABORERS - FOUNDATION AND MARINE

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2018</td>
<td>$38.07</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$61.17</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>$39.02</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$62.12</td>
</tr>
<tr>
<td>06/01/2019</td>
<td>$40.02</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$63.12</td>
</tr>
<tr>
<td>12/01/2019</td>
<td>$41.02</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.12</td>
</tr>
<tr>
<td>06/01/2020</td>
<td>$42.99</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$65.11</td>
</tr>
<tr>
<td>12/01/2020</td>
<td>$42.99</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$66.09</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>$44.01</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$67.11</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>$45.02</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$68.12</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST BORING LABORER</td>
<td>06/01/2018</td>
<td>$37.95</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$61.05</td>
</tr>
<tr>
<td>LABORERS - FOUNDATION AND MARINE</td>
<td>12/01/2018</td>
<td>$38.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$62.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$39.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$63.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$40.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$41.89</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$64.99</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$42.87</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$65.97</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$43.89</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$66.99</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$44.90</td>
<td>$7.70</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$68.00</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRACTORS/PORTABLE STEAM GENERATORS</td>
<td>06/01/2018</td>
<td>$46.61</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.11</td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>12/01/2018</td>
<td>$47.75</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$48.84</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.34</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$49.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.48</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.06</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$77.56</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.20</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.70</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.29</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.79</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.43</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.93</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRAILERS FOR EARTH MOVING EQUIPMENT</td>
<td>12/01/2016</td>
<td>$33.02</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$54.82</td>
</tr>
<tr>
<td>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUNNEL WORK - COMPRESSED AIR</td>
<td>06/01/2018</td>
<td>$50.23</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$73.73</td>
</tr>
<tr>
<td>LABORERS (COMPRESSED AIR)</td>
<td>12/01/2018</td>
<td>$51.18</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$74.68</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$52.18</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$75.68</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$53.18</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$76.68</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$54.17</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$77.67</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$55.15</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$78.65</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$56.17</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$79.67</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$57.18</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$80.68</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE)</td>
<td>06/01/2018</td>
<td>$52.23</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$75.73</td>
</tr>
<tr>
<td>LABORERS (COMPRESSED AIR)</td>
<td>12/01/2018</td>
<td>$53.18</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$76.68</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$54.18</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$77.68</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$55.18</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$78.68</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$56.17</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$79.67</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$57.15</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$80.65</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$58.17</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$81.67</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$59.18</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$82.68</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUNNEL WORK - FREE AIR</td>
<td>06/01/2018</td>
<td>$42.30</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$65.80</td>
</tr>
<tr>
<td>LABORERS (FREE AIR TUNNEL)</td>
<td>12/01/2018</td>
<td>$43.25</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$66.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$44.25</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$67.75</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$45.25</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$68.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$46.24</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$69.74</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$47.22</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$70.72</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$48.24</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$71.74</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$49.25</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$72.75</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>---------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>TUNNEL WORK - FREE AIR (HAZ. WASTE) LABORERS (FREE AIR TUNNEL)</td>
<td>06/01/2018</td>
<td>$44.30</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$67.80</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$45.25</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$68.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$46.25</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$69.75</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$47.25</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$70.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$48.24</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$71.74</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$49.22</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$72.72</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$50.24</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$73.74</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$51.25</td>
<td>$7.70</td>
<td>$15.80</td>
<td>$0.00</td>
<td>$74.75</td>
</tr>
<tr>
<td>VAC-HAUL TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</td>
<td>12/01/2016</td>
<td>$32.44</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$54.24</td>
</tr>
<tr>
<td>WAGON DRILL OPERATOR LABORERS - ZONE 2</td>
<td>06/01/2018</td>
<td>$33.50</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$55.22</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$34.34</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.06</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$35.21</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$56.93</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$36.07</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$57.79</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$36.96</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$58.68</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$37.85</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$59.57</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$38.77</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$60.49</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$39.68</td>
<td>$7.70</td>
<td>$14.02</td>
<td>$0.00</td>
<td>$61.40</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WASTE WATER PUMP OPERATOR OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2018</td>
<td>$47.08</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$73.58</td>
</tr>
<tr>
<td></td>
<td>12/01/2018</td>
<td>$48.23</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$74.73</td>
</tr>
<tr>
<td></td>
<td>06/01/2019</td>
<td>$49.33</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$75.83</td>
</tr>
<tr>
<td></td>
<td>12/01/2019</td>
<td>$50.48</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$76.98</td>
</tr>
<tr>
<td></td>
<td>06/01/2020</td>
<td>$51.58</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$78.08</td>
</tr>
<tr>
<td></td>
<td>12/01/2020</td>
<td>$52.73</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$79.23</td>
</tr>
<tr>
<td></td>
<td>06/01/2021</td>
<td>$53.83</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$80.33</td>
</tr>
<tr>
<td></td>
<td>12/01/2021</td>
<td>$54.98</td>
<td>$11.00</td>
<td>$15.50</td>
<td>$0.00</td>
<td>$81.48</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATER METER INSTALLER PLUMBERS &amp; PIPEFITTERS LOCAL 51</td>
<td>09/01/2018</td>
<td>$42.04</td>
<td>$10.00</td>
<td>$18.20</td>
<td>$0.00</td>
<td>$70.24</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- PLUMBER/PIPEFITTER&quot; or &quot;PLUMBER/GASFITTER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside Electrical - East</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABLE TECHNICIAN (Power Zone) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</td>
<td>09/03/2017</td>
<td>$27.14</td>
<td>$7.75</td>
<td>$1.81</td>
<td>$0.00</td>
<td>$36.70</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LINEMAN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABLEMAN (Underground Ducts &amp; Cables) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</td>
<td>09/03/2017</td>
<td>$38.45</td>
<td>$7.75</td>
<td>$9.53</td>
<td>$0.00</td>
<td>$55.73</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LINEMAN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRIVER / GROUNDMAN CDL OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</td>
<td>09/03/2017</td>
<td>$31.66</td>
<td>$7.75</td>
<td>$9.44</td>
<td>$0.00</td>
<td>$48.85</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LINEMAN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRIVER / GROUNDMAN -Inexperienced (&lt;2000 Hrs) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</td>
<td>09/03/2017</td>
<td>$24.88</td>
<td>$7.75</td>
<td>$1.75</td>
<td>$0.00</td>
<td>$34.38</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LINEMAN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQUIPMENT OPERATOR (Class A CDL) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</td>
<td>09/03/2017</td>
<td>$38.45</td>
<td>$7.75</td>
<td>$13.61</td>
<td>$0.00</td>
<td>$59.81</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice- LINEMAN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>---------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>EQUIPMENT OPERATOR (Class B CDL)</td>
<td>09/03/2017</td>
<td>$33.92</td>
<td>$7.75</td>
<td>$10.21</td>
<td>$0.00</td>
<td>$51.88</td>
</tr>
<tr>
<td><strong>For apprentice rates see &quot;Apprentice- LINEMAN&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROUNDMAN</td>
<td>09/03/2017</td>
<td>$24.88</td>
<td>$7.75</td>
<td>$1.75</td>
<td>$0.00</td>
<td>$34.38</td>
</tr>
<tr>
<td><strong>For apprentice rates see &quot;Apprentice- LINEMAN&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROUNDMAN - Inexperienced (&lt;2000 Hrs.)</td>
<td>09/03/2017</td>
<td>$20.35</td>
<td>$7.75</td>
<td>$1.61</td>
<td>$0.00</td>
<td>$29.71</td>
</tr>
<tr>
<td><strong>For apprentice rates see &quot;Apprentice- LINEMAN&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEYMAN LINEMAN</td>
<td>09/03/2017</td>
<td>$45.23</td>
<td>$7.75</td>
<td>$16.61</td>
<td>$0.00</td>
<td>$69.59</td>
</tr>
</tbody>
</table>

### LINEMAN (Outside Electrical) - East Local 104

<table>
<thead>
<tr>
<th>Step</th>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>09/03/2017</td>
<td>$27.14</td>
<td>$7.75</td>
<td>$3.31</td>
<td>$0.00</td>
<td>$38.20</td>
</tr>
<tr>
<td>2</td>
<td>09/03/2017</td>
<td>$29.40</td>
<td>$7.75</td>
<td>$3.38</td>
<td>$0.00</td>
<td>$40.53</td>
</tr>
<tr>
<td>3</td>
<td>09/03/2017</td>
<td>$31.66</td>
<td>$7.75</td>
<td>$3.45</td>
<td>$0.00</td>
<td>$42.86</td>
</tr>
<tr>
<td>4</td>
<td>09/03/2017</td>
<td>$33.92</td>
<td>$7.75</td>
<td>$3.52</td>
<td>$0.00</td>
<td>$45.23</td>
</tr>
<tr>
<td>5</td>
<td>09/03/2017</td>
<td>$36.18</td>
<td>$7.75</td>
<td>$3.59</td>
<td>$0.00</td>
<td>$47.57</td>
</tr>
<tr>
<td>6</td>
<td>09/03/2017</td>
<td>$38.45</td>
<td>$7.75</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$50.02</td>
</tr>
<tr>
<td>7</td>
<td>09/03/2017</td>
<td>$40.71</td>
<td>$7.75</td>
<td>$3.72</td>
<td>$0.00</td>
<td>$52.43</td>
</tr>
</tbody>
</table>

### Notes:

- Apprentice to Journeyworker Ratio: 1:2

- **TELEDATA CABLE SPLICER**
  - 02/05/2018 | $29.98 | $4.70 | $3.15 | $0.00 | $37.83 |
  - 02/04/2019 | $30.73 | $4.70 | $3.17 | $0.00 | $38.60 |

- **TELEDATA LINEMAN/EQUIPMENT OPERATOR**
  - 02/05/2018 | $28.22 | $4.70 | $3.10 | $0.00 | $36.02 |
  - 02/04/2019 | $28.93 | $4.70 | $3.14 | $0.00 | $36.77 |

- **TELEDATA WIREMAN/INSTALLER/TECHNICIAN**
  - 02/05/2018 | $28.22 | $4.70 | $3.10 | $0.00 | $36.02 |
  - 02/04/2019 | $28.93 | $4.70 | $3.14 | $0.00 | $36.77 |

- **TREE TRIMMER**
  - 01/31/2016 | $18.51 | $3.55 | $0.00 | $0.00 | $22.06 |

- **TREE TRIMMER GROUNDMAN**
  - 01/31/2016 | $16.32 | $3.55 | $0.00 | $0.00 | $19.87 |

This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company’s equipment, and (c) by a person who is using hand or mechanical cutting methods and is not on the ground. This classification does not apply to wholesale tree removal.

### Notes:

- This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company’s equipment, and (c) by a person who is using hand or mechanical cutting methods and is not on the ground. This classification does not apply to wholesale tree removal.
Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the pre-determined hourly wage rate established by the Commissioner under the provisions of the M.G.L. c. 149, ss. 26-27D. Apprentice ratios are established by the Division of Apprenticeship Training pursuant to M.G.L. c. 23, ss. 11E-11L.

All apprentices must be registered with the Division of Apprenticeship Training in accordance with M.G.L. c. 23, ss. 11E-11L.

All steps are six months (1000 hours.) Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified.

** Multiple ratios are listed in the comment field.
*** APP to JM; 1:1, 2:2, 2:3, 3:4, 4:5, 4:6, 5:7, 6:8, 6:9, 7:10, 8:10, 8:11, 8:12, 9:13, 10:13, 10:14, etc.
**** APP to JM; 1:1, 1:2, 2:3, 2:4, 3:5, 4:6, 4:7, 5:8, 6:9, 6:10, 7:11, 8:12, 8:13, 9:14, 10:15, 10:16, etc.
## INDEX

FOR

SECTION 007390

SPECIAL CONDITIONS

<table>
<thead>
<tr>
<th>NO.</th>
<th>PARAGRAPH TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>RESPONSIBILITY AND COMPLIANCE</td>
</tr>
<tr>
<td>1.02</td>
<td>CONTRACT CONDITIONS SPECIFICALLY BY LAW AND REGULATIONS</td>
</tr>
<tr>
<td>1.03</td>
<td>WORKING TIMES AND TIME FOR COMPLETION</td>
</tr>
<tr>
<td>1.04</td>
<td>LIQUIDATED DAMAGES</td>
</tr>
<tr>
<td>1.05</td>
<td>TESTS AND INSPECTIONS</td>
</tr>
<tr>
<td>1.06</td>
<td>COORDINATION OF WORK</td>
</tr>
<tr>
<td>1.07</td>
<td>REQUESTS FOR INFORMATION (RFIs)</td>
</tr>
<tr>
<td>1.08</td>
<td>CLERK OF THE WORKS</td>
</tr>
<tr>
<td>1.09</td>
<td>PROJECT MEETINGS</td>
</tr>
<tr>
<td>1.10</td>
<td>EXISTING UTILITIES</td>
</tr>
<tr>
<td>1.11</td>
<td>TEMPORARY AND TRIAL USAGE</td>
</tr>
<tr>
<td>1.12</td>
<td>USE AND OCCUPANCY PRIOR TO ACCEPTANCE BY THE OWNER</td>
</tr>
<tr>
<td>1.13</td>
<td>GLASS BREAKAGE</td>
</tr>
<tr>
<td>1.14</td>
<td>PERMITS AND FEES</td>
</tr>
<tr>
<td>1.15</td>
<td>WELDING AND CUTTING</td>
</tr>
<tr>
<td>1.16</td>
<td>SNOW AND ICE REMOVAL</td>
</tr>
<tr>
<td>1.17</td>
<td>WINTER CONSTRUCTION</td>
</tr>
<tr>
<td>1.18</td>
<td>CONSTRUCTION REQUIREMENTS</td>
</tr>
<tr>
<td>1.19</td>
<td>CONSTRUCTION PARKING</td>
</tr>
<tr>
<td>1.20</td>
<td>CLEANING</td>
</tr>
</tbody>
</table>

END OF INDEX

Section 007390 Special Conditions
SECTION 007390
SPECIAL CONDITIONS

PART 1 - GENERAL

1.01 RESPONSIBILITY AND COMPLIANCE

A. All requirements set forth under this SECTION 007390 are directed to the General Contractor except as specifically excepted.

B. Be responsible for arranging for facilities as specified herein and in SECTION 015000, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS, as required for proper and expeditious prosecution of the work. Pay costs for such general services and temporary facilities, except as otherwise specified, until final acceptance of the work, and remove same at completion of work.

C. Comply with applicable OSHA, State, and municipal regulations and requirements for services and facilities required under this SECTION 007390, and in performance of all requirements of this Contract.

D. Referenced Standards: Where industry standards and publications of public bodies are referred to in the Specifications, references shall be understood to be the revision in force at the date of receiving Bids, except where otherwise indicated.

1.02 CONTRACT CONDITIONS SPECIFICALLY REQUIRED BY LAW AND REGULATIONS

A. This Contract is subject to all applicable Federal regulations, State and local laws, and all amendments thereto, and where any requirements contained herein do not conform to such regulations and statutes governing the construction work of this Contract, the regulations, and statutes shall govern.

B. Special attention shall be given to the requirements of Chapter 30, Section 9 (1), of the General Laws of the Commonwealth of Massachusetts, and all amendments thereto, concerning conformity of the Work to the Contract Documents; deviations; certificates; penalties; and the provisions contained herein are made part of this Contract as set forth in full herein.

C. Referenced Codes, Rules and Regulations: Where codes, rules, regulations and laws are referred to in the Specifications, references shall be understood to be the revision in force at the date of receiving Bids.

1.03 WORKING TIMES AND TIME FOR COMPLETION

A. It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the 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 by the date specified therein.

B. Unless written authorization to the contrary is received from the Owner, perform the work of this Contract between the hours of 7:00 AM and 7:00 PM, Mondays through Fridays. No work at the site will be permitted on Saturdays or Sundays without written permission from the Owner.
C. The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such a rate of progress as will ensure completion thereof within 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 the same, taking into consideration the usual industrial and climatic conditions prevailing in this locality. Refer to SECTION 013300, SUBMITTAL PROCEDURES, for progress schedule requirements and submittal procedures.

D. It is further agreed that the time is of the essence of each and every portion of the Contract Documents wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new limit fixed by such extension shall be of the essence of this Contract. Provided, that the Contractor shall not be charged with liquidated damages for any excess cost when the delay in the completion of the work is due:

1. To any preference, priority, or allocation order duly issued by the Government;

2. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, Acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a Contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and extreme weather conditions which are rare and unusual for the season during which the Work is being performed; and

3. To any delays of subcontractors or suppliers occasioned by any of the clauses specified in subparagraphs 1. and 2. of this paragraph.

Provided, further, that the Contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the Contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain within a reasonable time of its decision in the matter.

1.04 LIQUIDATED DAMAGES

A. If the Contractor shall neglect, fail, or refuse to bring all required work under the Contract to Substantial Completion, as defined in the GENERAL CONDITIONS, and so certified by the Architect by the date stipulated in the Contract, the Owner will deduct, from sums otherwise due under the Contract, not as a penalty, but as liquidated damages for such breach of Contract, for each and every calendar day that the Contractor shall be in default after the said date or authorized extension thereof, the amounts included in the GENERAL CONDITIONS.

1.05 TESTS AND INSPECTIONS

A. Make, or have made, such tests and inspections on workmanship and materials as may be required by the Building Code, State or municipal laws, or as called for under the various SECTIONS of the Specifications. Refer to Section 014000, Testing Laboratory Services, for additional information.

B. Bear all expense to such tests and inspections, unless otherwise specified under the various SECTIONS of the Specifications and furnish all labor, tools, instruments, water, temporary power and light, construction, and equipment necessary for these tests and inspections. Furnish records of all tests and inspections to the Architect.
Remove all temporary work, materials, and equipment upon completion of tests and inspections.

C. Where, in the various SECTIONS of the Specifications, inspections and testing of materials, processes, and the like is called for, the selection of bureaus, laboratories, and/or agencies for such inspection and testing shall be subject to the approval of the Architect.

D. Should any material or work be found, after testing or inspections, to be defective or inferior, remove and replace such material and/or work with new sound materials and/or work as approved by the Architect, and bear all costs therefor.

E. The Owner will, by separate contract, secure the services of an independent testing laboratory to test various element of the Work as they see fit, throughout the progress of the Work. These tests and inspections do not relieve the Contractor of their responsibility to perform tests and make inspections as stated herein. The Contractor shall cooperate with the Owner's testing contractor and facilitate the completion of their work.

1.06 COORDINATION OF THE WORK

A. The Contractor and each subcontractor shall coordinate their work with all adjacent work and shall cooperate with all other trades so as to facilitate general progress of the work. Each trade shall afford all other trades every reasonable opportunity for the installation of their respective work and for the storage of their materials and equipment. The Contractor shall be responsible for coordination. Refer to SECTION 013300, SUBMITTAL PROCEDURES, for coordination drawing requirements, preparation, and submittal procedures.

B. Each subcontractor shall assume responsibility for the correctness and adequacy of his work. Each subcontractor shall be responsible for and pay for all damages done by his work or his workmen.

C. The Contractor shall cooperate with, and provide access and working area to, the Owner's contractors for the performance of specific work assigned to them.

1.07 REQUESTS FOR INFORMATION (RFIs)

A. The Contractor's responsibility for the review of the Contract Documents is set forth in the General Conditions.

B. Prior to submitting a request for information, the Contractor shall first carefully study and compare the Contract Documents, field conditions, field drawings and other supplied materials, Coordination Drawings, and prior project correspondence and documentation to determine that the information sought is not reasonably obtainable therein.

C. Study the documents applicable to each component of the Work sufficiently in advance of the time such Work will have to be ordered, fabricated or installed, so that if additional information or instructions are needed, the Architect will have sufficient time to respond to such requests before the information is needed by the Contractor. Allow at least 14 calendar days for the Architect to respond. Copies of all Requests for Information shall be copied simultaneously to the Owner's Project Manager and to the Clerk-of-the-Works.

D. Requests for Information specific to the work of Civil, Structural, Mechanical, Plumbing, Fire Protection, and Electrical trades shall be submitted, via the Contractor,
directly to the applicable consultant, with an additional record copy of the Requests for Information simultaneously to the Architect, the Owner's Project Manager and to the Clerk-of-the-Works.

E. Submit each request on a standard form, consecutively numbered, and with such accompanying information as the Architect may require. Clearly state what information is requested and include a reference to the drawing and/or detail number and sheet number, and/or the specification section and paragraph number, or give other precise information to direct the Architect's attention to any sources the Contractor consulted to prevent the Architect from duplicating the efforts of the Contractor.

1. Requests for Information that are not accompanied by a precise, detailed reference to the Contract Documents will be returned to the Contractor unanswered for revision.

2. Requests for Information regarding information clearly shown in the Contract Documents will be returned to the Contractor unanswered.

3. Requests for Information which should properly be addressed in the context of a shop drawing, Coordination Drawing, substitution request, or similar submittal, will be returned to the Contractor unanswered.

4. Requests for Information returned to the Contractor unanswered shall be considered resolved and the matter closed. Requests for Information returned to the Contractor unanswered for revisions shall be resubmitted to the Architect with the required accompanying documentation, after which the Contractor shall allow at least 14 calendar days for the Architect to respond.

1.08 CLERK OF THE WORKS

A. The Owner, through its Owner's Project Manager, will employ a Clerk-of-the-Works for this Project and shall, upon request by the Contractor, furnish to the Contractor a written statement of duties, responsibilities, and limitations of authority of such Clerk-of-the-Works. Except as expressly set forth in such an exhibit, the Clerk-of-the-Works shall have no authority to approve Work, to approve changes, or to exercise any of the power and authority of the Owner or the Architect.

B. The Owner will pay for the services of its Clerk-of-the-Works during normal working hours, Monday through Friday, up to 40 hours in any one week. Saturdays, Sundays, and holidays excluded.

C. Should the Contractor perform work outside of normal working hours, or in excess of 40 hours in any one week, or on Saturdays, Sundays and holidays, either by election or because the Contractor is required to do so in order to keep the Project on schedule, or for any other reason, then the Owner’s Clerk-of-the-Works will work the same hours as the Contractor, and the Contractor shall reimburse the Owner for the additional cost of the services of the Owner’s Clerk-of-the-Works during these hours at the rate of $75/hour. For any work after August 15, 2018 window related work September onwards, second shift work is considered normal hours. This reimbursement shall be by means of a credit Change Order executed periodically on the requisition and payment submitted by the General Contractor following the month the additional cost is incurred or at such other time convenient to the Owner prior to Final Completion. This reimbursement shall be by means of a credit Change Order executed at the time of Final Completion.

D. The Owner designates NV5 as the Owner's Project Manager, to represent the Owner during the progress of the Work. The Owner's Project Manager shall report to and
advise the Owner in accordance with the agreement between those parties. The Owner's Project Manager shall not, by undertaking to represent the Owner, incur any obligation to the Contractor, and nothing stated herein shall act to create any contractual relationship between the Contractor and the Owner's Project Manager. The Owner's Project Manager shall not have the authority to direct changes in the Work, or agree to an adjustment of the Contract Time or the Contract Sum.

1.09 PROJECT MEETINGS

A. The Contractor, including the Contractor's Project Manager and site Superintendent, and all major Subcontractors, will be required to meet with the Architect, the Owner's Project Manager, and the Clerk of the Works, at the site of the work, at regular intervals during the course of the Contract for purpose of progress review, planning for the upcoming work, coordination of shop drawing schedules, coordination drawings, sample submittals, and any other items of work requiring such coordination. The dates of such meetings shall be established by the Architect. The intervals of such meetings shall be no less than twice a month, unless otherwise determined by the Architect. All attendees must be authorized to make binding agreements.

B. The Owner’s Project Manager shall chair these meetings, be responsible for taking notes at each meeting, and for distributing printed copies of the notes to all parties in attendance at the project meetings, and to others who are affected by the actions taken at the meeting.

C. Sub-contractor Progress Meetings: The Contractor shall schedule, prepare and send out an agenda listing required attendees, and administer weekly Sub-contractor meetings throughout the progress of the Work, which include at a minimum, a superintendent from each of the major sub-contractors and the Contractor's superintendent; each authorized to make binding agreements for their respective firms. The Contractor shall prepare meeting minutes for these meetings and distribute to all attendees, the Clerk-of-the-Works and the Architect. The Clerk-of-the-Works will attend each of these meetings.

1. Major sub-contractors are defined as follows: All filed-sub-bid sub-contractors, plus steel, while each is on site, each week following their respective Sub-contractor Startup Meetings, until such time as their work is substantially complete, unless their work is not included on the agenda.

2. Sub-contractor Startup Meetings: Before permitting any sub-contractor to begin work on the site, meet with the subcontractor to preview the work ahead. At a minimum, review the Contract Documents for work pertaining to that sub-contractor, approved shop drawings and coordination drawings as applicable, examine the existing conditions effecting the work of the sub-contractor, and discuss compliance with the Contract Documents and adherence to the Project Schedule.

1.10 EXISTING UTILITIES

A. Immediately repair any active existing utility lines (cables, conduits, ducts, and piping), except where such lines are to be abandoned. Protect and maintain such active existing utilities in use, until relocation of same has been completed, or cut, or capped, or prepared for service connections, as applicable. Perform such repair and protection work at no additional cost to the Contract.

B. If any existing active utility, which is not indicated on the Drawings, is unintentionally damaged, and such utility is to remain, immediately repair the damage and restore the utility to its original integrity. Reimbursement of cost for performing such repair will
be made by an adjustment in the contract price, at rates determined and approved by
the Architect. Consideration of any adjustment as outlined herein shall be based on the
assumption that the Contractor has performed in a prudent manner at the time such
damage occurred. If extra expense is incurred in protecting and maintaining any utility
line not shown on the Drawings, as adjustment in the Contract Price will be made.

C. The existence and location of underground and other utilities and construction
indicated as existing are not guaranteed. Before beginning sitework, investigate and
verify the existence and location of underground utilities and other construction. Prior
to construction, verify the location and invert elevations at points of connection of
sanitary sewer, storm sewer and water-service piping.

D. Notify Dig-Safe (Telephone number 811 or 1-888-DIG-SAFE, (1-888-344-7233)) at
least 72 hours, excluding weekends and legal Massachusetts holidays, but not more
than thirty (30) days, prior to commencing excavation, requesting certification of the
notice of electric, telephone, water, sewer, and other utilities. Include, in the notice, the
name and location of the project, street names or route numbers where the work is
contemplated, and an accurate description of the nature of the proposed work. Do not
commence the stated work until certification of notice receipt has been received from
Dig-Safe. Note: Record Dig-Safe ticket number after notifying Dig-Safe. The work
must start within 30 days from the date of issue. Beyond this point, tickets are valid
indefinitely, provided that the Dig-Safe marks are maintained, and the work is
continuous.

1.11 TEMPORARY AND TRIAL USAGE

A. Temporary and trial usage by Owner of any mechanical device, machinery, apparatus,
equipment, or any work or materials supplied under Contract, before final completion
and written acceptance by the Architect, shall not be construed as evidence of
Architect's acceptance of same.

B. The Owner reserves the privilege of such temporary or trial usage, for such reasonable
time as required to properly test such item. Claims for damages, due to injury to, or
breaking of, any parts of such work, when the determined cause is weakness or
inaccuracy of structural parts, or by defective material or workmanship, will not be
permitted.

C. If the Owner so requests, place an approved person, or persons, to instruct and assist in
such trial usage and bear the costs therefor. Trials shall be made under the Architect's
supervision.

1.12 USE AND OCCUPANCY PRIOR TO ACCEPTANCE BY THE OWNER

A. Prior to the date of Substantial Completion as stipulated in the Contract, or authorized
extension thereof, the Contractor agrees to permit selected use and occupancy of the
new building, or any portions thereof, before final acceptance by the Owner.

B. If the work for the new building has not been completed and accepted by the Owner,
by the date of Substantial Completion, the Owner, at his election, may from time to
time, occupy the new building, or any portions thereof, as the work in connection
therewith is completed to such a degree as will, in the opinion of the Owner, permit the
use of the building, or other portions of the project, for the purpose for which they are
intended.

C. The Owner will, prior to any such partial occupancy, give notice to the Contractor
thereof and such occupancy shall be predicated upon the following items:
1. In the case of partial occupancy after the stipulated date (or dates) of Substantial Completion, the Contractor shall extend all the necessary insurance coverage as stipulated until the certificate of final acceptance of the project is issued by the Architect. It is further noted that the use and occupancy prior to the final acceptance does not relieve the Contractor of his responsibility to maintain the insurance coverage as required under the CONTRACT and GENERAL CONDITIONS.

2. The one-year guarantee period shall not commence until the Certificate of Substantial Completion of the work is issued by the Architect.

   a. The one-year guarantee period for incomplete portions of the Work excepted from the Certificate of Substantial Completion, whether or not they are noted on the Certificate of Substantial Completion or included in the Punch list which are not completed within the time period given for Final Completion on the Certificate of Substantial Completion, shall commence when those portions of the Work are accepted by the Architect as complete.

3. The Owner's occupancy of the new building, or any portions thereof, shall not constitute an acceptance of work not performed in accordance with the Contract Documents or relieve the Contractor of liabilities to perform any work required by the Contract but not completed at the time of occupancy.

4. The Contractor shall be relieved of all maintenance costs on the portions of the new building occupied under this agreement.

5. The Contractor will not be held responsible for wear and tear or damage resulting solely from temporary occupancy.

6. The Contractor will not be required to furnish heat, electricity, and water, used in the occupied portions of the new building without proper remuneration therefor.

7. The provision of adequate parking for the Owner's employees' vehicles, during the period of temporary occupancy, in accordance with such terms, and at a location either on or off the site, as are mutually agreed upon by the Owner and the Contractor.

1.13 GLASS BREAKAGE

   A. Be responsible for all breakage of glass, from the time the construction operations commence in each portion of the project, until each portion of the project is occupied by the Owner. Replace all broken glass and deliver the building with all glazing intact, labels removed, and clean.

   B. Prior to the start of Work, identify all broken, missing and cracked glazing within the existing building to remain and submit a schedule of same to the Architect for approval. Obtain the Architect's written approval of the schedule. Be responsible for the replacement of any broken, cracked or missing existing glazing, in kind, when not included on the approved schedule, regardless of whether it was broken during, or prior to the commencement of the Work.

1.14 PERMITS AND FEES

   A. The local fees for permits required from New Bedford inspectional services have been waived by the City of New Bedford.
B. Be responsible for all permits and fees required to comply with state and local rules and regulations. A copy of the executed building permit shall be delivered to the Architect within ten (10) days of its receipt by the Contractor.

1.15 WELDING AND CUTTING

A. Require all Subcontractors to give the Contractor notice and obtain his approval prior to performing torch-cutting and welding operations. Where electric or gas welding or cutting work is done above or within ten (10) feet of combustible material or above space that may be occupied by persons, use interposed shields of incombustible material to protect against fire damage or injury due to sparks and hot metal.

B. Place tanks supplying gases for gas welding or cutting at no greater distance from the work than is necessary for safety, securely fastened and maintained in an upright position where practicable. Such tanks, when stored for use, shall be remote from any combustible material and free from exposure to the rays of the sun or high temperatures.

C. Maintain suitable fire extinguishing equipment within ten (10) feet from all welding and cutting operations. When operations cease for the noon hour or at the end of the day, thoroughly wet down the surroundings adjacent to welding and cutting operations.

D. Station a workman equipped with suitable fire extinguishing equipment near welding and cutting operations to see that the sparks do not lodge in floor cracks or pass thru floor or wall openings or lodge in any combustible material. Keep the workman at the source of work which offers special hazards for thirty (30) minutes after the job is completed to make sure that smoldering fires have not been started.

E. Place a qualified electrician in charge of installing and repairing electric or arc welding equipment.

F. Quality Assurance:

1. Structural Welds shall be made only by operators who have been qualified by tests, as prescribed in the "Standard Qualification Procedure" of the American Welding Society.

2. Pipe weld shall be made only by operators who have been qualified by the National Certified Pipe Welding Bureau and the operator's qualification record shall be submitted to the Architect before any work is performed.

3. Shop welding shall be in accordance with the "Code for Welding in Building Construction".

1.16 SNOW AND ICE REMOVAL

A. Remove all snow and ice which may impede the work, damage the finishes or materials, be detrimental to workmen, or impede trucking, delivery, or moving of materials at the job site, or prevent adequate drainage of the site or adjoining areas.

1.17 WINTER CONSTRUCTION

A. Be responsible for providing protection against damage to materials and work installed in freezing weather, by providing special heat and coverings to prevent damage by the elements, in a manner approved by the Architect. Protect the ground surfaces, under
footings, under pipelines, under masonry, under concrete, and other work subject to damage, against freezing or ice formation. If low temperature makes it impossible to continue operations safely in spite of cold weather precautions, cease work, and so notify the Architect.

Be responsible for providing protection against damage to materials and work installed in freezing weather, by providing special heat and coverings to prevent damage by the element, in a manner approved by the Architect. Refer Section 015000, CONSTRUCTION FACILITIES & TEMPORARY CONTROLS for specific requirements for temporary heating and protection. Protect the ground surfaces, under footings, under pipelines, under masonry, under concrete, and other work subject to damage, against freezing or ice formation. If low temperature makes it impossible to continue operations safely in spite of cold weather precautions, cease work, and so notify the Architect. Refer to the individual trade SECTIONS for specific temperature ranges, within which the work of said SECTIONS may be performed.

1.18 CONSTRUCTION REQUIREMENTS

A. Receive approval, in writing, of the submitted Erosion and Sedimentation Control Plan.

B. Install all perimeter fencing and Erosion and Sedimentation Control Devices prior to any excavation or clearing activities.

C. Install all access fencing, delineate construction parking areas and construct access points, install temporary lighting and post directional signage, in conformance with approved plan.

D. Install temporary trap-rock entrance to the site at the location of anticipated truck traffic to prevent the accumulation of silt, dirt or other materials accumulating on the roadways.

E. Erect all protective barriers around trees and other site features to remain.

F. Segregate all stockpiles of new materials from potential contamination from existing stockpiled materials, unless existing materials have been tested and approved in accordance with SECTION 013300, SUBMITTAL PROCEDURES.

G. The site and adjacent areas (roadways, sidewalks and parking areas) shall be swept broom-clean as is necessary to prevent the accumulation of debris or materials that may create dust.

H. All trucks leaving the site with demolition debris shall be covered to prevent the creation of dust.

I. The site shall be secured at the end of the construction day to prevent unauthorized entry into site.

J. The project is located adjacent to many residential properties. It is understood that coordination and cooperation with the neighbors is a critical part of the Work, and the contractor will endeavor to maintain access and safety for the duration of the Project.

K. Site Use Phasing Plan: The Contractor shall prepare a Site Use Phasing Plan in conjunction with the sub-contractors and with input from the Architect and the Owner's Project Manager. Site Use Phasing Plan shall show the Contractor's proposed Construction Facilities, including office and storage trailers, construction
fencing and gates, workman parking areas, layout and storage areas, tree protection, and permanent parking for the School Staff and the public. Submit Site Use Phasing Plan to the Architect for approval in accordance with Section 013300, Submittals, Section 015000, Construction Facilities and Temporary Controls, and this Section 007390, Special Conditions. The Site Use Phasing Plan shall include the following, at a minimum:

1. Construction fence lines, including gates, for the various phases of the work.

2. Temporary parking location for contractor vehicles, school staff and public visitors to the existing school, during construction, including safe vehicular and pedestrian access to the town hall without entering the construction zone.

3. Locations of temporary signage, trailers, storage and layout areas, for the various phases of the work.

4. Other items identified by the Architect and the Owner's Project Manager.

1.19 CONSTRUCTION PARKING

A. The Contractor shall park all equipment and vehicles, including the personal vehicles of the Contractor's and Sub-contractor's work force, within the construction fence or make other arrangements for other legal offsite parking. Public parking lots and parking spaces associated with local businesses, and municipal facilities shall not be used for Contractor Parking.

B. The Contractor shall insure that vehicles and equipment are not parked in the public ways or the shoulders of the public ways, and that all other requirements of this paragraph 1.20 are met, for the duration of the project.

C. The existing elementary school will remain open and occupied throughout the construction activities. Provide and maintain safe access and egress to the school for both the public and employees until the Work has been completed and Substantial Completion has been achieved for each phase.

1.20 CLEANING

A. General:

1. Perform general cleaning operations on a daily basis during the course of the work. Ensure that each Subcontractor engaged on the project bears full responsibility for cleaning up during and immediately upon completion of his work in each area, and removes all rubbish, waste, tools, equipment, and appurtenances caused by, and used in, the execution of his work from such areas; but such requirement shall in no way be construed to relieve the Contractor of his primary responsibility for maintaining the building and site in a clean, free from debris, leaving all work in proper condition satisfactory to the Architect and/or Owner. Final cleaning will be performed under SECTION 017700, PROJECT CLOSEOUT.

2. Refer to Refer Section 015000, CONSTRUCTION FACILITIES & TEMPORARY CONTROLS for specific requirements regarding debris and rubbish removal.

3. Leave pipe and duct spaces, chases, and furred spaces thoroughly clean, as work is completed therein.
SECTION 007550

CORI REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 CORI REQUIREMENTS

A. Each employee of the General Contractor, Trade Contractors and Subcontractors that will be present on the project site must fill out a CORI form and present in person the form with a valid and legal picture identification card to the authorized CORI representative for a criminal background check to be performed.

B. The CORI representative will provide the General Contractor, Trade Contractors and Subcontractors with forms of identification for each employee that are cleared and authorized to be on site.

C. A copy of each employee’s identification card must be readily visible at all times throughout construction activities.

1.03 FORMS

A. The following forms shall, which shall be used for this Contract, will be provided by the Owner:

1. CORI Request Form
2. Criminal Inquiry Form

END OF SECTION 007550
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

SECTION 010100
SUMMARY OF WORK

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Project Name and Description:

1. The Elizabeth Carter Brooks Elementary School project (the project) consists of replacement of exterior window/doors/associated systems, the replacement of the existing boiler plant, as well as various handicap accessibility modifications at the Elizabeth Carter Brooks Elementary School in New Bedford, MA.

   a. Exterior window and door work will include the demolition and removal of existing exterior door and window assemblies and selective removal of existing exterior wall panel assemblies along with the installation of new windows, doors, frames, and new insulated metal panel wall systems, complete with all components and accessories.

   b. Boiler room work will include the removal of (2) existing fire tube boilers (including all pumps, hydronic specialties, electrical, and associated piping) along with the installation of a new high efficiency gas-fired system (including boilers, pumps, hydronic specialties, electrical, and associated piping) and the installation of air cooled condensing units (located at grade).

   c. Handicap accessibility modifications work will include the demolition and removal of miscellaneous equipment, partitions, and finishes, the modification of fixed casework, the removal and replacement of an existing interior vestibules, the construction of a new interior vestibule and associated adjacent space, modifications to doors, door frames, and door hardware, the installation of a new vertical wheelchair lift, modifications to existing toilet rooms as well as the construction of new toilet rooms, the installation of room signage, the removal and replacement of an existing kitchen exhaust hood, and the installation of a new fire alarm system.

2. The Project includes everything as indicated on the Drawings. The Project also contains connections of utilities to existing utility systems.

END OF SECTION
SECTION 012200

UNIT PRICES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. The predetermined Unit Prices set forth herein shall be used to determine the equitable adjustment of the Contract Price in connection with the changes or extra work performed under this Contract, as authorized in writing by the Architect. Compensation for changes in the work which do not involve Unit Price items, shall be determined by other methods of payment in accordance with the requirements of GENERAL CONDITIONS OF THE CONTRACT.

B. It is mutually understood and agreed that such Unit Prices include all items of cost, equipment, taxes and insurance of every kind, overhead, and profit for the Contractor, and any Subcontractors performing work under the respective Unit Price items, and they shall be used uniformly, without modification, for additions to, and deductions from, the Contract Price.

C. Sufficient prior notice shall be given to the Architect so that he may take the proper measurements of materials removed or to be replaced. All quantities used in the determination of additions to or deductions from the Contract Price due to Unit Prices shall be those which have been determined and approved by the Architect.

D. Performance of work which is not required under the Contract Documents, or which is not authorized by Change Order, whether or not such item is set forth as a Unit Price item, shall not be considered cause for any extra payment. The Contractor will be held fully responsible for such unauthorized work, including the performance of all corrective measures required by the Architect.

E. All Unit Prices shall be in effect from the date of commencement of work until final completion of all work under the Contract.

F. All materials, methods of installation, and definition of terms set forth for the various Unit Price items, shall be as set forth in the Contract Documents.

G. The payment lines of the Contract shall be as indicated in the Contract Documents.
**1.02 UNIT PRICE SCHEDULE**

A. **ITEM OF WORK**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>ADD</th>
<th>DEDUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Re-pointing of existing brick masonry vertical walls, including preparation of joints for new work.</td>
<td>$24.00 SF</td>
<td>$19.20 SF</td>
</tr>
<tr>
<td>2.</td>
<td>Remove a defective steam trap in the steam tunnel and furnish and install a new 3/4-inch F&amp;T steam trap.</td>
<td>$2000.00 EA</td>
<td>$1600.00 EA</td>
</tr>
<tr>
<td>3.</td>
<td>Remove a defective steam trap in a unit ventilator chassis (or other accessible area) and furnish and install a new 3/4-inch F&amp;T steam trap.</td>
<td>$1200.00 EA</td>
<td>$960.00 EA</td>
</tr>
<tr>
<td>4.</td>
<td>Oil contaminated soils, in conjunction with the removal of oil tanks.</td>
<td>Refer to section 026000</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>General excavation, (including peat and other unsuitable materials, boulders or stone not classified as rock hereunder), machine excavated, transported, and dumped at an off-site legal dumping location.</td>
<td>$18.00 CY</td>
<td>$12.00 CY</td>
</tr>
<tr>
<td>6.</td>
<td>Trench excavation 0 to 6 feet (including peat and other unsuitable materials, boulders and stone not classified as rock hereunder) machine excavated transported and dumped at an off-site legal dumping location.</td>
<td>$24.00 CY</td>
<td>$19.20 CY</td>
</tr>
<tr>
<td>7.</td>
<td>Trench excavation 6 to 10 feet (including peat and other unsuitable materials, boulders and stone not classified as rock hereunder) machine excavated transported and dumped at an off-site legal dumping location.</td>
<td>$25.00 CY</td>
<td>$20.00 CY</td>
</tr>
<tr>
<td>8.</td>
<td>Hand excavation, all materials (except rock), transported, and dumped at an off-site legal dumping location.</td>
<td>$52.00 CY</td>
<td>$42.00 CY</td>
</tr>
<tr>
<td>9.</td>
<td>Structural fill in place, including compaction. Refer to SECTION 310000 for gradation and compaction.</td>
<td>$32.00 CY</td>
<td>$28.00 CY</td>
</tr>
<tr>
<td>10.</td>
<td>Gravel Borrow fill in place, including compaction. Refer to SECTION 310000 for gradation and compaction.</td>
<td>$29.00 CY</td>
<td>$24.00 CY</td>
</tr>
<tr>
<td>11.</td>
<td>Granular fill in place, including compaction. Refer to SECTION 310000 for gradation and compaction.</td>
<td>$27.00 CY</td>
<td>$22.00 CY</td>
</tr>
<tr>
<td>Item</td>
<td>Unit Price CY</td>
<td>Unit Price CY</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>12. Ordinary borrow in place, including compaction. Refer to SECTION 310000 for gradation and compaction.</td>
<td>$ 15.00</td>
<td>$ 12.00</td>
<td></td>
</tr>
<tr>
<td>13. Crushed Stone (3/4 to 1-inch)</td>
<td>$ 27.00</td>
<td>$ 23.00</td>
<td></td>
</tr>
<tr>
<td>14. Double Washed Crushed Stone (3/4 to 1-inch)</td>
<td>$ 27.00</td>
<td>$ 23.00</td>
<td></td>
</tr>
<tr>
<td>15. Sand</td>
<td>$ 18.00</td>
<td>$ 15.00</td>
<td></td>
</tr>
<tr>
<td>16. Rock * exceeding two (2) cubic yards in volume, encountered in general excavation or grading, broken up using explosives, if necessary, (where explosives are not otherwise prohibited,) excavated, transported, and dumped at an off-site legal dumping location.</td>
<td>$ 55.00</td>
<td>$ 45.00</td>
<td></td>
</tr>
<tr>
<td>17. Rock * exceeding two (2) cubic yards in volume, encountered in general excavation or grading, where explosives are prohibited, mechanically broken up or thermally fractured, excavated, transported and dumped at an off-site legal dumping location.</td>
<td>$ 90.00</td>
<td>$ 72.00</td>
<td></td>
</tr>
<tr>
<td>18. Trench Rock * exceeding one (1) cubic yard in volume, encountered in trenches, broken up using explosives, if necessary, (where explosives are not otherwise prohibited,) excavated, transported, and dumped at an off-site legal dumping location.</td>
<td>$ 55.00</td>
<td>$ 45.00</td>
<td></td>
</tr>
<tr>
<td>19. Trench Rock * exceeding one (1) cubic yard in volume, encountered in trenches, where explosives are prohibited, mechanically broken up or thermally fractured, excavated, transported, and dumped at an off-site legal dumping location.</td>
<td>$ 120.00</td>
<td>$ 95.00</td>
<td></td>
</tr>
<tr>
<td>20. Controlled Density Fill (CDF), in place, Refer to SECTION 310000 for placement requirements</td>
<td>$ 115.00</td>
<td>$ 92.00</td>
<td></td>
</tr>
<tr>
<td>21. Asbestos abatement: pipe &amp; hard joint insulation.</td>
<td>Refer to Section 022820</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Asbestos abatement: Transite panels.</td>
<td>Refer to Section 022820</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Asbestos abatement: electrical wire jacketing.</td>
<td>Refer to Section 022820</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
* Refer to SECTION 310000, EARTHWORK for definition of term "rock" as used herein.
SECTION 012300
ALTERNATES

PART 1 - GENERAL

1.01 GENERAL INSTRUCTIONS

A. Each General Bidder and each Filed Sub-Bidder shall be held fully responsible for examining the scope of the Alternates generally defined herein, and for recognizing any modifications to his work caused by any Alternate, whether or not a particular trade SECTION is mentioned therein.

B. All trades shall examine the Drawings to ascertain if they need to furnish and/or perform work under the Alternates.

C. General Bidders shall enter a single amount for each Alternate, in the appropriate space provided in the FORM FOR GENERAL BID. Said amount shall include theFiled Sub-Bidders' amounts and the amount for all work to be performed by the General Contractor, and shall represent the total cost for all work to be performed under each respective Alternate.

D. Filed Sub-Bidders shall enter only the amount of the addition or subtraction necessitated by the scope of each Alternate which pertains to the work of his trade in the appropriate space provided in the FORM FOR SUB-BID.

E. All SECTIONS of work which are affected by the Alternates, which are not designated as Filed Sub-Bid SECTIONS, shall be considered to be work performed by the General Contractor.

F. The work of the various trades, to be performed under the Alternates, shall be in strict accordance with the requirements of the particular trade SECTION of the Specifications.

G. The Contract Documents describe the project in its entirety, including work designated as Alternates. Base Bids shall include all work except the work required under the various Alternates. The amount quoted in the FORM FOR GENERAL BID for each Alternate, if elected to be accepted by the Owner, will be added to the quoted Base Bid amount.

1.02 ALTERNATE NO. 1 – INSULATED METAL PANEL SYSTEM

A. Scope: Carefully demolish and remove existing insulated metal panel system at the clerestory of the existing multipurpose room, provide temporary protection, make modifications to existing steel framing system and rough openings, furnish and install a new insulated metal panel system, including rough openings and associated reinforcements for rough openings for new operable metal windows, translucent fiberglass wall panels, mechanical louvers and other items which penetrate the wall system, integration with and accommodations for existing to remain elements, cutting and patching of existing roofing and new roofing and flashing work, wood blocking, ductwork modifications, sealants and insulation, and other systems, as specified herein and shown on the Drawings, as Alternate No. 1, complete. Additionally, the work of Alternate No. 1 includes the following:

1. Installation of operable metal windows shown to be installed in existing openings within the existing metal wall panels as part of the work of the Base Bid.
2. Installation of translucent fiberglass wall panels shown to be installed in existing openings within the existing metal wall panels as part of the work of the Base Bid, as well as furnishing and installation of new areas of translucent fiberglass wall panels installed within the new insulated metal panel system.

3. Furnishing and installation of new prefinished metal louvers installed within the new insulated metal panel system, to replace existing louvers, including connections to existing ductwork, blocking, accessories, and joint sealers.

4. Cutting and patching of the existing roofing, removal and replacement of existing metal roof edge, wood blocking, fascia, flashings, gutters and downspouts, and associated work on the roof and flashing systems.

5. Furnish and install prefinished metal building signage on the face of the insulated metal panel system.

6. Removal, cleaning, and reinstallation, and/or modifications of minor items as required to complete the work for Alternate No. 1, including but not necessarily limited to, the metal ladder between the upper and lower roofs and existing flashings to remain.

END OF SECTION
SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS
   A. Refer to the various technical SECTIONS of the Specifications for description of the submittals required.
   B. Refer to the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS for general requirements for submittals.

1.02 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.03 DEFINITIONS
   A. Action Submittals: Written and graphic information that requires Architect's responsive action.
   B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.04 ELECTRONIC SUBMITTAL PROCEDURES
   A. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals as requested, and in accordance with the requirements set forth by the Architect's consultants, if any.
   B. Electronic Submittals – Summary:
      1. Shop drawings and project data submittals shall be transmitted to the Architect in electronic (PDF) format using Submittal Exchange, Newforma Cloud, or equal website service designed specifically for transmitting submittals between construction team members. All costs for such services, if any, shall be paid for by the General Contractor.
      2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
      3. The electronic submittal process is not intended for color samples, color charts, or physical material samples. Additionally, if any shop drawing or product data submittal has an original size exceeding 8.5” x 11”, submit original paper copies of such shop drawing or product data directly to the Clerk of the Works.
   C. Electronic Submittals – Procedures:
      1. Submittal Preparation - Contractor may use any or all of the following options:
         a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the Submittal Exchange website.
b. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.

c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.

2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.


4. Architect / Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.

5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.

D. Submit paper copies of reviewed submittals at project closeout for record purposes in accordance with Sections 017700, Project Closeout, and 17823, Operation and Maintenance Data.

E. 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 and Owner's Project Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

F. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

G. 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. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work, as set forth below, to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15
days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

a. Section 087100 - Finish Hardware  
b. Section 220000 - Plumbing  
c. Section 230000 - HVAC  
d. Section 260000 - Electrical  
e. Division 31 - Earthwork  
f. Division 32 - Exterior Improvements  
g. Division 33 - Utilities

H. 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 x 4 inch on label or beside title block to record Contractor's review and approval markings and action taken by Architect.  
3. 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 number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

   i. Number and title of appropriate Specification Section.  
   j. Drawing number and detail references, as appropriate.  
   k. Location(s) where product is to be installed, as appropriate.  
   l. Other necessary identification.

I. Deviations: Highlight, cloud, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

J. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
K. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
1. Transmittal Form: 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. Category and type of submittal.
   g. Submittal purpose and description.
   h. Specification Section number and title.
   i. Drawing number and detail references, as appropriate.
   j. Transmittal number, numbered consecutively.
   k. Submittal and transmittal distribution record.
   l. Remarks.
   m. Signature of transmitter.

2. 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 in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

L. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Approved", "Approved for Fabrication" or "Approved as Noted."

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

N. Use for Construction: Use only final submittals with mark indicating "Approved", "Approved for Fabrication" or "Approved as Noted."

1.05 CONTRACTOR’S USE OF ARCHITECT’S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
1. CAD files shall be utilized for the basis of submittal, and to aid in the development of submittal documents, rather than as submittals themselves. Submittals which are substantially the same as the Architect's CAD files, with no substantial additional
annotation, modification, coordination, field measurements, and/or supplementation with additional information, will be returned marked "Not Approved, Revise and Resubmit."

2. CAD files may be provided by the Architect's consultants, upon written request, as determined solely by the consultant, under the same conditions noted above for the Architect's CAD files, and any additional provisions or requirements as determined by each individual consultant.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Submit electronic submittals directly to extranet specifically established for Project.

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 operation and maintenance manuals.
   k. Compliance with specified referenced standards.
   l. Testing by recognized testing agency.
   m. Application of testing agency labels and seals.
   n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.

5. Number of Copies: Submit six copies of Product Data, unless otherwise indicated. Architect, will return three copies. Mark up and retain one returned copy as a Project Record Document.

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: Fully illustrate requirements in the Contract Documents. 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 (of professional engineer if specified.)
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.
   m. Relationship to adjoining construction clearly indicated.
   n. Seal and signature of professional engineer if specified.
   o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

3. Number of Copies: Except for electronic submittals, submit six opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit six copies where copies are required for operation and maintenance manuals. Architect will retain two (one each for the records of the Architect and the Owner's Project Manager/Clerk-of-Works) copies; remainder will be returned.

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

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.

3. 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 not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, 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.
   4. Number of Copies: Submit six copies of product schedule or list, unless otherwise indicated. Architect will return three copies.
      a. Mark up and retain one returned copy as a Project Record Document.

F. Submittals Schedule: The Contractor, within 20 calendar days after being awarded the Contract, shall prepare, and submit for the Architect's approval, a schedule of shop drawings, product data, and samples, as required in the Contract Documents. No Submittals will be processed prior to the receipt of such schedule. The schedule shall indicate, by trade, the date by which final approval of each item must be obtained, and shall be revised as required by the conditions of the work, subject to the Architect's approval. The Architect's review period, including those of consultants, will not exceed 15 days from the established date of each submission of shop drawings, product data, and samples, plus the additional time, if any, for distribution by the Contractor and receipt of submissions by the Architect. The Contractor shall be required to strictly adhere to the dates established in the schedule.
G. 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. Use CSI Form 1.5A, or similar format. 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.
4. Number of Copies: Submit six copies of subcontractor list, unless otherwise indicated. Architect, will return three copies.
   a. Mark up and retain one returned copy as a Project Record Document.

2.02 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit three 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 specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: The Contractor shall be responsible for the coordination of all mechanical and electrical work. Before materials are fabricated or work begun, he shall submit to the Architect complete Coordination Drawings in the form of reproducible transparencies at not less than 1/4 inch scale. Congested areas and sections through shafts shall be prepared at not less than 3/8-inch scale, such areas being as determined by the Architect.

1. Coordination Drawings shall indicate the necessary offsets for all ductwork, piping, conduit, and other items to clear the work of all other trades and to maintain the required ceiling height and partition layout.
2. Prepare Coordination Drawings as follows:
   a. The Contractor shall require the HEATING, VENTILATING & AIR CONDITIONING Subcontractor to prepare original Drawings showing all ductwork, hot water and other heating lines.
   b. The Contractor shall have sepia transparencies made therefrom.
   c. The Contractor shall then require the PLUMBING Subcontractor to indicate all his/her equipment and plumbing lines on these transparencies.
   d. The Contractor shall then require the ELECTRICAL Subcontractor to indicate all his/her equipment and conduit lines on these transparencies.
   e. The Contractor shall resolve conflicts and then submit these transparencies to the Architect for review.
3. Coordination Drawings shall bear the signature of all Subcontractors involved indicating that all space conditions have been satisfactorily resolved. In addition, the Drawings shall bear the Contractor’s stamp bearing the notation “Drawings Have Been Checked and Coordinated With All Trades”. Drawings without these notations will not be accepted by the Architect.

4. If any space conflicts cannot be resolved by the Contractor, he shall immediately notify the Architect and request disposition of the conflict.

5. Coordination Drawings are for the Contractor’s and Architect’s use during construction and shall not be construed as replacing any Shop, "As-Built", or Record Drawings required elsewhere in these Contract Documents.

6. Architect’s review of Coordination Drawings shall not relieve the Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirement of the Contract.

7. Requests for Information (RFIs) submitted to the Architect relative to conflicts between the systems, and/or between the systems and the structure or finishes required to be included on the Coordination Drawings, prior to the receipt and review of the Coordination Drawings by the Architect, shall be invalid and will be return unanswered.

C. Contractor's Construction Schedule:

1. Submit Gantt/Bar progress schedule in triplicate within 15 days after date of Owner-Contractor Agreement for Architect's review. Revise and resubmit as required.

2. Schedule shall be of format approved by Architect showing complete sequence of construction activity, identifying Work of separate stages and specified Construction Phases, and other logically grouped activities. Indicate the early and late start, early and late finish, float dates and duration.

   a. The Schedule shall show the sequence and phasing of activities required and shall reflect the manner in which actual work will be performed. The number of activities shown in the Schedule must be at least equal and related to the number of items listed in the Schedule of Values including back-up detail.

   b. Indicate implementation and termination of each temporary utility.

   c. Define portions of work which are dependent on the schedule of other related activities and phasing.

   d. Define activities on which the work is dependent, including:

      1) Submittal of show drawings, equipment schedules, samples, color submission, coordination drawings, templates, fabrication, material delivery times,

      2) Architect/Engineer's review of shop drawings, equipment schedules, samples and templates,

      3) Delivery times of Owner furnished equipment.

      4) Provision of work or work by others under separate contract with the Owner.

   e. Conclude all activities on one common end date, show contract completion dates for each specified Construction Phase as a milestone activity on the Schedule.
3. Update schedule showing actual progress of Work in progress, identify Work started and completed during the previous update period, show the estimated time required to complete each activity started but not yet completed, and reflect any changes in the schedule.

4. Prepare a Schedule Analysis for submission with revised project schedules. The Schedule Analysis shall include a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates, and an explanation of corrective action to be taken. All activities that are behind schedule by more than two weeks shall be addressed individually in the Schedule Analysis.

5. Submit revised schedules with attached Schedule Analysis, with each Application for Payment; clearly identify changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission.

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

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

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

G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

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

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 in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. 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.

K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building codes, rules and regulations 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.

L. 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 in the Contract Documents.

M. Pre-construction Documentation: Prior to any demolition activities, the Contractor shall pictorially record the existing on-site conditions, adjacent roadways, utilities, and properties. If photographs are taken, a key to the location of each photograph shall be provided. Duplicate sets of the photographs and/or videos shall be provided to the Architect and Owner’s Project Manager. Each set shall be dated with the date of the photograph/video and the name and address of the photographer. Each set shall be a duplicate of the original, which shall be maintained by the Contractor for his/her records until Substantial Completion (for each phase) of the project has been achieved.

N. 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.

O. 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 in the Contract Documents.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

Q. 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.

R. 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.
S. 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.

T. 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.

U. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect unless specifically required for LEED requirements.

1. Architect will not otherwise review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.03 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, and pay all costs and fees for said design services or certifications.

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

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit six copies of 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.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and 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.

3.02 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 stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
   1. APPROVED AS SUBMITTED: No corrections, no marks.
   2. APPROVED AS NOTED: Resubmission not required. Minor amount of corrections; all items can be fabricated without further corrections to original drawing; checking is complete and all corrections are deemed obvious without ambiguity.
   3. NOT APPROVED, REVISE AND RESUBMIT: Resubmission required. Minor amounts of corrections; checking is not complete; details of items noted by checker are to be clarified further before full review can be given. Correct and resubmit, do not fabricate noted items requiring correction.
   4. NOT APPROVED: Drawing is rejected as not in accord with the Contract Documents, too many corrections, or other justifiable reasons. When returning drawings, Architect will state reasons for rejection. Correct and resubmit, do not fabricate.
   5. APPROVED FOR FABRICATION: Resubmission is required for record purposes only. Minor amount of corrections; all items can be fabricated without further approval, checking is complete and all corrections are deemed obvious without ambiguity.
   6. CONSULTANT ENGINEER APPROVAL REQUIRED: No corrections by Architect. Submittal is referred to consulting engineers for review and, approval or rejection. Do not fabricate rejected items or those requiring correction; revise and resubmit as directed by consulting engineer.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

C. The Drawings indicate the general extent, only, of the demolition, removals, and alteration work to be performed. Prior to commencing any demolition and removals work, carefully examine all conditions as they exist at the project, and verify with the Architect the actual extent of the demolition and removals work. Be fully responsible for removing all existing materials which would otherwise interfere with the proper installation or function of the new work, whether or not such existing materials or conditions have been indicated, such work being performed without additional cost to the Contract; and perform the required demolition, removals, and alteration work, except where specifically noted to the contrary in the various trade SECTIONS of the Specifications, in which cases the specific trades shall perform such designated segments of the demolition and removals work.

1.02 HAZARDOUS MATERIALS PROCEDURE

A. Asbestos:

1. The General Contractor shall retain the services of a Massachusetts Licensed asbestos abatement contractor to properly remove and dispose of Asbestos Containing Materials (ACM) listed in Section 02 28 20.

2. Unknown and inaccessible ACM: During the work of the Contract, it is possible that previously unknown asbestos materials may be discovered in currently concealed or unknown locations.

3. Notification: If the General Contractor or any Sub-Contractor discover or encounter any ACM during the performance of the work, the General Contractor or any Sub-Contractor shall immediately:

   a. Stop work, notify the Owner and architect about the presence of suspect ACM and request instructions for proper action, and

   b. Take whatever steps and measures are necessary to reduce, control or eliminate the risk of exposure of workers and the public to the ACM.

   c. Every effort will be made to obtain DEP (12 working day notification period) waivers to remove hidden or unforeseen ACM by the asbestos contractor. The General Contractor or any Sub-Contractor shall allow sufficient time for the removal of the ACM at no additional charges to the owner for delays and should waivers be denied by the DEP.

4. Responsible Person On-Site: The General Contractor or any Sub-Contractor shall designate one of its senior on-site employees to be in charge of coordination between the Architect and the General Contractor or any Sub-Contractor with respect to hazardous materials issues.
5. Responsibility for Hazardous Material Discovery: It is the sole responsibility of the General Contractor or any Sub-Contractor and its Subcontractors to undertake whatever measures methods of procedures are necessary, required or otherwise appropriate to safeguard the health and safety of all workers and members of the public with respect to identification and discovery of previously unknown hazardous materials during the work of the Project.

6. Indemnification: To the fullest extent permitted by law, the General Contractor or any Sub-Contractor shall indemnify and hold harmless the Owner and the Architect and their agents and employees from and against all claims, damages, losses and expenses including, but not limited to, attorneys’ fees arising out of or relating to the performance of the Work, including the discovery or identification of any hazardous materials, provided that any such claim, damage, loss or expense attributable to bodily injury, sickness, disease or death, or to damage to or destruction of tangible property (other than the Work itself) including the lose of use resulting therefrom; and is caused in whole or in part by any negligent act or omission of the General Contractor or any Sub-Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

B. Lead:

1. The General Contractor or any Sub-Contractor shall be made aware that Lead Based Paint exists on painted surfaces.

2. All the work of this Contract shall conform to the standard set by all applicable Federal, State and Local laws, regulations, ordinance and guidelines in such from in which they exist at the time of the work on the Contract and as may be required by subsequent regulations.

3. The General Contractor or any Sub-Contractors is solely responsible for means and methods, and techniques used for demolition and lead control. The General Contractor or any Sub-Contractor shall collect and control lead contaminated debris and to properly remove and dispose of lead contaminated soil around the building due to demolition activities.

4. The General Contractor or any Sub-Contractor shall at his own cost and expense comply with all laws, ordinance, rules and regulations of Federal, State, Regional and Local authorities during demolition, prepping, sanding, cutting, burning, scraping, painting over, grinding and regarding handling, storing and disposing of lead and lead contaminated waste material.

5. The General Contractor or any Sub-Contractor shall submit to the Architect prior to commencing of work the following:
   a. Written respiratory and notification program
   b. Written lead compliance program in accordance with OSHA regulations including:
      1. Training requirement certifications.
      2. Supervisor qualifications.
      3. Written compliance program specific to this project
      4. Respirators fit test records.
      5. Medical surveillance certificates.

6. The EPA and the DEP require demolition debris with lead to be tested in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) to determine the potential for significant amounts of lead to leach out of the waste. If the results are below the DEP
standard (5.0 ppm), the waste may be disposed of in a conventional landfill for demolition debris. If, however, the TCLP results are above the DEP standard, the waste must be disposed of in a DEP approved, hazardous waste landfill. The General Contractor or any Sub-Contractor shall at own cost and expense perform all required testing of waste by the TCLP. The General Contractor or any Sub-Contractor must submit to the Owner copy of tests performed and all waste shipment records prior to disposing of debris. The Owner reserves the right to have own TCLP samples collected to verify results. All disposal costs shall be at the General Contractor or any Sub-Contractor’s responsibility.

7. The following references are cited as current applicable publications. This project is subject to compliance with the all regulations including but not limited to:
   a. Commonwealth of Massachusetts, Department of Labor and Work Force Development 454 CMR 11.00, Structural Painting Safety Code, as currently amended.
   b. Commonwealth of Massachusetts, Department of Environmental Protection, and Hazardous Materials Regulations at 310 CMR 30.00 as currently amended.
   e. Commonwealth of Massachusetts, Department of Labor and Work Force Development 454 CMR 22.00.

8. All above regulations are applicable to this project. Where there is a conflict between this section and the applicable regulations, the more stringent requirement shall prevail.

C. Polychlorinated Biphenyls (PCB’s):

1. The General Contractor or any Sub-Contractor be made aware that buildings materials including but not limited to caulking, painted surfaces, glue, coatings and other buildings materials might contain >1 ppm of PCB’s.
2. The General Contractor or any Sub-Contractor is to be aware that testing of the caulking, glazing or other materials for PCBs has not been performed and is not planned. The abatement contractor shall be solely responsible for means & methods and techniques used for demolition, removal, control and disposal of the caulking and glazing. The abatement contractor shall protect the soil and shall collect and control PCB contaminated debris. All work shall conform to the standard set by all Federal, State and Local laws, regulations, ordinances and guidelines.
3. The General Contractor or any Sub-Contractor shall at his own cost and expense comply with all laws, ordinance, rules and regulations of Federal, State, Regional and Local authorities during prepping, sanding, cutting, burning, scraping, painting over, grinding and regarding handling, storing and disposing of contaminated waste material and during renovation and demolition.

PART 2 – (PRODUCTS) Not Used
PART 3 – (EXECUTION) Not Used
END OF SECTION
SECTION 014000
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 SUMMARY
A. This Section specifies administrative and procedural requirements for testing laboratory services required for the Project.

1.02 REQUIREMENTS
A. The Owner reserves the right, at his sole discretion, to select and pay for the services of an Independent Testing Laboratory to perform specified services and testing as may be in the Owner's best interest.

1. Contractor shall cooperate with the laboratory to facilitate the execution of its services.

2. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.

1.03 RELATED REQUIREMENTS
A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.

2. Respective sections of specifications: Certification of products.

3. Section 019113 Commissioning Requirements: Commissioning requirements for the Project.

1.04 REFERENCES
A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.


a. E 329: Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
1.05 LABORATORY DUTIES

A. Cooperate with Architect and Contractor; provide qualified personnel promptly on notice.

B. Acquaint Owner, Architect, and Contractor's superintendent with testing procedures and with all special conditions encountered at the site.

C. Inspections, sampling, and testing of materials and construction methods shall be as specified in individual technical specification sections.

1. Comply with specified standards, ASTM, ANSI, and other recognized authorities.

2. Conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state any deviations therefrom.

3. Obtain Contractor's written acknowledgement of each inspection, sampling, and test made.

D. Promptly notify Architect and Contractor of irregularities or deficiencies of Work or Products which are observed during performance of services.

E. Promptly submit written report of each test and inspection; one copy each to Architect, Owner, Owner’s Commissioning Authority, Contractor, and one copy to Project Record Documents File. Each report shall include:

1. Date issued.
2. Project title and number.
3. Testing laboratory name, address, and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.
7. Date of test.
9. Location of sample or test in the Project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by Architect.

F. Perform properly authorized additional services as required by the Owner.

1.06 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work, except as specifically authorized by the specifications.

3. Perform any duties of the Contractor.
1.07 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to Work, and to Manufacturer's operations.
   1. Monitor each inspection, sampling, and test.
   2. Provide Laboratory or Agency with written acknowledgement of each inspection, sampling, and test.
   3. Within 24 hours notify Architect and Owner in writing of reasons for not acknowledging Laboratory results.

B. Secure and deliver to the Laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the Laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.

D. Furnish copies of Product test reports as required.

E. Furnish incidental labor and facilities:
   1. To provide access to Work to be tested.
   2. To obtain and handle samples at the Project site or at the source of the Product to be tested.
   3. To facilitate inspections and tests.
   4. For storage and curing of test samples.

F. Furnish verification of materials and equipment compliance with Contract Documents.

G. Identify materials to be tested or inspected by Testing Laboratory or Agency.

H. After determination of need for testing or inspecting by Owner, notify Laboratory sufficiently in advance, minimum five days, of operations to allow for its assignment of personnel and scheduling of tests.
   1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

I. Make arrangements with laboratory and pay for additional samples and tests required:
   1. For the Contractor's convenience; or
   2. When initial tests indicate Work does not comply with Contract Documents.

1.08 CONDUCT OF INSPECTIONS AND TESTS

A. The Contractor shall notify the Owner, Architect, and Testing Laboratory in sufficient time before the performance of work to permit the proper conduct of Owner-authorized inspections and tests.
B. Representatives of Testing Laboratory shall inspect the manufacture, assembly, and placement of materials as required and as authorized by the Owner, and shall report their findings to the Architect, Owner, and Contractor.

C. Work shall be checked as it progresses, but failure to detect any defective work or materials shall in no way prevent later rejection when such defect is discovered nor shall it obligate the Owner to accept such work.

1.09 TESTS REQUIRED

A. General Construction Tests: More detailed testing requirements are given in individual Specification Sections. The Awarding Authority shall retain the right to make any additional tests the Architect deems necessary or appropriate. The Contractor is responsible for providing his own tests to determine that materials meet specified requirements. The scope of tests required and paid for by the Awarding Authority (unless otherwise noted below) shall include as a minimum the following:

1. Sealants: Chemical analysis; adhesive strength; compatibility with adjacent materials; elasticity.

2. Paints and Finishes: Chemical analysis; coating thickness.

3. Testing associated with the building enclosure: Contractor shall be responsible for coordinating the testing.

B. Plumbing: At least the following tests will be performed. Conform to requirements specified in individual Division 21 through 27 Specification Sections. The test shall be performed and paid for by the subcontractor and witnessed by the Contractor and Authority's on site representative:

1. Water supply piping hydrostatic pressure test.

C. HVAC Testing: All HVAC work shall be tested by an independent testing and balancing agency. Conform to requirements specified in individual Division 21 through 27 Specification Sections. All costs of these tests will be paid by the subcontractor. Adjustments shall be made by the subcontractor as directed by the Authority. At least the following tests will be performed:

1. Piping hydrostatic tests.
2. Air and water balancing.
3. Thermostat control monitoring and testing.
4. Boiler efficiency testing.

D. Fire Alarm System Testing: At least the following tests will be performed. Conform to requirements specified in individual Division 26 and 27 Specification Sections. The test shall be performed and paid for by the subcontractor and witnessed by the Contractor and Authority's on site representative:

1. All smoke and heat detectors.
2. Proper operation as required by authorities having jurisdiction.

E. Contractor's Responsibilities: The Contractor shall notify the Authority, Architect, and Testing Laboratory personnel at least 48 hours prior to performance of work requiring testing. The Contractor shall fully cooperate with testing agencies and permit free access to all areas at all times. The Contractor shall permit taking samples at any time during construction, either before or after installation. Prior to notice to proceed with construction, the Contractor shall submit a Testing Log of
planned tests and scheduled test dates. Tests shall be numbered based on type of work, type of test, and sequence. The Testing Log shall be maintained by the Contractor and updated weekly.

1. Coordination: The Contractor shall coordinate all testing, including all testing and inspections to be paid for by the Authority. The Contractor will arrange testing and sampling performed by the Authority’s testing agency and will have prepared test record forms. Upon receipt of test results, the Authority will distribute copies with test results as follows:

   Contractor [2 copies].
   Architect [2 copies].

F. Follow-up and Corrective Action: The Contractor and the Authority will note the test record on the Testing Log to acknowledge test procedures and results. If follow-up or corrective action is needed, the Contractor shall submit to the Authority two written copies of proposed follow-up or corrective plans and obtain the Authority's written approval before proceeding.

1. Cost of Testing: If tests indicate that materials or work do not comply with requirements, the Contractor shall pay for all retesting, and shall remove and replace non-complying work at no additional cost to the Authority.

G. Local Authority Inspections: The Contractor is also responsible for coordinating and cooperating with local requirements for inspections.

END OF SECTION
# INDEX

**FOR**

## SECTION 015000

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

<table>
<thead>
<tr>
<th>NO.</th>
<th>PARAGRAPH TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>RESPONSIBILITY AND COMPLIANCE</td>
</tr>
<tr>
<td>1.02</td>
<td>SECURITY AND PROTECTION</td>
</tr>
<tr>
<td>1.03</td>
<td>ACCIDENT PREVENTION</td>
</tr>
<tr>
<td>1.04</td>
<td>TEMPORARY SERVICES AND UTILITIES</td>
</tr>
<tr>
<td></td>
<td>A. Temporary heating and ventilating</td>
</tr>
<tr>
<td></td>
<td>B. Electrical and lighting</td>
</tr>
<tr>
<td></td>
<td>C. Temporary toilets</td>
</tr>
<tr>
<td></td>
<td>D. Water</td>
</tr>
<tr>
<td>1.05</td>
<td>TEMPORARY OFFICES</td>
</tr>
<tr>
<td>1.06</td>
<td>TEMPORARY ENCLOSURES, BARRIERS, AND FENCING</td>
</tr>
<tr>
<td>1.07</td>
<td>TEMPORARY HOISTING AND RIGGING EQUIPMENT AND MACHINERY</td>
</tr>
<tr>
<td>1.08</td>
<td>TEMPORARY SCAFFOLDING AND STAGING</td>
</tr>
<tr>
<td>1.09</td>
<td>TEMPORARY STAIRS, RAMPS AND LADDERS</td>
</tr>
<tr>
<td>1.10</td>
<td>TEMPORARY CONTROLS</td>
</tr>
<tr>
<td></td>
<td>A. Dust control</td>
</tr>
<tr>
<td></td>
<td>B. Water control</td>
</tr>
<tr>
<td></td>
<td>C. Pest control</td>
</tr>
<tr>
<td></td>
<td>D. Rodent control</td>
</tr>
<tr>
<td></td>
<td>E. Debris control and rubbish removal</td>
</tr>
<tr>
<td></td>
<td>F. Pollution control</td>
</tr>
<tr>
<td></td>
<td>G. Noise control</td>
</tr>
<tr>
<td>1.11</td>
<td>WORK AREAS, STORAGE, ACCESS, AND PARKING</td>
</tr>
<tr>
<td>1.12</td>
<td>OVERLOADING</td>
</tr>
<tr>
<td>1.13</td>
<td>TEMPORARY FIRE PROTECTION</td>
</tr>
<tr>
<td>1.14</td>
<td>MUNICIPAL POLICE SERVICES</td>
</tr>
<tr>
<td>1.15</td>
<td>PROGRESS CLEANING</td>
</tr>
</tbody>
</table>

**END OF INDEX**
PART 1 - GENERAL

1.01 RESPONSIBILITY AND COMPLIANCE

A. All requirements set forth under this SECTION 015000 are directed to the Contractor except as specifically excepted.

B. Be responsible for arranging for facilities as specified herein and as required for proper and expeditious prosecution of the work. Pay costs for such general services and temporary facilities, except as otherwise specified, until final acceptance of the work, and remove same at completion of work.

C. Comply with applicable OSHA, State, and municipal regulations and requirements for services and facilities required under this SECTION 015000, and in performance of all requirements of this Contract.

D. Pre-Construction Requirements:

1. Pre-construction documentation: The contractor shall pictorially record the existing on-site conditions, adjacent roadways, utilities, and properties. If photographs are taken a key to the location of the photographer shall be provided. Duplicate sets of the photographs and/or videos shall be provided to the Architect and the Owner. Each set shall be dated with the date of the photograph/video and the name and address of the photographer. Each set shall be a duplicate of the original, which shall be maintained by the Contractor for his/her records until Substantial Completion of the Project has been issued.

2. Dig-Safe: Prior to the initiation of any demolition, construction, subsurface explorations or related activities, the Contractor shall contact Dig-Safe as required by law.

3. Permit Issuance and Force: Prior to the initiation of any demolition, construction, subsurface explorations or related activities, the Contractor shall obtain copies of all pertinent permits and permit requirements and review same for future compliance during all phases of the contract. The Contractor shall ensure, by receipt of permits, licenses and related documents, that all such documents are in full force and any/all pre-construction requirements have been met.

1.02 SECURITY AND PROTECTION

A. Provide and maintain, for the duration of the Contract, all security precautions and proper protective measures as may be required to adequately protect the Owner's personnel, the public, and other interests of the Owner, from hazards resulting from, or related to, the work performed hereunder. When regulated by local building code or other Authority, the requirements of this Paragraph 1.02 shall be considered as minimum requirements and the Contractor shall be responsible for the protection of such minimum requirements as may be required by public safety laws.
1. Take all proper precautions to protect the Owner's property from damage and replace or put in good condition, any existing items that are damaged in carrying out the work, unless designated to be permanently removed or demolished.

2. Bear full responsibility for adequately patrolling and protecting the work under construction and the materials stored on the site.

B. The requirements of this paragraph 1.02 shall be in addition to, not in lieu of, other protection requirements contained in these Contract Documents.

C. Furnish, erect, and maintain, until such time as removal is approved by the Architect, temporary fencing and barricades to the extent recommended by OSHA and as otherwise required for the protection of life and property during operations under the Contract. The General Contractor shall be responsible, at all times, for the control of access through and into/out of the site. A general plan shall be developed and submitted to the Architect, and the local Building Inspector (if required) for approval.

D. Construct barricades and protective facilities in accordance with local and State regulations. Furnish and install all signs, lights, reflectors, and all such protection facilities as may be required.

E. Bear full responsibility for saving the Owner harmless from all claims arising from the use of public streets, sidewalks, and adjoining premises for construction purposes.

F. Keep all access roads and walks clear of debris, materials, construction plant and equipment during building operation. Repair streets, drives, curbs, sidewalks, fences, poles and the like where disturbed during the construction operations, and leave them in as good condition after completion of the work as before operations started.

G. Protect all utilities and site improvements not otherwise designated to be removed under this Contract.

H. Bear full responsibility for the maintenance of construction barriers and traffic barriers in order to maintain traffic around the Work with the maximum of safety and practical convenience to such traffic during the life of the Contract, and whether or not work has been suspended temporarily. Take all precautions for preventing injuries to persons or damage to property on or about the Work.

I. Execute the Work, and erect necessary barriers, in such a manner as to provide safe passage at all times for public travel and with least obstruction to traffic. Provide, and maintain in a safe and passable condition, such temporary bypasses created by the barriers as may be necessary to accommodate both pedestrian and vehicular traffic, and bear all costs in conjunction therewith.

J. Whenever gale or high winds are forecast, take proper measures to secure all loose material, equipment or other items which could blow about and be damaged or cause damage to other work. Do not leave loose or unsecured items at end of working day. Give special attention to scaffolding and items placed or stored on roofs or within the structure prior to being enclosed.

K. Remove all snow and ice which may impede the work, damage the finishes or materials, be detrimental to workmen, or impede trucking, delivery, or moving of materials at the job site, or prevent adequate drainage of the site or adjoining areas.
1.03 ACCIDENT PREVENTION

A. Comply with all Federal, State and municipal recommendations and requirements for safety, and accident prevention, and those of the Associated General Contractors of America, and the American Standards Association Standard A10.2. Ensure that the Field Superintendent conducts regular, frequent inspections of the site for compliance with safety regulations.

B. Neither the Owner nor the Architect shall be responsible for providing a safe working place for the Contractor, Subcontractors, or their employees, or any individual responsible to them for the work.

1.04 TEMPORARY SERVICES AND UTILITIES

A. Temporary heating and ventilating: Within twenty (20) calendar days after the commencement of work under this Contract, submit three (3) written copies of the proposed method(s) and time schedule for heating during construction, coordinated with the approved construction schedule, for approval of the Architect.

1. Be completely responsible, and bear all costs, for furnishing, installing, maintaining, and operating temporary heating equipment required to ensure that a minimum temperature of 50 degrees Fahrenheit at all interior locations of the new building, except for a period commencing ten days prior to the installation of finish woodwork, flooring, or painting, whichever occurs first, after which time the temperature shall be maintained at a minimum of 65 degrees Fahrenheit, until Substantial Completion of the work as defined in the GENERAL CONDITIONS.

2. Permitted types of temporary heating sources shall be limited to steam, hot water, piped gas, self-contained LP gas or fuel oil heaters, and electric resistance heaters. Vent fuel-burning heaters through enclosure to outside air. Provide only heating units that have been tested and labeled by UL, FM or other recognized trade association related to the type of fuel being consumed.

3. Use of the new permanent heating system when installed, or parts thereof, for temporary heating, will not be permitted.

4. Completely remove all temporary heating equipment, apparatus, and construction, only when so directed by the Architect.

B. Electrical and lighting:

1. Make all necessary arrangements with the local power authority to provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, including use of power tools, electrical heating (if any), lighting, and start-up testing of permanent electric-powered equipment prior to its permanent connection to electrical system. Provide overload protection. Coordinate the time schedule for all temporary power and lighting operations with the with the approved construction schedule.

2. Supply power for electric welding, if any, from either the temporary power distribution system or by engine-driven power-generator sets, at the Contractor's option.

3. Provide and pay for power distribution lines of 120/208 volt, 3-phase, 60 cycle AC capacity, as required throughout the Work Areas, for use throughout the construction period. Terminate the power distribution at one location in each major section of the building, approximately at the center of the building. Provide circuit
breakers, disconnect switches, and other electrical devices to protect the power supply system, at each termination location.

4. Furnish, install, maintain, and pay for sufficient temporary lighting to ensure proper workmanship everywhere; by combined use of daylight, general lighting, and portable plug-in task lighting to afford general illumination of not less than one (1) watt per square foot of floor area in the new building. Provide general lighting with local switching which will enable energy conservation during periods of varying activity (work-in-progress, traffic only, security check, lock-up, and other activities). Provide and pay for outdoor lighting to illuminate staging, stockpiles, trenches, projections, and similar hazards, with general illumination throughout adequate for watchmen and emergency personnel.

5. All temporary equipment and wiring for power and lighting shall be in conformity with the National Electrical Code, and in accordance with local ordinances and requirements of the power authority. Maintain all temporary wiring and accessories in a safe condition so as not to constitute a hazard to persons or property, and remove the same after they have served their purpose.

6. All necessary extension cords shall be provided and paid for by the parties requiring the same.

7. When new permanent electrical power and lighting systems are in operating condition, they may be used for temporary power and lighting for construction purposes, provided that written approval of the Architect and the Owner is obtained in advance. If the new permanent system is used for temporary lighting, install new light bulbs and fluorescent tubes immediately prior to date of Substantial Completion of the General Contract.

8. At completion of construction work, or at such time as permanent electrical installation is used, remove all temporary wiring, lighting, and other temporary electrical equipment and devices.

9. Maintain power and/or provide temporary power for all properties, adjacent and otherwise, served by the power lines noted on the documents to be removed and re-routed. Notify the effected neighbors and the Architect simultaneously, in writing at least 72 hours prior to any interruption in service.

C. Temporary toilets:

1. Furnish, erect, and maintain for the duration of the Contract, chemical toilet facilities in sufficient quantity to accommodate all workers on the project.

2. Chemical toilets and their maintenance shall meet requirements of State and local health regulations and ordinances, and be placed in locations acceptable to the Architect outside the resource setback areas as shown on the site plan.

D. Water: Make all necessary arrangements to provide a source for temporary water, sufficient to accommodate drinking and construction purposes, and pay all costs in conjunction therewith. Provide, and pay for all temporary extension piping, hoses, and fixtures, beyond the temporary water source. Provide and pay for temporary water coolers and single-service paper cups, conveniently located within the area of construction operations, for the use of all authorized personnel on the project, when work is in progress. When permanent water supply system and fixtures have been installed, completely remove the temporary water service, equipment, piping, and hoses. Coordinate the time schedule for all temporary water operations with the approved construction schedule.
1.05 TEMPORARY OFFICES

A. Furnish, install, maintain, and pay all costs in conjunction with, an adequate weathertight structure or trailer to serve as a temporary office for the Contractor, and a separate weathertight structure or trailer to serve as a temporary office for the Owner's Representative, no less than 12-feet x 20-feet new or in new condition, with full skirting to grade. It must be cleaned weekly by the contractor which would include washing of the floor and trash removal, each located on the site where directed, and remove same when no longer needed. Provide a crushed stone apron for parking adjacent to trailers, 100-feets x 30-feets x 6-inches deep.

B. Furnishings: Provide the following furniture for the Owner’s site office.

1. One (1) writing desk: 6-feet x 3-feet minimum desk top, with lockable drawers.
2. One (1) high level drawing desk with a minimum sloping top of 6-feet x 3-feet.
3. One (1) office chair with arm rests, adjustable seat heights and variable back rests.
4. Counter, of sufficient size to hold the Fax machine and copier, with adequate space for service and operation.
5. At least 3 ceiling-mounted fluorescent lights, each 4’-0” long, one over each desk.
6. One (1) lockable, metal, legal file cabinets, each 3'-6" long x 1'-6" wide x 4'-6” high.
7. One (1) Conference tables 30" x 60" with 6 padded folding chairs.
8. One (1) Bulletin board, wall mounted, at least 65 square feet of tack surface.
9. One (1) wastebaskets, 30 gal.

C. Equipment: Provide the following equipment for the Owner’s site office.

1. At least 4 power outlets, positioned throughout the office for desk lights, computers, printers, facsimile machine, AC units, etc.
2. One (1) telephone line for the sole use of the Owner and the Clerk of the Works.
3. Heating/HVAC equipment to comfortably control the environment of the office.
4. Drinking Water Dispenser: Provide a dispenser which holds bottled water and furnishes instant hot water as well as chilled water.

D. Computer System and Peripherals: Provide as a minimum the following equipment and software. This equipment shall remain property of the Owner after construction is complete.

1. All-in-One Printer: All-in-One Printer/copier/fax/scanner; HP Officejet 4500 All-in-One Printer, HP part number: CB867A#B1H, or comparable with
2. Broadband Internet connection, or similar speed connection, modem and peripherals as required. At the Contractor's option, wireless broadband can be provided if the baud rate is similar, as approved by the Architect, and the laptop as scheduled in paragraph D above, is equipment with a compatible wireless modem.

E. Consumables: Furnish supplies required to maintain the Owner’s site office for the duration of the contract, including, but not limited to, the following:

1. All-in-One Printer/copier/fax/scanner: 2 each of color and black ink cartridges, and one (1) box of paper containing 5 reams of 8 1/2 x 11 paper.
2. Drinking water: Provide bottled water for the water dispenser.
3. Lamps: Incandescent bulbs and fluorescent lamps of appropriate types and wattage for the overhead light fixtures.

F. Maintain the offices adequately lighted, heated, and ventilated, and bear all costs for therefore, except as otherwise specified herein.

1.06 TEMPORARY ENCLOSURES, BARRIERS, AND FENCING

A. Temporary barriers: Furnish, erect, and maintain for the duration of the work period, temporary barriers of types, and in such locations, as required to protect persons and property against accidents caused by falling materials from the roof and from other elevated exterior and interior locations where work is being performed.

B. Temporary fencing: Furnish, install, maintain, and pay for temporary fencing and other protection required for the safety of stored materials and work installed under this Contract, and bear full responsibility for same. Prior to erecting the construction fencing, submit to the Architect, for approval, a 1/8-inch to the foot scale plan layout of the proposed construction fencing and gates contained therein. At the Contractor's option, the fencing may be either one of the following types:

1. Chain link fencing, at least six (6) feet in height, complete with all required gates, posts, bracing, and post footings. Posts may be either standard fencing pipe posts or 4 by 4-inch wood posts, set securely into temporary concrete footings. Gates shall be equipped with locks.

2. Plywood fencing, at least six (6) feet in height, complete with all required gates, posts, bracing, and post footings. Plywood shall be clean, exterior grade, 3/4 or one inch thick. Fencing shall be adequately braced and have 4 by 4-inch posts spaced approximately 48 inches on centers. Gates shall be equipped with locks.

1.07 TEMPORARY HOISTING AND RIGGING EQUIPMENT AND MACHINERY

A. Furnish, install, operate, and maintain in safe condition, all hoisting and rigging equipment and machinery (including operator), at two (2) locations abutting the building where so designated by the Architect, as required for the proper and expeditious progress of the work, and as necessary to accommodate all materials and/or equipment delivered to each designated hoisting area. Bear all costs in conjunction with the temporary hoisting equipment, rigging, and machinery, unless specifically excluded in the Contract Documents.

1.08 TEMPORARY SCAFFOLDING AND STAGING

A. Except as otherwise specified in the various trade SECTIONS of the Specifications, furnish, install, maintain, and remove when no longer needed, temporary staging and scaffolding, having planking or other approved type of load-bearing working surfaces, including ladders and safety devices in conjunction therewith, as required for the work, for the use of all trades, at no cost to such trades. Staging and planking forFiled Sub-Bid trades shall be furnished, installed, and paid for by those trades, except for staging and planking over eight (8) feet in height which shall be furnished, installed, maintained, and paid for by the Contractor without charge to the Subcontractor. Ensure that all scaffolding, staging, safety devices, and related items, furnished hereunder, conform to all requirements of applicable codes and laws.

B. Include all costs for temporary scaffolding, staging, and related items in the Contract amount.
1.09 TEMPORARY STAIRS, RAMPS AND LADDERS

A. Furnish and maintain all temporary stairs, ladders, ramps, and runways, as required for the proper execution of the work, for the use of all trades, except as otherwise specified in the various trades SECTIONS of the Specifications.

B. All such apparatus, equipment and construction shall meet all applicable requirements of Federal, State and local regulations and codes.

C. As soon as permanent stairs have been installed, remove the temporary stairs and provide temporary protective treads on the permanent stairs, equipping the stairs with handrails, and shaft protection.

1.10 TEMPORARY CONTROLS

A. Dust control:

1. Maintain the construction site, stockpiles, access roads, and staging areas, and parking areas, used for the work, free from dust which would otherwise be a hazard or a nuisance to those at the site or adjacent sites.

2. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and as needed to prevent air-borne dust from dispersing into the atmosphere. Use water spray for dust control unless otherwise specifically allowed by the Architect, in writing. Proposed dust control methods and materials other than water spray, shall be submitted to the Architect for approval in accordance with SECTION 013000, SUBMITTAL PROCEDURES.

3. Furnish, erect, and maintain for the duration of the work period in any given area, temporary fire-retardant dustproof coverings, as required to prevent the spread of dust beyond the immediate area where work is being performed. Remove the temporary coverings when the work is completed in the area.

B. Water control:

1. Take over the responsibility for site drainage in the area of the new construction upon entering the premises and maintain such drainage during the life of this Contract in a manner approved by the Architect and so as not to adversely affect the adjacent areas.

2. During the progress of the work, provide and maintain all required pumps, suction and discharge lines, and power in sufficient number and capacity to keep all excavations, pits, trenches, foundations, and the entire property area free from accumulation of water from any source whatsoever, at all times, and under any and all circumstances and contingencies that may arise.

C. Pest control:

1. Provide control or abatement of interfering or harmful plant growth, bacterial fungi, and insects.

   a. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

   b. Should the use of pesticides be deemed necessary, submit an informational copy of the proposed program to the Owner, with a copy to the Architect. In the proposed program, clearly indicate:
(1) The type of nuisance to be controlled.

(2) The area or areas to be treated.

(3) The pesticides to be used, with a copy of the manufacturer's printed instructions for each product.

(4) The pollution preventative measures to be employed.

2. Ensure that the use of any pesticide is in strict accordance with the manufacturer's printed instructions and recommendations.

3. Ensure that applications of pesticides are made only by a Massachusetts-licensed pesticide applicator, and in strict compliance with State and local requirements.

D. Rodent control:

1. Provide rodent control as necessary to prevent infestation of the new construction, and of the storage areas and stockpiles on the site.

   a. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

   b. Should the use of rodenticides be deemed necessary, submit an informational copy of the proposed program to the Owner, with a copy to the Architect. In the proposed program, clearly indicate:

      (1) The area or areas to be treated.

      (2) The rodenticides to be used, with a copy of the manufacturer's printed instructions for each product.

      (3) The pollution preventative measures to be employed.

2. Ensure that the use of any rodenticide is in strict accordance with the manufacturer's printed instructions and recommendations.

3. Ensure that applications of rodenticides are made only by a Massachusetts-licensed pesticide applicator, and in strict compliance with State and local requirements.

E. Debris control and rubbish removal:

1. Initiate and maintain, until final completion of the work of the Contract, a specific program to prevent accumulation of rubbish and debris at the construction site, storage areas, parking areas, and along access roads and haul routes within the site, assume full responsibility enforcing such requirement for the duration of the Contract, and bear all costs therefor.

   a. Provide sufficient quantity of dumpsters at strategic on-site locations approved by the Architect, for deposit of debris, rubbish, and all other materials, which are to be disposed of, resulting from the work of all trades on the Project. Schedule frequent collection and legal off-site disposal of the contents of such dumpsters.
b. Notify all material suppliers, subcontractors, and other affected personnel, that the on-site dumpsters are available and shall be used by them for disposal of materials.

2. Ensure that each Subcontractor, at least once each day, bears full responsibility for placing into one of the dumpsters all packing materials, case lumber, excelsior, foam plastic pellets, wrappings, and other related rubbish, flammable or otherwise, caused by, and used in, the execution of his work.

3. Furnish, install, maintain, and pay for, two (2) enclosed rubbish chutes leading from the roof level of the building to each dumpster location, or to an active loading truck, at ground level, for disposal of all debris and rubbish attributed to the work of this Contract, the locations of the chutes being subject to approval the Architect. Remove chutes upon completion of the work.

4. Do not permit rubbish or other materials to be passed through the finished openings of exterior walls, without first providing proper protection around the opening. Be responsible, and bear all costs, for repair and/or replacement of damaged work caused by failure to comply with the requirements of this paragraph.

F. Pollution control:

1. Ensure that each Subcontractor engaged on the project bears full responsibility pollution control during the execution of his work; but such requirement shall in no way be construed to relieve the Contractor of his primary responsibility for maintaining the pollution control as set forth hereunder, and as otherwise required by applicable codes.

2. Provide methods, means, and facilities required to prevent contamination of soil, water, and atmosphere, by the discharge of noxious substances from construction operations.

3. Provide all necessary equipment and personnel, and perform emergency measures required to contain any spillages, and to remove contaminated soils and liquids.

   a. Excavate, completely remove, transport, and dispose of, at an off-site location legally approved for such deposits, all contaminated soils and liquids.

4. Take special measures to prevent harmful substances from entering public or private waters, whether on or off the site.

   a. Prohibit disposal of wastes, effluents, liquid and dry chemicals, and other deleterious or noxious materials, into open waterways and ponds, or into sanitary or storm sewers.

5. Provide necessary systems for control of atmosphere pollutants; including the prevention of toxic concentrations of chemicals at any location on the site, and prevention of harmful dispersal of pollutants into the atmosphere.

G. Noise control:

1. Develop, and maintain for the duration of the Contract, a noise-abatement program; and enforce strict discipline over all personnel to keep noise to a minimum. Comply with local Zoning Noise By-law, which are incorporated into the Section, by reference hereto.
2. Do not permit the starting of equipment engines, whether for warm-up or any other reason, prior to 7:00 AM, for the duration of this Contract.

3. Execute the construction work using methods and types of equipment which will reduce excess noise.
   a. Equip air compressors with silencers; and power equipment with mufflers.
   b. Handle and schedule vehicular traffic to reduce noise.

1.11 WORK AREAS, STORAGE, ACCESS, AND PARKING

   A. The limits of work areas are designated on the Drawings. Store all construction materials within the site boundaries; except when the Contractor has otherwise received written authorization from the Owner for off-site storage. Assume full responsibility for trespass on, and/or damage to, other property by any employees or subcontractors’ employees.

1.12 OVERLOADING

   A. Do not permit materials to be stacked on, or be transported over, any roof construction where such action would stress any segment of the roof construction beyond the designed live loads.

1.13 TEMPORARY FIRE PROTECTION

   A. Provide and maintain adequate temporary fire protection throughout the project, in the form of barrels of water with buckets, fire bucket tanks, fire extinguishers, or other effective means of extinguishing fire, ready for instant use.

   B. Store and dispense gasoline and other flammable liquids from UL-listed safety containers, in conformance with the National Board of Fire Underwriters' recommendations. Do not store such materials within the building at any time.

   C. Make arrangements for periodic inspections by the local fire protection authorities and insurance underwriter's inspectors. Cooperate with said authorities, and promptly carry out their recommendations.

   D. Ensure that all tarpaulins, used during the construction, are made of material which is resistant to fire, water, and weather, UL-approved, and complying with Federal Specification CCC-D-746.

   E. Do not permit fires of any kind to be lit in or about the premises.


      1. Temporary Fire Protection: Until permanent fire protection system is in operation, provide and maintain temporary fire protection devices in areas where work is in progress. As a minimum, provide portable fire extinguishers. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each useable stairwell, and at least one extinguisher in each room or space or room within the building used for storage, painting or workshop.
2. Institute controls to minimize the risk of fire:
   a. Maintain access to portable fire extinguishers.
   b. Maintain portable fire extinguishers in charged and operable condition.
   c. Prohibit smoking in hazardous fire exposure areas.
   d. Store combustibles in containers in fire-safe locations.
   e. Torch and welding operations.
   f. Supervise and maintain combustion type temporary heating units.
   g. Maintain the site in a clean and orderly fashion. Promptly remove rubbish and combustible debris.
   h. Develop and post an evacuation plan.

3. Fire Watch: Maintain a fire watch of the interior and exterior of the facility for at least one hour after the day's work is completed when the following activities have been done: torching, welding, installation of epoxy or other activities capable of ignition.

1.14 MUNICIPAL POLICE SERVICES

A. Make all necessary arrangements with the municipal police department in advance of times when regular off-duty, or insert part-time and auxiliary police officers will be needed for traffic control or protection, due to the operations performed under this Contract. Pay police officers at the contract rate in the local contract in the municipality for such services. Extend the Workman's Compensation Insurance and Employer's Liability Insurance, required under the General Contract, to cover police used on the project.

1.15 PROGRESS CLEANING

A. General:

1. Perform general cleaning operations on a daily basis during the course of the work. Ensure that each Subcontractor engaged on the project bears full responsibility for cleaning up during and immediately upon completion of his work in each area, and removes all rubbish, waste, tools, equipment, and appurtenances caused by, and used in, the execution of his work from such areas; but such requirement shall in no way be construed to relieve the Contractor of his primary responsibility for maintaining the building and site in a clean, free from debris, leaving all work in proper condition satisfactory to the Architect and/or Owner. Final cleaning will be performed under Section 017700, Project Closeout.

2. Refer to paragraph entitled TEMPORARY CONTROLS for specific requirements regarding debris and rubbish removal.

3. Leave pipe and duct spaces, chases, and furred spaces thoroughly clean, as work is completed therein.

END OF SECTION
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON-TEXT PAGE
INDEX

FOR

SECTION 017700

PROJECT CLOSEOUT

<table>
<thead>
<tr>
<th>NO.</th>
<th>PARAGRAPH TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>SUMMARY</td>
</tr>
<tr>
<td>1.02</td>
<td>CLOSEOUT PROCEDURES - SUBSTANTIAL COMPLETION</td>
</tr>
<tr>
<td>1.03</td>
<td>CLOSEOUT PROCEDURES - FINAL ACCEPTANCE</td>
</tr>
<tr>
<td>1.04</td>
<td>FINAL CLEANING</td>
</tr>
<tr>
<td>1.05</td>
<td>ADJUSTING</td>
</tr>
<tr>
<td>1.06</td>
<td>PROJECT RECORD DOCUMENTS</td>
</tr>
<tr>
<td>1.07</td>
<td>OPERATION AND MAINTENANCE MANUALS</td>
</tr>
<tr>
<td>1.08</td>
<td>WARRANTIES</td>
</tr>
<tr>
<td>1.09</td>
<td>SPARE PARTS AND MAINTENANCE MATERIALS</td>
</tr>
</tbody>
</table>

END OF INDEX
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON-TEXT PAGE
SECTION 017700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 SUMMARY

A. This SECTION 017700 contains requirements for the following:

1. Closeout procedures for substantial completion and final acceptance

2. Final cleaning

3. Adjusting

4. Project record documents

5. Operation and maintenance manuals

6. Warranties

7. Spare parts and maintenance materials

1.02 CLOSEOUT PROCEDURES - SUBSTANTIAL COMPLETION

A. Prior to requesting inspection for certifications of Substantial Completion, complete the following:

1. On Application for Payment, show 100 percent completion for portions of work claimed as Substantially Complete. Submit list of incomplete items, value of incomplete work, and reasons work is not complete.

2. Submit evidence of compliance with requirements of governmental agencies having jurisdiction including, but not necessarily limited to:

   a. Certificate of Final Inspections.


3. Submit all product and installation warranties, workmanship bonds, maintenance agreements, installer certifications and similar documents specified in individual SECTIONS of the Specifications.

4. Submit all test/adjust/balance reports.

5. Change-over permanent locks and submit keys to the Owner.

6. Remove temporary facilities and services that are no longer required.

7. Remove mock-ups, field samples and similar items.

8. Complete Final Cleaning, including repair and restoration, or replacement of damaged Work.
9. Complete adjusting of all operating products
10. Remove surplus materials, rubbish and similar elements.
11. Submit application for reduction of retainage
12. Submit notification of shifting insurance coverages.

B. Within 2 weeks after receipt of the notice of Substantial Completion from the Contractor, the Architect will inspect to determine status of completion.

1. Should the Architect determine that the work required under this Contract is not Substantially Complete:
   a. The Architect will notify the Contractor in writing, stating the reasons therefore.
   b. The Contractor shall remedy the deficiencies and send a second written notice of Substantial Completion to the Architect, requesting re-inspection.

C. When the Architect concurs that the work is Substantially Complete:

1. The Architect will prepare AIA Document G 704 - CERTIFICATE OF SUBSTANTIAL COMPLETION, in accordance with the requirements of the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS, accompanied by the Subcontractors list of items to be completed or corrected, as verified by the Architect
2. The Architect will submit the Certificate to the Owner, and to the Contractor, for their written acceptance of the responsibilities, assigned to them in the Certificate.

1.03 CLOSEOUT PROCEDURES - FINAL ACCEPTANCE

A. Prior to requesting inspection for certificate of Final Acceptance and final payment, perform the following:

1. Completion of incomplete work, submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance.
2. Prove that all taxes, fees and similar legal obligations have been paid.
3. Submit final payment requests with release of all liens, and supporting documentation.
4. Provide assurances that all unsettled claims are in the process of and will be resolved.
5. Submit final meter readings for utilities, a record of stored fuel, and similar data, taken on date of Substantial Completion.
6. Submit updated final statement, including accounting for final additional changes to the Contract Sum. Show additions Contract Sum, additions and deductions, previous Change Orders, Total Adjusted Contract Sum, previous payments and Contract Sum due.
7. Submit consent of surety to Final Payment.
8. Submit evidence of continuing insurance coverage complying with insurance requirements.

9. Remove remaining temporary facilities and services.

10. Deliver to Owner and obtain receipts for:
   a. Operation and Maintenance Manuals for items so listed in individual SECTIONS of the Specifications, and for other items when so directed by the Architect.
   b. Project Record Documents, including reproducible mylars, compact disks, and/or removable flash drives.
   c. Warranties and bonds specified in individual SECTIONS of the Specifications.
   d. Keys and keying schedule
   e. Spare parts and materials extra stock.
   f. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service and all times including nights, weekends, and holidays.

11. Submit certification stating work required under this Contract has been inspected for compliance with the Contract Documents.

12. Submit certification stating equipment and systems having been tested in presence of Owner's representative and are fully operational.

13. Submit certification stating that work required under this Contract is 100 percent complete and ready for final inspection.

B. Within 2 weeks after receipt of the request for Final Acceptance from the Contractor, the Architect will inspect to determine status of completion.

1. Should the Architect determine that the Work is incomplete or defective:
   a. The Architect will notify the Contractor in writing, stating the reasons listing the incomplete or defective work.
   b. Take immediate steps to remedy the deficiencies and send a second written notice of request for Final Acceptance to the Architect.
   c. Costs relative to the Architects re-inspection due to failure of work to comply with claims made by the Contractor, will be compensated by the Owner, who will deduct the amount of such compensation from the Final Payment due to the Contractor.

C. After the Architect finds the work required under this Contract acceptable, the Architect will review the final closeout submittals.

D. Application for Final Payment: Submit Application for Final Payment in accordance with procedures and requirements of the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS.
1. The Architect will prepare a Final Change Order, reflecting approved adjustments to the Contract Sum not previously made by other Change Orders.

1.04 FINAL CLEANING

A. Complete final cleaning prior to Certification of Substantial Completion

B. Cleaning shall include all surfaces, interior and exterior, to which the Contractor has had access whether existing or new.

C. Refer to individual SECTIONS of the Specifications for cleaning of specific products or work.

D. Use only those cleaning materials and methods that are recommended by the manufacturer of the surface to be cleaned. Use only those materials which will not create hazards to health or property and which will not damage surfaces.

E. Employ experienced workmen, or professional cleaners, for final cleaning operations.

F. Clean, repair, patch, or otherwise touch up marred surfaces of specified finishes, to match adjacent surfaces.

G. Without limiting the generality of the GENERAL CONDITIONS, perform the following specific cleaning work at time of completion of the Contract. Perform cleaning in all areas where construction work has occurred, or has been soiled as a result of actions by the Contractor or his employees:

1. Clean all exposed to view concrete free of all foreign material. If, in the opinion of the Architect, further cleaning of specific areas is required, scrub the surfaces with water or other non-acidic cleaning agents.

2. Clean metal surfaces, hardware, fixtures, appliance, equipment, and similar items free of all foreign matter and, if necessary, shall be lightly scrubbed at specific stains with clean water, mild soap, and soft rags, thoroughly rinsed and wiped with clean, soft white rags. Do not use abrasive cleaners.

3. Replace broken, shipped and defective glass. Remove from glass surfaces all stains, spots, marks, paint smears, dirt and foreign materials. Clean and polish exterior and interior glass in all areas where work of this Contract has been performed. Clean and polish mirrors.

4. Remove paint smears, spots, marks, dirt, mud and dust and similar disfigurement created by the Work, from all exposed to view existing or new interior and exterior finished surfaces.

5. Clean and polish finished hardware, remove marks, stains, scratches and blemishes.

6. Clean and polish floor and wall tile where construction work has occurred.

7. Dust and clean millwork, wood doors, and finish woodwork items, remove all stains, spots, and foreign matter using methods and cleaning agents which will not harm the various finishes.

8. Remove all advertising matter and temporary instructional material from exposed surfaces.

10. Thoroughly clean all items of mechanical and electrical equipment; remove excess oils and grease from exposed surfaces.

11. Clean permanent filter, and replace disposable filters if ventilating units were operated during construction.

12. Clean ducts, blowers and coils, if units were operated without filters during construction.

13. Clean out existing and exterior entrances and stairways, remove all leaves, dirt and debris.

1.05 ADJUSTING

A. Complete adjusting prior to request for Certification of Substantial Completion.

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

C. Comply with the requirements of all related SECTIONS, including, but not limited to, 019113 COMMISSIONING REQUIREMENTS.

1.06 PROJECT RECORD DOCUMENTS

A. Submit prior to request for Certificate of Final Acceptance.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and shop drawings for preparing the record drawings.

1. Where shop drawings are used, record a cross-reference at the corresponding location on the Contract Documents.

C. Do not use Record Documents for construction purposes; protect from loss in a secure location. Mark-up these drawings to show the actual installation reflecting all changes made in the Work during construction.

1. Mark whichever drawing is most capable of showing conditions accurately.

2. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

3. Record new information that is important to the Owner, but was not shown on the Contract Drawings, or shop drawings.

D. The mechanical and electrical trades shall be responsible to the Contractor to keep the record documents for their portions of the work marked currently to record all changes in the mechanical and electrical work made during construction.

E. The Architect may periodically inspect these record drawings, and their proper maintenance may be a condition precedent to approval of applications for periodic payments.

F. Deliver all Project Record Documents, shop drawings, product data, and samples to the Architect for the Owner's use, upon completion of the Work and prior to request for Final Acceptance of the Work.

G. In addition, prepare at the completion of the work, neat, clean well drafted, and complete record drawings in the form of electronic CAD files. Submit these Project
Record Documents to the Architect as a condition precedent to final payment, and include documents prepared by the mechanical, and electrical trades.

H. Record the progress of the work with black and white photography taken at no less than two week intervals. Provide two (2) sets of 4x6 prints to the Architect showing each of the four elevations as well as no less than three detail shots of the current work in progress as directed by the Architect.

1.07 OPERATING AND MAINTENANCE MANUALS

A. Deliver to an on-site location designated by the Owner, four (4) bound and properly identified Operating and Maintenance Manuals prior to request for Final Acceptance.

B. Refer to Section 017823, Operation and Maintenance Data, for Operating and Maintenance Manuals requirements.

C. Submit one copy of completed volume in final form 21 days prior to final inspection. This copy will be returned after final inspection with Architect comments. Revise and submit all volumes to the Owner.

1.08 WARRANTIES

A. Furnish a notarized copy of the full one-year warranty for all work, with validity commencing on the date of Substantial Completion of the Contract, as defined in the GENERAL CONDITIONS.

B. Provide duplicate notarized copies of extended warranties specified in individual Specifications SECTIONS for all copies of operations and maintenance manuals.

1.09 SPARE PARTS AND MAINTENANCE MATERIALS

A. Deliver, to on-site location designated by the Owner, all spare parts, maintenance materials, and additional materials; of the types and quantities specified in individual Specifications SECTIONS; and obtain receipt from the Owner prior to request for certification of final acceptance.

1. Include “NOT FOR WARRANTY REPAIRS” on the labels.

2. Obtain receipt prior to final payment.

B. Notwithstanding the requirements of the individual Specifications SECTIONS, provide, as additional material, the following items under the following SECTIONS. Where sections noted are filed sub-bid sections; furnishing and placing the additional materials, in a location designated by the Owner, is the responsibility of the said filed sub.

1. One quart of paint, minimum in the various colors and sheens used, in sealed quart containers, labeled with manufacturer's name, color names, color numbers, and color formulas. High Performance coatings are not required for additional materials: Section 099100, Painting.

C. Do not use the spare parts and maintenance materials required by the Contract Documents to remedy defects during the one-year period except when approved otherwise by the Owner. In such cases, replace items used.

END OF SECTION
SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, including, but not limited to 019113 COMMISSIONING REQUIREMENTS, apply to this Section.

1.02 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 products, materials, and finishes, systems and equipment.
5. Schematic diagrams of control systems, circuit directories for each electric panel and charts showing the tagging of all valves.

B. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "Project Closeout" for submitting operation and maintenance manuals.
3. Divisions 02 through 32 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.03 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.
1.04 SUBMITTALS

A. Initial Submittal: Submit four (4) draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 21 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.

1.05 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

2.01 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 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."
2.02 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.

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. Name and address of Owner's Project Manager
8. 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 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.
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 or plastic sleeves, and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.03 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   5. Power failure.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.04 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

OPERATION AND MAINTENANCE DATA
017823 - 4
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.
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.

2.05 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.
   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.

2.06 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 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. 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

3.01 MANUAL PREPARATION

A. 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.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. 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.

D. 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.

E. 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.

F. Comply with Division 01 Section "Project Closeout" for schedule for submitting operation and maintenance documentation.

END OF SECTION
SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, including, but not limited to 019113 COMMISSIONING REQUIREMENTS, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training videotapes.

B. Related Sections include the following:

1. Divisions 02 through 32 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one complete training manual(s) for Owner's use.

B. Qualification Data: For facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:
1.04 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. Heat generation, including boilers, feedwater equipment, pumps and water distribution piping.
   2. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
   3. HVAC instrumentation and controls.
   4. Kitchen hood systems.
   5. Plumbing systems, including domestic water heaters, valves, hose bibs, and fixtures.
   6. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
   7. Fire Alarm systems including all components.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.

   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Operations manuals.
      c. Maintenance manuals.
      d. Project Record Documents.
      e. Identification systems.
      f. Warranties and bonds.
      g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through the Owner's Project Manager and the CxA, with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and/or demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.
3.03 DEMONSTRATION AND TRAINING VIDEOTAPES

A. General: Engage a qualified commercial photographer to record demonstration and training videotapes. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Videotape Format: Provide high-quality video on DVD.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on videotape by audio narration by microphone while videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

E. Review operation of DVD training video with Owner to facilitate its use without further instruction.

END OF SECTION
SECTION 018100

ENERGY CODE REQUIREMENTS

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. PART A and DIVISION 1 of PART B, as listed in the TABLE OF CONTENTS, are hereby made part of this SECTION by reference thereto.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

D. Refer to SECTIONS 017700, PROJECT CLOSEOUT and 019113 COMMISSIONING REQUIREMENTS, for additional information.

1.02 SUMMARY

A. The intent of this Section is to require compliance with the 2017 revisions of the Massachusetts State Building Code, Ninth Edition for Chapter 13: 780 CMR 13.


1.03 ENERGY CONSERVATION CODE REQUIREMENTS:

A. Comply with the requirements of the 780 CMR Massachusetts State Building Code, Chapter 13: 780 CMR 13 (IECC 2015) for permitting, reporting, testing and mandatory and prescriptive standards. If there is any conflict between these requirements and the individual specification sections, the more stringent standard takes precedence.

B. Maximum U-value and solar heat gain coefficient (SHGC) for fenestration (IECC 2015 Table C402.4).

1. Maximum U-value for Entry doors: 0.77
2. Maximum U-value for Fixed Windows: 0.38
3. Maximum U-value for Operable Windows: 0.45
4. Maximum SHGC value for all fenestration: 0.53
C. Air Leakage shall comply with (780 CMR Chapter 13, IECC, c. 502.4).

D. Mechanical Systems comply with (780 CMR Chapter 13, IECC, c. 503)

END OF SECTION
# SECTION 019113
## MEP COMMISSIONING REQUIREMENTS

### TABLE OF CONTENTS

**PART 1 - GENERAL**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>RESPONSIBLE PERSONNEL</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>DESCRIPTION</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
<td>COORDINATION</td>
<td>2</td>
</tr>
<tr>
<td>1.4</td>
<td>COMMISSIONING PROCESS</td>
<td>2</td>
</tr>
<tr>
<td>1.5</td>
<td>RELATED WORK</td>
<td>3</td>
</tr>
<tr>
<td>1.6</td>
<td>COMMISSIONING COMPLETION</td>
<td>3</td>
</tr>
<tr>
<td>1.7</td>
<td>SYSTEMS TO BE COMMISSIONED</td>
<td>4</td>
</tr>
<tr>
<td>1.8</td>
<td>RESPONSIBILITIES</td>
<td>4</td>
</tr>
<tr>
<td>1.9</td>
<td>TESTING PREREQUISITES</td>
<td>11</td>
</tr>
<tr>
<td>1.10</td>
<td>MONITORING</td>
<td>11</td>
</tr>
</tbody>
</table>

**PART 2 - PRODUCTS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>TEST EQUIPMENT</td>
<td>12</td>
</tr>
</tbody>
</table>

**PART 3 - EXECUTION**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>MEETINGS</td>
<td>12</td>
</tr>
<tr>
<td>3.2</td>
<td>REPORTING</td>
<td>12</td>
</tr>
<tr>
<td>3.3</td>
<td>SUBMITTALS</td>
<td>13</td>
</tr>
<tr>
<td>3.4</td>
<td>START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT</td>
<td>13</td>
</tr>
<tr>
<td>3.5</td>
<td>FUNCTIONAL PERFORMANCE TESTING</td>
<td>14</td>
</tr>
<tr>
<td>3.6</td>
<td>DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS</td>
<td>16</td>
</tr>
<tr>
<td>3.7</td>
<td>DEFERRED TESTING</td>
<td>16</td>
</tr>
<tr>
<td>3.8</td>
<td>OPERATION AND MAINTENANCE MANUALS</td>
<td>17</td>
</tr>
<tr>
<td>3.9</td>
<td>FINAL COMMISSIONING REPORT</td>
<td>17</td>
</tr>
<tr>
<td>3.10</td>
<td>TRAINING OF OWNER PERSONNEL</td>
<td>18</td>
</tr>
<tr>
<td>3.11</td>
<td>WRITTEN WORK PRODUCTS</td>
<td>18</td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.1 RESPONSIBLE PERSONNEL

A. Commissioning Authority: WSP will act as the Commissioning Authority. The Commissioning Authority observes and documents the commissioning work.

B. Responsibility of Disciplines: The parties listed below are part of the commissioning team and will be required to participate in the commissioning process. The responsibilities relative to commissioning for each of these parties is defined in this section.

1. Architect
2. Owner
3. Engineers
4. Commissioning Authority
5. General Contractor
6. Mechanical Contractor
7. Plumbing Contractor
8. Fire Protection Contractor
9. Electrical Contractor
10. Controls Contractor
11. Testing, Adjusting and Balancing Contractor
12. Independent Contractor(s)
13. All subcontractors and equipment suppliers/manufacturers that are associated with the above disciplines

1.2 DESCRIPTION

A. The commissioning process shall be completed in accordance with the requirements for set forth in Section C of Attachment A-2, Standard Scope of Commissioning Services for Accelerated Repair Projects.

B. Commissioning:

1. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the Post Construction Phase with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

2. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
a. Verify that applicable equipment and systems are installed according to the manufacturer’s recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

b. Verify and document proper performance of equipment and systems.

c. Verify that O&M documentation site is complete.

d. Verify that Owner and operations staff is properly trained.

3. The commissioning process does not take away from or reduce the responsibility of the installing contractors to provide a finished and fully functioning product.

C. This project will have selected building systems commissioned. The commissioning process will be directed by a Commissioning Authority (CA) whose services will be provided by the Owner.

D. Abbreviations:

1. The following are common abbreviations used in the Specifications and in the commissioning process.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/E-</td>
<td>Architect and design engineers</td>
</tr>
<tr>
<td>CxA-</td>
<td>Commissioning authority</td>
</tr>
<tr>
<td>CC-</td>
<td>Controls contractor</td>
</tr>
<tr>
<td>CM-</td>
<td>Construction Manager</td>
</tr>
<tr>
<td>CO-</td>
<td>Contracting Officer</td>
</tr>
<tr>
<td>Cx-</td>
<td>Commissioning</td>
</tr>
<tr>
<td>EC-</td>
<td>Electrical contractor</td>
</tr>
<tr>
<td>FT-</td>
<td>Functional performance test</td>
</tr>
<tr>
<td>FM-</td>
<td>Facility Manager</td>
</tr>
<tr>
<td>GC-</td>
<td>General contractor</td>
</tr>
<tr>
<td>MC-</td>
<td>Mechanical contractor</td>
</tr>
<tr>
<td>PC-</td>
<td>Prefunctional checklist</td>
</tr>
<tr>
<td>Subs-</td>
<td>Subcontractors</td>
</tr>
<tr>
<td>TAB-</td>
<td>Test and Balance contractor</td>
</tr>
</tbody>
</table>

1.3 COORDINATION

A. Management: The GC will coordinate the efforts of the contractors and equipment suppliers so that the commissioning process is coordinated and completed in advance of substantial completion.

B. Scheduling: The CxA will develop and provide the commissioning schedule with input from the Owner, contractors and GC. The GC will incorporate commissioning schedule activities into the overall project schedule.

1.4 COMMISSIONING PROCESS

A. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

1. Commissioning during construction begins with a scoping meeting conducted by the CxA wherein the commissioning process is reviewed with the commissioning team members.

2. Additional meetings scheduled by the CxA will be required throughout construction, to plan, scope, coordinate, and schedule future activities and resolve problems.
3. Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures. The CxA will review and comment on applicable items.

4. The Subcontractors develop startup plans and startup documentation formats and provide to the CxA. The CxA may use this information to develop prefunctional checklists to be completed during the startup process if manufacturer’s startups are not completed.

5. The Subcontractors execute and document the prefunctional checklists and perform startup and initial checkout if no manufacturer’s startup will be completed. The CxA documents that the checklists and startup were completed according to the approved plans. This may include the CxA witnessing startup and prefunctional checkout or manufacturer's startup activities of selected equipment.

6. The CxA develops specific equipment and system functional performance test procedures. The Subcontractors review the procedures.

7. The procedures are executed by the Subcontractors, under the observation of, and documented by the CxA. The Owner is invited to witness testing.

8. Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.

9. The CxA reviews the O&M documentation for completeness.

10. The CxA audits training.

11. Commissioning is completed before Substantial Completion.

12. Deferred testing is conducted, as specified or required.

1.5 RELATED WORK

A. All of the following sections apply to the Work of this section.

1. Division 21 – FIRE PROTECTION
2. Division 22 – PLUMBING
3. Division 23 – HVAC
4. Division 26 – ELECTRICAL

1.6 COMMISSIONING COMPLETION

A. Prerequisites to functional completion

1. All TAB work and commissioning activities must be complete prior to Functional Completion, unless approved in writing by the Owner. Exceptions to this are the planned control system training performed after occupancy and any required seasonal or approved deferred testing. This includes for all systems, but is not limited to:
ELIZABETH CARTER BROOKS SCHOOL  
WINDOW, DOOR & BOILER REPLACEMENT  
New Bedford, MA

 MEP COMMISSIONING REQUIREMENTS  
019113 – 4

a. Completed and signed start-up and prefunctional checklist documentation  
b. Requested trend log data  
c. Submission of final approved TAB report  
d. Completion of all functional testing  
e. Required training of Owner personnel completed and approved  
f. Submission of the approved O&M manuals  
g. All identified deficiencies have been corrected or are approved by the Owner to be excepted from this milestone

B. The GC will determine the date of Functional Completion after reviewing the Commissioning Agent’s recommendation for Functional Completion.

C. Commissioning activities are non-compensable and cannot be a cause for delay claims.

1.7 SYSTEMS TO BE COMMISSIONED

The systems listed under this section will be commissioned. Functional performance test procedures will be developed by the CA and demonstrated by the responsible contractors. All contractors will be responsible for carrying out and documenting startup and Prefunctional test procedures for each piece of equipment in these systems. The Owner and CA reserve the right to amend this list at any time during the construction and acceptance process.

**Mechanical Systems**

- Boilers  
- Pumps  
- Makeup Air Unit  
- Ductless Split AC Units  
- Exhaust Fans  
- Building management system (BMS) as it pertains to the systems to be commissioned  
- Testing, adjusting, and balancing (TAB) Report review

**Electrical Systems**

- Lighting & Lighting Control  
- Normal Panelboards  
- Fire Alarm (Type B Witness Samples)

**Plumbing and Fire Protection Systems**

- Domestic Hot Water and associated recirculation pumps  
- Fire Protection Tests (Type B Witness Samples)

1.8 RESPONSIBILITIES

A. The responsibilities of all parties in the commissioning process are specified below.

B. All Parties:
1. Attend commissioning meetings.

C. Architect:

1. Construction Phase
   a. Attend the commissioning scoping meeting and selected commissioning team meetings.
   b. Perform normal submittal review, construction observation, as-built drawing review, O&M manual preparation, etc.
   c. Provide any design narrative documentation requested by the CxA.
   d. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
   e. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

2. Post Construction Phase
   a. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

D. Design Engineer:

1. Construction Phase
   a. Perform normal submittal review, construction observation, as-built drawing review, etc., as contracted. Site observations should be completed as required prior to system startup.
   b. Provide any design narrative and sequences documentation requested by the CxA. The design engineers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment as required.
   c. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.

E. Commissioning Authority (CxA):

The CxA is not responsible for design concept, design criteria, design intent, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The primary role of the CxA (both fundamental and enhanced) is to observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all labor, instrumentation, tools or the use of tools to start-up, check-out and functionally test equipment and systems.

1. Construction Phase
a. Coordinate the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties.

b. Coordinate the commissioning work and, with the GC, verify that commissioning activities are being scheduled into the master schedule.

c. Plan and conduct a commissioning scoping meeting and other commissioning meetings.

d. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

e. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

f. Review systems being commissioned for compliance with commissioning needs.

g. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress.

h. Provide pre-functional checklists to the MEP/FP sub-contractors for them to complete prior to system startups unless manufacturer’s startups to be completed.

i. Approve systems startup by reviewing start-up reports and by selected site observation.

j. Review TAB execution plan.

k. Approve air and water systems balancing by spot testing, by reviewing completed reports and/or by selected site observation.

l. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone data logger monitoring or manual functional testing.

m. Analyze any functional performance trend logs and monitoring data to verify performance.

n. Coordinate witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.

o. Maintain a master deficiency and resolution log and a separate testing record. Provide the GC with written progress reports and test results with recommended actions.
p. Witness performance testing of all other owner contracted tests or tests by manufacturer’s personnel over which the CxA may not have direct control. Document these tests and include this documentation in Systems manuals.

q. Compile and maintain a commissioning record.

r. Review O&M manuals submitted by contractors.

s. Provide a final commissioning report.

2. Post Construction Phase / Warranty Phase
   a. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

   b. Return to the site during the opposite season from when functional testing was performed (approximately 6 months into the Post Construction Phase and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning.

F. General Contractor (GC):
   1. Construction Phase
      a. Coordinate the commissioning work and ensure that commissioning activities are scheduled.

      b. Attend a commissioning scoping meeting and other commissioning team meetings.

      c. Perform the normal review of Contractor submittals.

      d. When necessary, observe and witness prefunctional checklists, startup and functional testing of selected equipment.

      e. Review commissioning progress and deficiency reports.

      f. Coordinate the resolution of non-compliance and deficiencies identified in all phases of commissioning.

      g. Sign-off (final approval) on individual commissioning tests as completed and passing.

   2. Post Construction Phase
      a. Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

G. Owner’s Project Manager (PM)
   1. Construction Phase
a. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training.

b. Provide final approval for the completion of the commissioning work.

2. Post Construction Phase

a. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

H. Mechanical, Electrical, Plumbing, Fire Protection, Telecom, Controls and TAB Contractors:

The commissioning responsibilities applicable to each of the contractors are as follows (all references apply to commissioned equipment only):

1. Construction Phases

a. Include and itemize the cost of commissioning in the contract price.

b. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.

c. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.

d. Contractors shall provide the CxA with normal cut sheets and shop drawing submittals of commissioned equipment.

e. Provide additional requested documentation, prior to normal O&M manual submittals, to the CxA for development of start-up and functional testing procedures.

1) Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CxA.

2) The Commissioning Agent may request further documentation necessary for the commissioning process.

3) This data request may be made prior to normal submittals.

f. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CxA for review.
g. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment as required.

h. Provide assistance to the CxA in preparing the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

i. Fill-out completely, the pre-functional checklists provided by the CxA. These pre-functional forms should be completed prior to start-up of the associated piece of equipment. Completed pre-functional checklists are to be reviewed and approved, by the CxA; prior to any functional testing of equipment begins.

j. Develop professional/start-up check lists and a full start-up and initial checkout plan using manufacturer’s start-up procedures all commissioned equipment. Submit to CxA for review prior to startup.

k. Perform and clearly document all completed startup and system prefunctional checklists, providing a copy to the CxA.

l. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.

m. Provide skilled technicians, tools, instrumentation, equipment and materials necessary to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

n. Correct deficiencies (differences between specified and observed performance) as interpreted by the CxA, GC and A/E and retest the equipment.

o. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

p. During construction, maintain as-built red-line drawings for all drawings and provide final CAD record drawings. Update after completion of commissioning (excluding deferred testing).

q. Provide training of the Owner’s operating staff using expert qualified personnel.

r. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

2. Post Construction Phase

a. Execute seasonal or deferred functional performance testing, witnessed by the CxA.
a. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal or deferred testing.

I. Mechanical Contractor:

The responsibilities of the mechanical contractor, during Construction Phases in addition to those listed above are:

1. Prepare a preliminary schedule for system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CxA. Update the schedule as appropriate.

2. Notify the CM, who will notify the CxA, when startup of each piece of equipment and TAB will occur. Be responsible to notify the GC, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction.

J. Controls Contractor:

The commissioning responsibilities of the controls contractor, during Construction Phases in addition to those listed above are:

1. Assist and cooperate with the CxA in the following manner:
   a. Using a skilled technician who is familiar with this building, execute the functional testing of the controls system as specified for the controls contractor. Assist in the functional testing of all equipment specified.
   b. Execute all control system trend logs specified.

2. Provide a signed and dated certification to the CxA and GC upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.

3. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as requested by the CxA to demonstrate system operation.

4. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

K. TAB Contractor: The commissioning responsibilities of the TAB contractor, in addition to those listed above are:

1. Submit the outline of the TAB plan and approach for each system and component to the CxA, GC and the controls contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.
2. A running log of events and issues shall be kept by the TAB field technicians. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CxA and GC at least weekly.

3. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.

4. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CxA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.

5. Provide the CxA with any requested data, gathered, but not shown on the draft reports.

6. Provide a final TAB report for the CxA with details, as in the draft.

1.9 TESTING PREREQUISITES

A. The following applicable generic prerequisite checklist items are required to be completed and checked off by the contractor prior to functional testing.

1. All related equipment has been started up and start-up reports and prefunctional checklists submitted and approved ready for functional testing. The CxA may spot check items on the prefunctional checklist before beginning functional testing.

2. All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final set points and schedules with debugging, loop tuning and sensor calibrations completed.

3. Test and balance (TAB) complete and approved for the HVAC air and water systems.

4. All A/E punchlist items for this equipment corrected.

5. These functional test procedures reviewed and approved by installing contractor.

6. Safeties and operating ranges reviewed by the CxA.

7. Test requirements and sequences of operation attached.

8. Schedules and set points attached.

9. False loading equipment, system and procedures ready.

10. Sufficient clearance around equipment for servicing.

B. The testing requirements specified for commissioning are in addition to and do not replace any testing requirements specified elsewhere.

1.10 MONITORING

1. Monitoring is a method of testing as a stand-alone method or to augment manual testing.

2. All points listed in the required monitoring section of the test requirements which are control system monitored points shall be trended by the controls contractor.
At the CxA’s request, the controls contractor shall trend up to 20% more points than listed herein at no extra charge.

3. Provide data electronically (Microsoft Excel) in 15 minute intervals for all analog hardware and software points.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. Two-way radios shall be provided by the Division Contractor.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price and left on site.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping / Kickoff Meeting

1. Within 30 days of commencement of construction, the CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA.

B. Regular Meetings:

1. Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs to coincide with weekly construction meetings.

3.2 REPORTING

A. The CxA will provide regular reports to the GC, with increasing frequency as construction and commissioning progresses.

B. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

D. CxA to issue the Final Commissioning Record Report.
3.3 SUBMITTALS

A. LEED Certification Documentation: Submit documentation from the manufacturer highlighting LEED requirements for materials and products of this Section. Comply with requirements of Section 018110, SUSTAINABLE DESIGN REQUIREMENTS

B. The Commissioning authority will review submittals related to the commissioned equipment as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures.

C. The CxA may request additional design narrative from the A/E and Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. The O&M manuals shall be developed by the Contractor and reviewed by the CxA.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned,

B. General:

1. Prefunctional checklists verify that the equipment and systems are installed and operational. It ensures that functional performance testing may proceed without unnecessary delays. Each piece of equipment may receive full prefunctional checkout if no manufacturer’s official startup will be completed. No sampling strategies are used. The prefunctional checkout for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. Start-up and Initial Checkout Plan:

1. The primary role of the CxA in this process is to verify that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefunctional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms. Parties responsible for executing functional performance tests are identified in the testing requirements for each system.

2. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each piece of equipment and a summary statement with a signature block at the end of the plan.

3. As a minimum, the start-up plan should consist of following:

   a. The manufacturer’s standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added at the end.
b. The manufacturer’s field checkout sheets.

c. If Start-up checklists are not available from vendor CxA will provide appropriate forms.

4. The subcontractor submits the full startup plan to the CxA for review and approval.

D. Sensor and Actuator Calibration:

1. All field-installed temperature, relative humidity, CO, CO₂ and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

2. All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results. All sensors shall be calibrated to the tolerances for the specific product.

E. Valve and Damper Stroke Setup and Check:

1. For all valve and damper actuator positions checked, verify the actual position against the BAS readout.

F. Execution of Prefunctional Checklists and Startup:

1. The Subs and vendors shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and prefunctional checklists.

2. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

G. Deficiencies, Non-Conformance and Approval in Checklists and Startup:

1. The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the CxA within two days of checklist completion.

2. The CxA reviews the report and submits either a non-compliance report or an approval. When satisfactorily completed, the CxA recommends approval of the execution of the checklists and startup of each system to the CM.

3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in back charges to the responsible party.

3.5 FUNCTIONAL PERFORMANCE TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.
B. The parties responsible to execute each test are listed with each test.

C. Objectives and Scope:

1. The objective of functional performance testing is to demonstrate that each system is operating according to the design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected.

2. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

D. Development of Test Procedures:

1. Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters.

2. The CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test shall provide assistance to the CxA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CxA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection.

3. The CxA shall review owner-contracted, factory testing or required owner acceptance tests which the CxA is not responsible to observe, including documentation format, and shall determine what further testing or format changes may be required to aid in the commissioning effort.

E. Coordination and Scheduling:

1. The Subs shall provide sufficient notice to the GC regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The GC will schedule functional tests through the Subs. The CxA shall witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

2. In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed.

F. Problem Solving:

1. The responsibility to solve, correct and retest problems is with the GC, Subs and A/E.
3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation:

1. The CxA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC and subs for review.

B. Non-Conformance:

1. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the GC on a standard non-compliance form.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.

3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues.

4. Cost of Retesting:
   a. The cost for the Sub to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
   b. For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CxA and GC will direct the retesting of the equipment once at no “charge” to the Subs for their time. However, the CxA’s and GC’s time for a second retest will be charged to the Sub.
   c. The time for the CxA and GC to direct any retesting required because a specific prefunctional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the responsible contractor.

5. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension.

C. Approval:

1. The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA and by the GC, if necessary. The CxA recommends acceptance of each test to the GC using a standard form. The CM gives final approval on each test using the same form, providing a signed copy to the CxA and the Contractor.

3.7 DEFERRED TESTING

A. Unforeseen Deferred Tests:

MEP COMMISSIONING REQUIREMENTS
019113 – 16
1. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing:

1. During the Post Construction Phase, seasonal testing (tests delayed until weather conditions are closer to the system’s design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

2. Test procedures indicate cooling season, heating season or both. If there is no season indicated, there is no special season test required and the test can be executed during any season if conditions simulation is appropriate. Where “design” is indicated in the procedure, it means that the season is within 5°F of the ASHRAE 2-1/2% design criteria or 95% of the loading design.

3.8 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals:

1. The specific content and format requirements for the standard O&M manuals are detailed in each Section.

2. CxA Review:

   a. Prior to substantial completion, the CxA shall review the O&M manuals, documentation to verify compliance with the Specifications. The CxA will communicate deficiencies in the manuals to the GC. Upon a successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the GC and A/E.

3.9 FINAL COMMISSIONING REPORT

A. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment and documentation in the following areas:

   1) Equipment meeting the equipment specifications.
   2) Equipment installation.
   3) Functional performance and efficiency.
   4) Equipment documentation and design intent.

   All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used.
(manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

3.10 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. The CxA shall be responsible for reviewing the content and adequacy of the training of Owner personnel for commissioned equipment.

1. The specific training requirements of Owner personnel by Subs and vendors are specified in their respective divisions.

2. Each Sub and vendor responsible for training will submit a written training plan to the CxA for review and approval prior to training. The plan will cover the following elements:
   a. Equipment (included in training)
   b. Intended audience
   c. Location of training
   d. Objectives
   e. Subjects covered (description, duration of discussion, special methods, etc.)
   f. Duration of training on each subject
   g. Instructor for each subject
   h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
   i. Instructor and qualifications

3. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

3.11 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in the Specifications. Below is a list of all the formal written work products and who is responsible to create them. In summary, the written products are:

<table>
<thead>
<tr>
<th>Product</th>
<th>Developed By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Meeting minutes</td>
<td>CxA</td>
</tr>
<tr>
<td>2. Commissioning schedules</td>
<td>CxA w/ GC</td>
</tr>
<tr>
<td>3. Equipment documentation submittals</td>
<td>Subs</td>
</tr>
<tr>
<td>4. Sequence clarifications</td>
<td>Subs and A/E as needed</td>
</tr>
<tr>
<td>5. Prefunctional checklists</td>
<td>CxA – Complete by Subs</td>
</tr>
<tr>
<td>6. Startup and initial checkout plan</td>
<td>Subs</td>
</tr>
<tr>
<td>7. Final TAB report</td>
<td>TAB</td>
</tr>
<tr>
<td>8. Corrective Action Tracking log (deficiencies)</td>
<td>CxA</td>
</tr>
<tr>
<td>9. Commissioning Progress Record</td>
<td>CxA</td>
</tr>
</tbody>
</table>
10. Deficiency reports     CxA
11. O&M manuals         Subs
12. Final commissioning report  CxA
13. Functional tests     CxA performed by CxA

END OF SECTION
# Functional Performance Test
## Heating Hot Water System

### 1. Project Information

<table>
<thead>
<tr>
<th>Test Revision:</th>
<th>Draft</th>
<th>Revision Date:</th>
<th>01/30/2018</th>
<th>System:</th>
<th>Hot Water System</th>
<th>Unit ID:</th>
<th>B-1, B-2, BP-1, BP-2, HWP-1, HWP-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name:</td>
<td>Elizabeth Carter Brooks School</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Location:</td>
<td>New Bedford, MA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WSP Project Number:</td>
<td>B1809277.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date of Testing:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2. Attendees

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commissioning Agent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATC Contractor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3. Documentation Verification

**Purpose:** Record that all design, manufacturer and contractor documents are received and reviewed prior to installation, equipment startup and functional testing.

**Procedure:**
- For each of the listed documents select:
  - “Yes” if the document was received, reviewed and approved
  - “No” if the document has not been received, or is found to be sub-standard

All “No” and “N/O” items are required to have a note explaining the lack of documentation.

<table>
<thead>
<tr>
<th>Document</th>
<th>Received? (Yes / No)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved Design Documentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approved Contractor Submittals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturer Operation and Maintenance Manuals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturer’s Specifications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturer’s Installation and Startup Instructions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. INSTALLATION CHECKLIST

**Purpose:**
Record that all design, manufacturer and contractor documents are received and reviewed prior to installation, equipment startup and functional testing

**Procedure:**
For each of the listed documents select:
- “Yes” if the installation check for the _____ is correct.
- “No” if the installation check for the _____ is incorrect.
- “N/O” if the item was Not Observed. Provide a detailed description of why the installation item was not observed in the Notes Section.

All “No” and “N/O” items are required to have a note explaining the lack of documentation

<table>
<thead>
<tr>
<th>Check ID</th>
<th>Hot Water System</th>
<th>Acceptable? (Yes, No, N/O)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All equipment clearly identified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>All Electrical disconnects clearly identified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>All isolation &amp; balancing valves installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>All temperature and pressure gauges installed, proper ranges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>OA Temp Sensor installed in proper location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>All DP Sensors installed and calibrated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>All pump strainers installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>ATC for plant is complete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Pumps have been tested and balanced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>All pump balancing valves are set and locked in place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>No excessive vibration or noise</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. ATC POINT VERIFICATION

**Purpose:**
Verify ATC graphics display points according to the design (point-to-point checkout and control diagram), or document the rationale for any deviations from the design values

**Procedure:**
Write the actual condition setpoint in appropriate “Actual Value” box as found on the BMS
In “Include in Trend?” write “Yes” or “No” to indicate whether the setpoint is included in data collection for later analysis
For each of the parameters select:
- “Yes” if the point is being monitored by ATC
- “No” if the point is not being monitored by ATC
- “N/O” if the actual setpoint cannot be determined

All “No” and “N/O” items are required to have a note explaining condition

<table>
<thead>
<tr>
<th>Point</th>
<th>Include in Trend?</th>
<th>Acceptable? (Yes, No, N/O)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Air Temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Water Differential Pressure Sensor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Water Supply Temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Water Return Temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HWP 1 Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HWP 1 VFD Fault</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HWP 2 Status</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6. SYSTEM SETPOINTS

**Purpose:**
Verify system setpoints are set according to the design, or document the rationale for any deviations from the design values.

**Procedure:**
Write the actual condition setpoint in appropriate “Actual Value” box as found on the BMS.
In “Include in Trend?” write “Yes” or “No” to indicate whether the setpoint is included in data collection for later analysis.

For each of the parameters select:
- “Yes” if the actual setpoint is the same as the design value, within the deadband
- “No” if the actual setpoint is not within the deadband of the design value
- “N/O” if the actual setpoint cannot be determined.

All “No” and “N/O” items are required to have a note explaining the condition.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Design Value</th>
<th>Actual Value</th>
<th>Acceptable? (Yes, No, N/O)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Air Hot Water Supply Temperature Reset</td>
<td>OA-T SW-T 0°F 65°F</td>
<td>OA-T 160°F 140°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler System Outside Air Temperature Enable</td>
<td>&lt;65°F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Hot Water Supply Alarm Temperature</td>
<td>&gt;180°F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Hot Water Supply Alarm Temperature</td>
<td>&lt;90°F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler Minimum Runtime</td>
<td>Set by Boiler Factory Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Water Pump Minimum Runtime</td>
<td>5 minutes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differential Pressure Setpoint</td>
<td>Determined by TAB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Water Pump Differential Pressure Setpoint</td>
<td>25 psi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Water Pump Minimum Speed</td>
<td>15hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead Boiler Rotation Schedule</td>
<td>Weekly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead Hot Water Pump Rotation Schedule</td>
<td>Weekly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Hot Water Differential Pressure Alarm</td>
<td>25% &gt; DP setpoint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Hot Water Differential Pressure Alarm</td>
<td>25% &lt; DP setpoint</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 7. FUNCTIONAL PERFORMANCE TEST

### Hot Water System

**Procedure:**
For each of the listed inspection items listed select:
- “Yes” if the test script is successfully executed completed as stated in the test script.
- “No” if the test script step is not successfully completed, the system responds differently than expected or the system fails to respond. If the script is determined to be failed, a descriptive explanation of the actual events and responses will be required in the Notes Section of this document.
- “N/O” if the response was Not Observed, provide a detailed description of why the test script item was not observed and discuss the reason for continuing or not continuing with the testing.

If a measurement is needed, take the measurement and record the value in the “Measured Value” column of the appropriate row.

All “No” and “N/O” items are required to have a note explaining condition.

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Test Mode</th>
<th>Test Step</th>
<th>Expected Results</th>
<th>Acceptable? (Yes, No, N/O)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>System Shutdown</td>
<td>Simulate OA-T above 65F, disabling the Hot Water System</td>
<td>Boilers are de-energized</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Boiler circulator pumps are de-energized</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hot water pumps are disabled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>System Enable</td>
<td>Simulate OA-T less than 65F, enabling the Hot Water System</td>
<td>System called to run; flow is proven</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lead Boiler runs and associated boiler circulator pump shall be energized; lead hot water pump shall run</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lag Boiler shall be commanded on by the lead when demand cannot be met by first boiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>System shall maintain the supply temperature setpoint and differential pressure setpoint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>HW Temperature</td>
<td>Increase/decrease OA-T to increase/decrease HWS-T</td>
<td>Boiler stages to maintain the hot water supply temperature set point based on the linear reset schedule</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control - Reset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Schedule</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Differential</td>
<td>Adjust system differential pressure setpoint</td>
<td>System shall modulate pump VFD speeds to maintain the DP setpoint</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pressure Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Simulate pump VFD’s running at min speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bypass valve shall modulate open from normally closed to maintain system pressure setpoint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lead-Lag Boiler</td>
<td>The hot water system shall enable</td>
<td>Lead boiler shall run first</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation</td>
<td></td>
<td>Standby boiler shall run</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lead boiler shall send an alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lead-Lag Boiler Control</td>
<td>Simulate lead-standby rotation via weekly changeover schedule</td>
<td>Boilers shall rotate lead and lag responsibilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-------------------------</td>
<td>---------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Lead-Lag Pump Operation</td>
<td>The hot water system shall enable</td>
<td>Lead pump shall run first</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate failure of lead pump</td>
<td>Standby pump shall run</td>
<td>Lead pump shall send an alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lead-Lag Pump Control</td>
<td>Simulate lead-standby rotation via weekly changeover schedule</td>
<td>Pumps shall rotate lead and lag responsibilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Boiler Alarm [internal]</td>
<td>Alarm generated at the BMS Repeat for other Boiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Low Water Level Alarm [internal]</td>
<td>Alarm generated at the BMS Repeat for other Boiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Boiler Failure</td>
<td>Alarm generated at the BMS Repeat for other Boiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Boiler Running in Hand Alarm</td>
<td>Alarm generated at the BMS Repeat for other Boiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Boiler Runtime Exceeded Alarm</td>
<td>Alarm generated at the BMS Repeat for other Boiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Lead Boiler Failure</td>
<td>Lead Boiler in Failure; standby boiler is on; lead boiler shall turn off Alarm generated at the BMS Repeat for other Boiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate High Hot Water Supply Temp. Alarm (&gt;180F)</td>
<td>Alarm generated at the BMS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Low Hot Water Supply Temp. Alarm (&lt;90F)</td>
<td>Alarm generated at the BMS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Pump Failure Alarm</td>
<td>Alarm generated at the BMS Repeat for other Pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Pump Running in Hand Alarm</td>
<td>Alarm generated at the BMS Repeat for other Pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Pump Runtime Exceeded Alarm</td>
<td>Alarm generated at the BMS Repeat for other Pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulate Pump VFD Fault</td>
<td>Alarm generated at the BMS Repeat for other Pump</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Simulate High Hot Water Differential Pressure Alarm [25% higher than setpoint]  |  Alarm generated at the BMS  
---|---
Simulate Low Hot Water Differential Pressure Alarm [25% below setpoint]  |  Alarm generated at the BMS  

--- END OF TEST ---

9. NOTES

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Deficiency (Yes / No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# PRE-FUNCTIONAL CHECK LIST

**Boiler – Hot Water System**

## 1. PROJECT INFORMATION

<table>
<thead>
<tr>
<th>Revision</th>
<th>Draft</th>
<th>Revision Date</th>
<th>01/30/18</th>
<th>System</th>
<th>HWS</th>
<th>Unit ID</th>
<th>B-1</th>
</tr>
</thead>
</table>

- **Project Name:** Elizabeth Carter Brooks School
- **Project Location:** New Bedford, MA
- **WSP Project Number:** B1809277.000
- **Date of Checkout:**
- **Company Performing Pre-Functional**

## 2. NAMEPLATE INFORMATION

Procedure: Record equipment data from the nameplate in the appropriate location

<table>
<thead>
<tr>
<th>Automatic Transfer Switch, ATS- ____</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
</tr>
<tr>
<td>Model Number</td>
</tr>
</tbody>
</table>

**General Comments:**
3. PREREQUISITES VERIFICATION

**Purpose:**
Record that all prerequisites are completed and documented prior to pre-functional checkout.

**Procedure:**
For each of the listed documents select:
- "Yes" if the document was received, reviewed and approved
- "No" if the document has not been received, or is found to be sub-standard
- "NA" if the documentation is not required per the specifications

All "No" items are required to have a note explaining the lack of documentation

<table>
<thead>
<tr>
<th>Document</th>
<th>Received? (Yes / No / NA)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Data submittal has been provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturer’s Instructions – For assembly, support details, connection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>requirements etc.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Pre-Functional Checklist

**Purpose:**
The purpose of this form is to pre-functionally check the unit prior to energizing.

**Procedure:**
For each listed materials select:
- "Yes" if the correct equipment and amount thereof is on-hand at the time of testing
- "No" if the equipment is not available at the time of testing
- Provide specific note if unit does meet acceptable expectations

All "No" items are required to have a note explaining the lack of equipment and resulting status of testing

<table>
<thead>
<tr>
<th>Point</th>
<th>Yes/No</th>
<th>Note(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General appearance good, no apparent damage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site sufficiently clean for unit startup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permanent equipment labels attached</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seismic Restraints installed as per associated detail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flue completely installed and sloped as specified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combustion air supply completed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water System has been filled and flushed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler BACnet interface installed for BMS integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermometers installed as per detail attached</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure gages installed as per detail attached</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P/T plugs installed as per detail attached</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe all gas train vents to the outdoors in accordance with all local and state codes (per the specification)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydronic piping complete, including blowdown system, makeup water piping and safety relief's</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydronic system flushing complete and strainers cleaned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation valves and balancing valves installed as per detail below</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Disconnect Switch installed and operational</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vent connector manifolds installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler Circulation pump installed per manufacturer recommendation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boilers Circulation pump confirmed accessible for servicing purposes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connect each boiler to a common all stainless steel breeching and stack system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air inlet &amp; exhaust vent connections installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condensate piping installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dirt trap installed as per manufacturer's recommendations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air/fuel valve, manual shut off valve, &amp; gas pressure regulator installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air vents and bleeds installed at high points in system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety valves installed (safety shut off valve, relief valves, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure/Temperature relief valves piped to the nearest floor drain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe fittings and accessories complete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test ports installed near all control sensors as per spec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow switch installed as required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piping type and flow direction labeled on piping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical treatment system or plan installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expansion tanks verified to not be air bound and system completely full of water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power to unit and disconnect completed. Please note if power is temporary or not.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All electrical components grounded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensors calibrated and operational</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control system interlocks completed and functional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All control devices, pneumatic tubing and wiring complete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motorized valves, dampers and float switches operational</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire and smoke sensing components installed and operational</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shunt trip breakers/relays installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>System Testing and Balancing has been completed and report</td>
<td>provided</td>
<td></td>
</tr>
<tr>
<td>System Control Point-to-Point Checkout has been completed and</td>
<td>report provided</td>
<td></td>
</tr>
</tbody>
</table>

-- END OF CHECKLIST --
SECTION 019114

BUILDING ENCLOSURE COMMISSIONING (BECx) REQUIREMENTS

1. GENERAL

1.1 General

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

The requirements of this Section shall in no way relieve the Owner, the General Contractor, the Architect of Record, the Engineer of Record and other parties to this project of their respective Contractual obligations to the Owner for meeting the specified performance levels in the design and construction of this project.

1.2 Description

This Section specifies the requirements for the building enclosure commissioning (BECx) process, the purpose of BECx and the roles of each party during the BECx process for this project, including, but not limited to the following:

1. Above-grade construction, including: exterior glazing systems and assemblies; low-slope roofing;
2. Interface conditions (flashings, expansion joints, and sealant) between each of the materials, components and systems that comprise the above-grade building exterior enclosure; and
3. New work (such as penetration conditions) to be tied into existing-to-remain portions of the low-slope roofing.

1.3 Related Work

Principal classes of work related to the work of this Section are listed below, and are specified to be performed under the indicated Sections of the Specifications. Refer to the indicated Sections for description of the extent and nature of the indicated work, and for coordination with related trades. This listing may not include all related work items, and it is the responsibility of the Contractor to fully coordinated the work of this Section with that of all other trades.

- 017823 – OPERATION AND MAINTENANCE DATA
- 019113 – COMMISSIONING REQUIREMENTS
- 022820 – ASBESTOS REMEDIATION
- 024119 - SELECTIVE DEMOLITION
- 033000 – CAST-IN-PLACE CONCRETE
- 042000 – UNIT MASONRY
- 055000 – MISCELLANEOUS METALS
- 071000 – WATERPROOFING, DAMPPROOFING & CAULKING
- 074213 – INSULATED METAL WALL PANELS
- 075100 – BUILT-UP ASPHALT ROOFING
1.4 Standards

The following Standards and Guidelines are incorporated into these Specifications. Unless noted otherwise, comply with the current version of these Standards.

.1 ASTM (American Society for Testing and Materials):
   .1 ASTM E2813-12: Standard Practice for Building Enclosure Commissioning
.2 NIBS (National Institute of Building Sciences):
   .1 NIBS Guideline 3-2012: Building Enclosure Commissioning Process BECx
.3 ASHRAE Guideline 0 – 2005 The Commissioning Process

1.5 Purpose of Building Enclosure Commissioning

.1 The purpose of Building Enclosure Commissioning (BECx) is to provide a process for independent, third-party verification that the installed performance of the building enclosure meets or exceeds the minimum performance requirements set forth by the Contract documents for this project.

.2 The materials, components, systems, and assemblies that comprise the above-grade building enclosure, the low-slope roofing as well as at interface conditions will be evaluated and tested as outlined in this Section, as well as in accordance with each of the technical sections associated with the design and construction of the building enclosure.

.3 WSP Building Enclosures Division will serve as the Building Enclosure Commissioning Agent (BECxA) and be a sub-consultant to the Commissioning Authority (CxA). The BECxA will be managed by the CxA as retained by the owner, and will include, by reference, all requirements set forth by the architect of record for pre-construction laboratory and field functional performance testing of the materials, components, systems and assemblies that comprise the building enclosure.

.4 This Section is meant to follow and build upon the following general commissioning requirements in Section 019113 COMMISSIONING REQUIREMENTS:
   .1 Submittals to CxA
   .2 Cx Team
   .3 Quality Assurance
.4 Contractor Responsibilities
.5 Commissioning Overview
.6 Scheduling
.7 Meetings
.8 Submittal Review Process
.9 Pre-functional Checklists
.10 Functional Performance Test
.11 Failed Tests, Disputed Tests, Non-Conformance and Test Acceptance
.12 Deferred Testing

.5 The BECx process for this project will impact the following phases, this scope is in alignment with the requirements of Fundamental Commissioning requirements:

.1 Design Phase
  .1 Review OPR and BOD
  .2 Construction Document Drawings Review

1.6 Roles and Responsibilities

.1 The table below describes parties addressed in this Section and their roles and responsibilities as related to the BECx.

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Role</th>
<th>Responsibilities by Phase</th>
</tr>
</thead>
</table>
| CxA   | WSP USA | Commissioning Authority | All Phases/General:  
|       |      |                  |   ▶   Lead the Cx Team  
|       |      |                  |   ▶   Manage the BECxA  
|       |      |                  |   ▶   Distribute Documentation |
| BECxA | WSP, Building Enclosures Division | Building Enclosure Commissioning Agent | All Phases/General:  
|       |      |                  |   ▶   Write BECx Plan & Provide to CxA  
|       |      |                  | Design Phase:  
|       |      |                  |   ▶   Review Drawings & Provide Comments  
|       |      |                  |   ▶   Attend Meetings  
|       |      |                  | Construction Phase:  
|       |      |                  |   ▶   Observe Mock-Up, Construction and Testing through Site Visits  
|       |      |                  |   ▶   Document Findings from Site Visits  
|       |      |                  |   ▶   Create and Supply Reports to CxA |
| O     | New Bedford Public Schools | Owner (O) | All Phases/General:  
|       |      |                  |   ▶   Review documentation provided by CxA  
|       |      |                  |   ▶   Comment and provide direction based on documentation presented by CxA  
|       |      |                  |   ▶   Authorize any changes prior to implementation on the project |
| OPM   | NV5  | Owners Project Manager (OPM) | All Phases/General:  
<p>|       |      |                  |   ▶   Support Owner in Owner’s responsibilities and coordinate with the CxA |</p>
<table>
<thead>
<tr>
<th>AOR</th>
<th>Johnson Roberts Associates, Inc.</th>
<th>Architect of Record (AOR)</th>
<th>All Phases/General:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Attend Meetings</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Review Documentation, Comments and Correspondence provided by CxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Comment and provide clarity in their design where required by the owner or internal quality control</td>
</tr>
<tr>
<td>Construction Phase:</td>
<td></td>
<td></td>
<td>▶ Provide new drawings if required</td>
</tr>
<tr>
<td>GC</td>
<td>TBD</td>
<td>General Contractor (GC)</td>
<td>All Phases/General:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Follow BECx Plan as a part of the total Cx Plan</td>
</tr>
<tr>
<td>Design Phase:</td>
<td></td>
<td></td>
<td>▶ Attend Meetings</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Provide Submittals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Coordinate and Provide Shop Drawings</td>
</tr>
<tr>
<td>Construction Phase:</td>
<td></td>
<td></td>
<td>▶ Attend Kick Off Meetings and coordinate attendance of critical subcontractors; provide project specific Quality Assurance (QA) program</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Retain copies of all required items on site for reference</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Provide safe access to Work</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Complete Mock-Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Retain Testing Authority as required under other specification sections</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Provide Manpower and Equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Facilitate Testing of Mock-Up, to include repair and remediation protocol if necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Provide Submittals: QA program, construction schedule, manufacturer literature, reports, testing results, protocols and timelines for repairs, change orders</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▶ Respond to deficiencies noted and provide proposed and final resolution documentation</td>
</tr>
</tbody>
</table>
Building Enclosure Systems to Be Commissioned

.1 The BECx requirements are included under Part 1 of each of the technical specification sections included in this Project Manual as they relate to the design and construction of the building enclosure for this project. These requirements apply to GC and any sub-Contractor or trade responsible for the final detailing and construction of the building enclosure. A table of Performance Requirements is included in Item 2.1 of this Section as a general guide; however, refer to Part 1 in each Section for more information on the specific testing required for each enclosure system.

.2 Refer to Item 1.3 of this Section for Related Sections of the Project Manual that will be affected by the BECx process. The enclosure materials, components, systems and assemblies to be commissioned include, but are not limited to:

1. Roofs
2. Exterior walls including translucent wall panel systems, metal panel systems, and unit masonry
3. Existing wall assemblies including mass masonry, masonry veneer, brick masonry, cast stone, and ornamental metal window grating
4. Windows
5. Exterior doors
6. Sealants, control joints, and expansion joints
7. Air barriers and vapor retarders as necessary
8. Flashings
9. Waterproofing, dampproofing, and vapor retarder
10. Floors
11. Louvers and vents
12. Rainwater management at roof
13. Interface conditions between each of the above listed elements including any tie-in to existing building(s)

1.7 BECxA’s Responsibilities

.1 Cooperate with the CxA, OPM, AOR, and GC and provide qualified personnel when scheduled.

.2 Promptly notify OPM, AOR and GC of irregularities or deficiencies of Work which are observed during performance of services.

.3 Provide qualified personnel to observe all testing of all building enclosure systems as defined in the Contract Documents.

.4 BECxA is not authorized to:
   .1 Release, revoke, alter or expand requirements of Contract Documents.
   .2 Approve or accept any portion of the Work.
   .3 Perform any duties of the Contractor.
2. REQUIREMENTS

The requirements for each building enclosure component are included under each of the technical specification sections included in this Project Manual as they relate to the design and construction of the building enclosure for this project. These requirements apply to GC and any subcontractor or trade responsible for the final detailing and construction of the building enclosure. In addition to the below table refer to each Section for more information on the specific testing required for each enclosure system.

2.1 Performance Requirements

Laboratory Testing

.1 The following list of testing standards are designed to be performed in a controlled testing environment. Typically the product manufacturer is responsible for determining the product’s performance under these testing standards. Refer to Item 1.3 of this Section for Related Sections of the Project Manual that will be affected by the BECx process.

<table>
<thead>
<tr>
<th>Test Name</th>
<th>System</th>
<th>Test Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM E2099</td>
<td>Enclosure</td>
<td>General</td>
</tr>
<tr>
<td>ASTM E514</td>
<td>Masonry</td>
<td>Water</td>
</tr>
<tr>
<td>ASTM E2178</td>
<td>Walls</td>
<td>Air</td>
</tr>
<tr>
<td>ASTM E2357-11</td>
<td>Walls</td>
<td>Air</td>
</tr>
<tr>
<td>NFRC 100</td>
<td>Window</td>
<td>Thermal</td>
</tr>
<tr>
<td>NFRC 200</td>
<td>Window</td>
<td>Thermal</td>
</tr>
<tr>
<td>NFRC 300</td>
<td>Glazing</td>
<td>Color</td>
</tr>
<tr>
<td>NFRC 400</td>
<td>Window</td>
<td>Air</td>
</tr>
<tr>
<td>NFRC 500</td>
<td>Window</td>
<td>Condensation</td>
</tr>
<tr>
<td>AAMA 1502.7</td>
<td>Window, Door, and Curtain Wall</td>
<td>Condensation</td>
</tr>
<tr>
<td>AAMA 1503.1</td>
<td>Window, Door, and Curtain Wall</td>
<td>Thermal</td>
</tr>
<tr>
<td>ASTM E 283</td>
<td>Window, Door, and Curtain Wall</td>
<td>Air</td>
</tr>
<tr>
<td>ASTM E 330</td>
<td>Window, Door, and Curtain Wall</td>
<td>Structure</td>
</tr>
<tr>
<td>ASTM E 331</td>
<td>Window, Door, and Curtain Wall</td>
<td>Water</td>
</tr>
</tbody>
</table>

Construction Mock-Up and In-Situ Field Testing

.2 The following list of testing standards are designed to be performed in the field to verify functional performance of a Mock-Up either on the building or elsewhere. Each test listed refers to the current version of the standard. Refer to Item 1.3 of this Section for Related Sections of the Project Manual that will be affected by the BECx process.

<table>
<thead>
<tr>
<th>Test Name</th>
<th>System</th>
<th>Test Type</th>
<th>Recommended Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM E1105-15</td>
<td>Window, Door, and Curtain Wall</td>
<td>Water Infiltration</td>
<td>At least one per wall type</td>
</tr>
</tbody>
</table>
2.2 Submittals

.1 GC is to submit the following items to the CxA, the BECxA, OPM, and AOR. These submittals are in addition to those specified in Division 01.

.1 Coordination Drawings
   Note on the shop drawings or provide a letter indicating:
   .1 That any and all shop drawings have been checked and cross-referenced by GC.
   .2 That adjacent elements (i.e. wall elements and fenestration elements), dimensions and construction tolerances indicated will allow all interfaces to be constructible.

.2 Qualifications Data
   .1 Submit all qualifications required in Related Specification Sections for fabricators, installers, and testing agencies.

.3 Preconstruction Reports
   .1 All preconstruction air and water leakage performance test results.
   .2 All failed tests, recording the noted deficiency and the required repair.

.4 Source Quality Control Reports
   .1 Retain a copy for field review by the CxA and include in the closeout submittal a copy of all manufacturer QA reports submitted for products supplied for the project.

.5 Field Quality Control Reports
   .1 Provide a copy of the test reports for all field water and air penetration and other appropriate building enclosure tests completed.

.6 Special Inspections Reports

.7 Remediation Protocols
   .1 Provide a copy of all remediation processes and QA processes that will be put in place to address all deficiencies on future Work product.

2.3 Manpower and Equipment
.1 GC is responsible to provide the following:
   .1 Adequate power and water to each test location.
   .2 Access to the outside and inside of the building at each test location for personnel, which
       may include installer, OPM, O, AOR, Cx team, and equipment.
   .3 No interior finishes shall be present at test area.
   .4 Manpower to assist with constructing spray racks and chambers for the testing.
   .5 Manpower to assist with conducting the testing.

.2 The Testing Authority, if present, is responsible to provide the following:
   .1 Directions on the test set-up.
   .2 Review of the test set up prior to a test.
   .3 Test equipment such as hoses, nozzles, gauges, small collapsible step ladder and other
       small equipment needed for testing.
   .4 Instructions for others on the test procedure.

.3 The BECxA is to:
   .1 Provide qualified personnel to be present on site to review Work or testing in progress as
       defined by the Contract with AOR and any authorized additional services approved by
       AOR or OPM.
BECX IMPLEMENTATION

2.4 Meetings

Under the BECx process for meetings during construction (can be part of regular project progress meetings) the following are requirements for GC:

.1 Coordinate and participate in a Building Enclosure Construction Kickoff Meeting
   .1 This meeting will be to discuss:
      .1 Construction sequencing related to the enclosure systems
      .2 Coordination of trades
      .3 GC’s project and site specific QA program to be implemented during construction of the building enclosure

.2 Ensure all subcontractors utilized for Work on this Contract related to the enclosure construction participate in the kick off meeting and other project meetings as relevant or required.
   .1 The subcontractors that should attend these meetings include all trades utilized during the construction of the building enclosure, including, but not limited to:
      .1 Roofing
      .2 Walls (installers for the façade materials, components, assemblies and systems, including, but not limited to: masonry, stone, glazing, metal panel, air barrier system, and flashing and water management system)
      .3 Doors
      .4 Sealant
      .5 Waterproofing

.3 Other participants for the kick-off meeting and as required, other project meetings should include, but are not limited to:
   .1 O
   .2 OPM
   .3 AOR
   .4 CxA
   .5 BECxA
   .6 MEP
   .7 Suppliers (as needed)
   .8 Manufacturer technical representatives (as needed)

.4 Include time in meetings for the BECxA and the appropriate subcontractors to:
   .1 Review and discuss issues and concerns noted by AOR and OPM, the CxA, the GC and O.
   .2 Determine what actions will be taken to address those concerns.
2.5 Mock-Ups

.1 GC is to:
   .1 Complete and participate in the construction of an on-site Mock-Up to check
       constructability, including building enclosure elements.
   .2 Utilize actual personnel from each trade that will be completing the Work in the field
       related to the Mock-Up.
   .3 Provide a written protocol and a timeline for repair of any deficiencies noted during the
       Mock-Up construction.
   .4 If a systemic problem is identified during Mock-Up construction, provide a repair and
       remediation protocol, including a timeline for repair of all affected elements. Repaired
       elements shall not be covered up without review by the BECxA; this may include
       photographs forwarded by the contracting team for review if issue is time sensitive and
       BECx cannot be on site.
   .5 During Mock-Up performance testing:
      .1 Provide personnel to be present, to include at least one representative from each trade
          or subcontractor who was a part of the Mock-Up construction.
      .2 Provide manpower and equipment as required in this Section.
      .3 Provide a written protocol and a timeline for repair of any deficiencies noted during
          testing, and/or
      .4 Provide a written report from the third party testing agency that indicates required
          repairs.
      .5 Comply with all other testing requirements in this Section as applicable to the Mock-
          Up phase.
   .2 The BECxA is to:
      .1 Provide written summaries (reports) of the Work in progress during the construction and
          testing of the Mock-Up. These reports will include, but may not be limited to:
         .1 Photographs, sketches and diagrams as required illustrating conditions observed in the
             field.
         .2 Deficiencies noted.
         .3 Proposed solutions for those conditions where appropriate for further review and
             acceptance by AOR.
   .3 Any changes to the Contract Documents arising out of the BECxA reports must be submitted
      to O, OPM and AOR for review. Any changes accepted must be done so in writing and
      submitted. Submittal to include a series of details/schematics and material specifications to
      GC for change order and pricing prior to implementation on the project.

2.6 Construction

.1 GC is to:
   .1 Submit a copy of the QA program to be implemented for construction for review by OPM, AOR, and O prior to beginning construction and prior to the kick-off meeting of the BECx process.
   .2 Cooperate with the CxA personnel and BECxA, provide access to Work, and provide
       adequate schedule for the Work for commissioning tasks.
.3 Furnish copies of all shop drawings, manufacturer’s literature, installation instructions, maintenance information, schedules, warranties or other information as requested.

.4 Provide a repair and remediation protocol for any systemic failures identified by the BECxA, including a timeline for repair of all affected elements. Repaired elements shall not be covered up without review by the BECxA.

.5 Be responsible for coordinating and managing the commissioning responsibilities of each of the subcontractors responsible for the building enclosure Work.

.2 The BECxA is to:

.1 Provide written summaries (reports) of the Work in progress during the construction of the building enclosure. These reports will include:
   .1 Photographs, sketches and diagrams as required illustrating conditions observed in the field.
   .2 Deficiencies noted.
   .3 Proposed solutions for those conditions where appropriate for further review and acceptance by AOR and OPM.

.3 Any changes to the Contract documents arising out of the BECxA reports must be submitted to O, AOR, and OPM for review. Any changes accepted must be done so in writing and submitted. Submittal to include a series of details/schematics and material specifications to GC for change order and pricing prior to implementation on the project.

2.7 Testing

.1 Testing Verification

   .1 GC is to:
      .1 Certify that building exterior enclosure systems, subsystems, and construction have been completed according to the Contract Documents, including all addenda and change order requirements.
      .2 Certify that QA procedures have been completed, QA reports have been submitted, discrepancies corrected, and corrective Work approved.
      .3 Have a representative present during any laboratory performance testing of building enclosure materials or systems.
      .4 Provide qualified personnel for assistance to complete the commissioning tests, including seasonal testing and all required air and water leakage testing for elements of the building enclosure.
      .5 Provide a representative to be present, and have a representative present from each trade and/or subcontractor associated with installing the system during the building enclosure air and water leakage performance testing, as indicated in Related Sections in Item 1.4.
      .6 Provide a written protocol and a timeline for repair of any deficiencies noted during the performance testing and/or a written report from the third party agency performing the tests indicating what repairs were required.

.2 The BECxA is to:
.1 Observe and report on the field quality-control testing of building exterior enclosure and test reports submitted by GC.

.2 For failed tests, additional test observations beyond quantity included in scope will be at additional cost.

.2 Deferred Testing:
   .1 If tests cannot be completed because of a deficiency outside the scope of the building enclosure, the deficiency shall be documented and reported to O, OPM, and AOR. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.

.3 Testing Reports:
   .1 Reports shall include measured data, data sheets, and a comprehensive summary describing the building enclosure systems at the time of testing.
   .2 Where a test has failed, deficiencies will be evaluated by GC, and as needed, AOR, OPM, O, and BECxA to determine corrective action. Deficiencies shall be corrected and test repeated.

.4 Corrective Action
   .1 If it is determined that the system is constructed according to the Contract Documents, O will decide whether modifications required to bring the performance of the system to a level where the noted failure or deficiency is eliminated and shall be implemented or if test results will be accepted as submitted. If corrective Work is performed, O will decide if tests shall be repeated and a revised report submitted.

End of Section
SECTION 02 28 20

ASBESTOS REMEDIATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

C. The Drawings indicate the general extent, only, of the demolition, removals, and alteration work to be performed. Prior to commencing any demolition and removals work, carefully examine all conditions as they exist at the project and verify with the Architect the actual extent of the demolition and removals work. Be fully responsible for removing all existing materials which would otherwise interfere with the proper installation or function of the new work, whether or not such existing materials or conditions have been indicated, such work being performed without additional cost to the Contract; and perform the required demolition, removals, and alteration work, except where specifically noted to the contrary in the various trade SECTIONS of the Specifications, in which cases the specific trades shall perform such designated segments of the demolition and removals work.

1.02 DESCRIPTION OF WORK

A. The work includes the complete removal and disposal of window wall systems as indicated in Part 3 of this Section.

1.03 POTENTIAL ASBESTOS HAZARD & DEBRIS

A. Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified ACM, take appropriate continuous measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state and local agencies.

B. If the Contractor failed to comply with the requirements of the specifications, the Owner's Representative (Industrial Hygienist) may present a written stop of work order. The Contractor must immediately and automatically stop all work until authorized in writing by the IH to commence work.

1.04 DEFINITIONS

A. Abatement: Procedures to control fiber release from ACM. Includes encapsulation, enclosure, and removal.

B. Area Monitoring: Sampling of asbestos fiber concentrations within the asbestos control area and outside the asbestos control area, which is representative of the airborne concentrations of asbestos fibers, which may reach the breathing zone.
C. **Asbestos:** The name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure are incombustible and are separable into fibers. Asbestos includes Chrysotile, Crocidolite, Amosite, Anthophyllite, and Actinolite.

D. **ACM:** Any material containing more than 1% or greater by weight of asbestos of any type or mixture of types. State laws may vary in their definition of asbestos containing material.

E. **Barrier:** Any surface that seals off the work area to inhibit the movement of fibers.

F. **Critical Barrier:** A solid, asbestos impermeable partition erected so as to constitute a work area closure; the outer perimeter of an asbestos work area, usually erected across corridors or other open spaces to complete containment.

G. **Designer:** Commonwealth of Massachusetts licensed Designer Ammar Dieb, Universal Environmental Consultants (AD-900326)

H. **Friable Asbestos Material:** Material that contains more than one percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

I. **HEPA Filter:** A High Efficiency Particulate Absolute (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in length.

J. **Industrial Hygienist:** An industrial hygienist certified in the Commonwealth of Massachusetts to perform air monitoring.

K. **Removal:** All herein specified procedures necessary to strip all ACM from the designated areas and to dispose of these materials at an acceptable site.

L. **Respirator:** A device designed to protect the wearer from the inhalation of harmful atmospheres.

M. **Visible Emissions:** Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.

N. **Wet Cleaning:** The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as asbestos contaminated waste.

O. **Work Area:** Any area indicated on the Drawings as asbestos abatement areas or as areas containing friable asbestos material.

1.05 **CONTRACTOR'S USE OF THE EXISTING BUILDING**

A. Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Do not use these areas for parking or storage of materials, unless authorized in writing by the Owner.

B. Smoking or open fires will not be permitted within the building enclosure or on the premises.
1.06 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. Provide a full time Site Supervisor for work under this Section with all appropriate state licenses, who is experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Competent Person as required by 29 CFR 1926 for the Contractor and is the Contractor's representative responsible for compliance with all applicable federal, state and local regulations, particularly those relating to ACM. This person shall have completed a course at an EPA Training Center or equivalent certificate course in asbestos abatement procedures, have had a minimum of two years on the job training and meet all additional requirements set forth in 29 CFR 1926 for a Competent Person.

B. The Site Supervisor must be certified by the State of Massachusetts. Asbestos Contractor shall provide proof of such certification to the Industrial Hygienist not less than 10 days prior to commencing any work.

1.07 SPECIAL REPORTS

A. Except as otherwise indicated, submit special reports directly to the Industrial Hygienist within one day of occurrence requiring special report, with copies to all others affected by the occurrence.

B. When an event of unusual and significant nature occurs at the site (examples: failure of negative pressure system, rupture of temporary enclosures, unauthorized entry into work areas), prepare and submit a special report listing date and time of event, chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. When such events are known or predictable in advance, advise the Industrial Hygienist in advance at earliest possible date.

C. Prepare and submit special reports of significant accidents, at the site and anywhere else work is in progress related to this project. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.08 CONTINGENCY PLAN

A. Prepare a contingency plan for emergencies including fire, accident, power failure or any other event that may require modification of decontamination or work area isolation procedures. Include in the plan specific procedures for decontamination or work area isolation. A copy of the plan shall be submitted to and approved by the Industrial Hygienist prior to any work being done.

B. Post in the clean room of the decontamination unit and in the Contractor's office trailer telephone numbers and locations of emergency services including but not limited to fire, ambulance, doctor, hospital and police.
1.09 PERMITS AND NOTIFICATIONS

A. Secure necessary permits in conjunction with asbestos removal, hauling, and disposition and provide timely notification as may be required by federal, state, regional, and local authorities. Notify the Department of Environmental Protection (DEP) and the Massachusetts Department of Labor and Standards (DLS) and provide copies of the notification to the Industrial Hygienist, Industrial Hygienist and the State Environmental Regulatory Agency 10 working days (Document Submission Date) prior to commencement of the work.

B. No later than the Document Submission Date, notify the local fire, police and Health Departments, in writing, of proposed asbestos abatement work. Advise the fire department of the nature of the asbestos abatement work, and the necessity that all firefighting personnel who may enter the work site in the case of fire wear self-contained breathing apparatus. Provide one copy of the notices to the Industrial Hygienist prior to commencing the work.

C. No later than the Document Submission Date, submit proof satisfactory to the Industrial Hygienist that all required permits, site location, and arrangements for transport and disposal of asbestos containing or contaminated materials, supplies, and the like have been obtained.

1.10 SAFETY COMPLIANCE

A. Comply with laws, ordinances, rules, and regulations of federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials.

B. Comply with the applicable requirements of the current issue of 29CFR 1926.1101 and 40CFR 61, Subparts A and B. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work.

1.11 RESPIRATOR PROGRAM

A. Establish a respirator program as required by ANSI Z88.2 and 29 CFR 1926.1101 (h), 1926.103, and 1910.134.

1.12 PERSONNEL PROTECTION

A. Prior to commencement of work, workers shall be instructed in and shall be knowledgeable of the hazards of asbestos exposure; use and fitting of respirators; use of showers; entry and exit from work areas, and all aspects of work procedures and protective measures.

B. All asbestos abatement workers shall receive training and shall be accredited as required by 40 CFR 763.90(g). Training and accreditation shall be in accordance with 40 CFR 763, Appendix C to Subpart E. Training shall also be provided to meet the requirements of OSHA Regulations contained in 29 CFR 1926.

C. Prior to the start of work, the Asbestos Contractor shall provide medical examinations for all employees in accordance with 29CFR 1926.1101 (m). All employees hired by the Asbestos Contractor after start of work shall have medical examinations in accordance with this paragraph before being put to work.
D. Maintain complete and accurate records of employee's medical examinations, during employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of OSHA, the Director of The National Institute for Occupation Safety and Health (NIOSH), authorized representatives of either of them, and an employee's physician upon the request of the employee or former employee.

E. Provide personnel exposed to airborne concentrations of asbestos fibers with fire retardant disposable protective whole-body clothing, head coverings, gloves, and foot coverings. Provide gloves to protect hands. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape. Asbestos Contractor shall require and monitor the use of complete protective clothing. A competent person designated by the Asbestos Contractor in accordance with 29CFR 1926.1101 shall periodically examine protective clothing worn by employees in the work area for rips or tears. When rips or tears are detected, they shall be immediately mended or replaced.

F. Provide goggles to personnel engaged in asbestos operations when the use of a full-face respirator is not required.

G. Provide authorized visitors with suitable protective clothing, headgear, eye protection and footwear, whenever they are required to enter the work area, to a maximum of 3 changes for 3 visitors per day. One of the sets of protective clothing shall be available for full time use by the Industrial Hygienist.

H. Provide all persons with personally issued and marked respiratory equipment approved by NIOSH and OSHA. The appropriate respiratory protection shall be selected according to the most recent Massachusetts regulations.

I. Once all visible asbestos material has been removed during decontamination, cartridge type respirators will be allowed during the final cleanup provided the measured airborne concentrations do not exceed 0.1 fibers per cubic centimeter. Where respirators with disposable filters are employed, provide sufficient filters for replacement as required by the worker or applicable regulation.

J. If the permissible respirators fail to provide sufficient protection against volatile emitted by any sealant used, the services of a qualified industrial hygienist will be procured, at the Asbestos Contractor's expense, to determine proper respiratory protection. The Owner and Industrial Hygienist will not be liable for the cost of increased respiratory protection.

K. Select respirators from those approved by the Mine Safety and Health Administration (MSHA), Department of Labor, or the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services. All personal wearing negative pressure respirators shall have respirator fit tests within the last six months and signed statements shall be available.

1.13 REFERENCE STANDARDS

A. Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Requirements of this Section shall in no way invalidate the minimum requirements of the referenced standards. Comply with the provisions of the following codes and standards, except as otherwise shown or specified. Where conflict among requirements or with this Section exists, the more stringent requirements shall apply.
B. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) requirements, which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

C. U.S. Environmental Protection Agency (EPA) requirements, which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

D. U.S. Department of Environmental Protection (DEP) and the Massachusetts Department of Labor and Standards (DLS).

1.14 SUBMITTALS

A. No work shall commence until the Contractor submits via email, completed submittals, not less than 10 working days prior to commencement of the work. The submittals shall include the following:

1. Submit all licenses and certification required.
2. Submit written evidence that the landfill to be used for disposal of asbestos is approved for disposal of asbestos by the EPA.
3. Submit all required items previously listed.
4. Secure necessary permits in conjunction with asbestos removal, hauling, and disposition and provide timely notification as may be required by federal, state, regional, and local authorities. Notify the Department of Environmental Protection (DEP) and the Massachusetts Department of Labor and Standards (DLS) and provide copies of the notification.
5. Notify the local fire, police and Health Departments, in writing, of proposed asbestos abatement work. Advise the fire department of the nature of the asbestos abatement work, and the necessity that all firefighting personnel who may enter the work site in the case of fire wear self-contained breathing apparatus. Provide one copy of the notices.
6. Submit proof that all required permits, site location, and arrangements for transport and disposal of asbestos containing or contaminated materials, supplies, and the like have been obtained.
7. The Contractor shall submit a plan for managing the waste including all collection, storage, disposal and decontamination practices/waste disposal.
8. Submit medical examinations for all employees in accordance with 29CFR 1926.1101 (m). All employees hired by the Asbestos Contractor after start of work shall have medical examinations in accordance with this paragraph before being put to work.
9. Provide MSDS for all used products on this Project.

1.15 REPORTING

A. Maintain on site a daily log documenting the dates and time of the following items, as well as other significant events:

1. Minutes of meetings: purpose, attendees, and brief discussion
2. Visitations: authorized and unauthorized
3. Personnel: by name, entering and leaving the work area
4. Special or unusual events
5. Personnel air monitoring tests and results

B. Documentation with confirmation signature of the Industrial Hygienist of the following:

1. Inspection of work area preparation prior to start of removal and daily thereafter.
2. Removal of any polyethylene barriers.
3. Removal of waste materials from work area and transport and disposal at approved site.
4. Decontamination of equipment.
5. Waste Shipment Records. No final payment will be approved until all above documents have been submitted.

C. Provide one emailed copy of this log to the Industrial Hygienist with the application for final payment.

1.16 AIR MONITORING

A. Full time monitoring will be conducted to ensure that the Asbestos Contractor is complying with the EPA and OSHA regulations and any applicable state and local government regulations. The Owner will provide an Industrial Hygienist (Universal Environmental Consultants) to take air samples at the job site at no cost to the Asbestos Contractor.

B. The purpose of the Industrial Hygienist’s air monitoring will be to detect faults in the work area isolation such as:
   1. Contamination of the building outside of the work area with airborne asbestos fibers,
   2. Failure of filtration or rupture in the negative pressure system,
   3. Contamination of the exterior of the building with airborne asbestos fibers.
   4. Should any of the above occur, the Asbestos Contractor should immediately cease asbestos abatement activities until the fault is corrected! Work shall not recommence until authorized by the Industrial Hygienist.

C. The Industrial Hygienist will monitor airborne fiber counts in the work area. The purpose of this air monitoring will be to detect airborne fiber counts higher than the Action Level of 0.1-f/cc which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building from contamination by airborne fibers.

D. The Asbestos Contractor shall be responsible for providing his/her own personnel monitoring within the work area as required to meeting CFR 1926.1101.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Plastic Sheet: 6 mil minimum thickness, unless otherwise specified, in sizes to minimize the frequency of joints.

B. Tape: Capable of sealing joints of adjacent sheets of plastic and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under dry and wet conditions, including use of amended water. Provide tape, which minimizes damage to surface finishes.

2.02 EQUIPMENT

A. Supply the required number of asbestos air filtration units to the site in accordance with these specifications.
2.03 DANGER SIGNS AND LABELS

A. Display danger signs at each location where airborne concentrations of asbestos fibers may be in excess of 0.01 fibers/cc. Post signs at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

B. The sign shall also contain a pictorial representation of possible danger or hazard, such as a skull and cross bone, or other suitable warning as approved by the Project Monitor. Sign shall meet applicable requirements.

C. Affix danger labels to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers.

PART 3 - EXECUTION

3.01 SCOPE OF WORK:

The asbestos abatement project might be performed in several phases. It is the asbestos contractor’s responsibility to comply with the phasing schedule prepared by the Architect. The scope of work includes the proper removal and disposal of ACM listed below. Refer to drawings for detailed scope, location and quantities.

The project monitor(s) will record on a daily basis all quantities removed. The asbestos contractor will be required to do the same. Both the contractor and the monitor must sign all daily logs. No work will continue until all logs are signed daily to the satisfaction of the Designer and Monitor. At the completion of the total project, should quantities removed were found to be less than the listed below, the asbestos contractor will be required to issue a credit to the owner based on unit prices listed at the end of this section or will be paid at the unit prices should quantities removed were found to be greater than the listed above.

Various Locations

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Vertical Caulking in CMU</td>
<td>Refer to Drawings</td>
</tr>
<tr>
<td>9” x 9” Vinyl Floor Tile and Mastic</td>
<td>Refer to Drawings</td>
</tr>
<tr>
<td>Indoor Doors</td>
<td>25 Total</td>
</tr>
<tr>
<td>Electrical Wire</td>
<td>2,500 LF</td>
</tr>
<tr>
<td>Pipe and Hard Joint Insulation</td>
<td>150 LF</td>
</tr>
<tr>
<td>Hidden Pipe and Hard Joint Insulation</td>
<td>250 LF</td>
</tr>
<tr>
<td>Walls/Ceilings Demolition to Access ACM</td>
<td>2,500 SF</td>
</tr>
<tr>
<td>Light Fixtures</td>
<td>Refer to Drawings</td>
</tr>
</tbody>
</table>

Kitchen

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft Ceiling Plaster</td>
<td>Refer to Drawings</td>
</tr>
</tbody>
</table>

Boiler Room

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe and Hard Joint Insulation</td>
<td>550 LF</td>
</tr>
<tr>
<td>Boiler Insulation</td>
<td>400 SF</td>
</tr>
<tr>
<td>Duct Insulation</td>
<td>300 SF</td>
</tr>
<tr>
<td>Interior Caulking</td>
<td>100 LF</td>
</tr>
<tr>
<td>Boilers</td>
<td>2 Total</td>
</tr>
</tbody>
</table>

Exterior

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>197 Total</td>
</tr>
<tr>
<td>Doors</td>
<td>22 Total</td>
</tr>
<tr>
<td>Caulking in Slate Stone Sills</td>
<td>150 LF</td>
</tr>
</tbody>
</table>

ASBESTOS REMEDIATION

02 28 20 - 8
Specific Notes:

A. All quantities are approximate. It's the Asbestos Contractor's responsibility to inspect the site and confirm condition and quantities prior to the submission of his/her bid package. It is also the Asbestos Contractor’s responsibility to review the demolition drawings, notes and phasing configurations. The contractor must include in his/her bid the entire scope of work listed above. The Contractor must agree and accept all unit prices listed at the end of this section. Means and methods of removal will be at the discretion of the contractor with prior approval by the onsite monitor and designer.

B. In all areas where ACM pipe and hard joint insulation has to be removed, ACM debris is included in the scope of work and has to be removed and disposed of as ACM at no extra cost to the Owner.

C. Remove and dispose as ACM of pipe and hard joint insulation found in areas scheduled to be renovated.

D. Remove and dispose as ACM of flooring materials listed above, including but not limited to vinyl floor tiles, carpet, resilient baseboard, stair treads, transition strips, leveling compound and mastic under all above items.

E. The Contractor shall make spot demolition in all walls/ceilings to uncover hidden ACM that may be found prior to the GC demolition activities. The asbestos contractor shall perform needed demolition at no additional cost to the owner to remove all ACM (Walls and Ceilings Demolition).

F. Remove and properly dispose of interior doors with windows including but not limited to doors, glass, glass blocks, caulking and all attachments. Caulking was found to contain asbestos and assumed to contain >1 ppm of PCB’s.

G. Remove and dispose as ACM of all ACM insulation found in boiler room.

H. Dismantle, remove ACM and dispose of both boilers including the concrete/brick pads and walls underneath both boilers.

I. Remove and properly dispose of all light fixtures. Tubes were assumed to contain mercury (Light Fixtures). The asbestos contractor shall retain the services of a licensed electrician to disconnect the lights.

J. Disconnect, remove and dispose as ACM of electrical wires. Wire insulation/wrap was assumed to contain asbestos.

K. Remove and properly dispose of all windows, curtain walls system, including but not limited to screens, windows, doors, metal, panels (interior/ exterior), glass, glass blocks, frames, sash, casings, sills, louvers, shims, fasteners, anchors, sealant, flashing and other related items. Remove and properly dispose of all caulking/debris found on the ground on the exterior of the building. Refer to drawings for scope, location and quantities. The contractor shall coordinate the work with other trades.

3.02 JOB CONDITIONS

A. Do not commence asbestos abatement work until:

1. Arrangements have been made for disposal of waste at an acceptable site. Submittal shall be made no later than the Document Submission Date.

2. Arrangements have been made for containing and disposal of wastewater resulting from wet stripping or filtering through a 5-micron filter.

B. All materials resulting from abatement work, except as specified otherwise shall become the property of the Asbestos Contractor and shall be disposed of as specified herein.

3.03 INSPECTION AND PREPARATION
ELIZABETH BROOKS ELEMENTARY:
WINDOW/EXTERIOR DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

A. Examine the areas and conditions under which asbestos will be abated and notify the Project Monitor in writing of conditions detrimental to the proper and timely completion of the work.
B. Before any work commences, post danger signs in and around the Work Area to comply with 29CFR l926.1101 (k) (I) as required by federal and state regulations, and as specified herein.
C. Pre-clean each area prior to setting up containment and remove all visible ACBM debris.
D. Clean all routes used to transport the ACM bags from the abated areas.
E. Asbestos abatement activities shall be performed using the glovebag method, mini-containment or full containment depending on each scope of work. Type of enclosures will be determined by the contractor and the on-site project monitor at no additional cost to the owner.

3.04 WORK PROCEDURE
A. Perform asbestos related work in accordance with 29CFR l926.1101 and as specified herein. Use wet removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein.
B. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos containing or contaminated materials and until final cleanup is completed.

3.05 REMOVAL OF ASBESTOS CONTAINING MATERIALS
A. Thoroughly wet ACM to be removed prior to stripping to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal Encapsulant. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for water or removal Encapsulant to penetrate material thoroughly. If a removal Encapsulant is used, apply in strict accordance with manufacturer's written instructions.
B. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
C. Remove saturated ACM in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.
D. For the removal of windows at a minimum the following shall be done.
1. Place 2 layers of 6-mil polyethylene sheeting on ground.
2. Seal the window opening on the interior of the school with 2 layers of 6-mil polyethylene sheeting wall to wall/ceiling to floor.
3. Remove window assembly including putty, glazing and frames.
4. Remove all perimeter caulking and sealant from the window frames at jambs, heads and sills. All caulking shall be removed from the adjacent surfaces until there is no visible emission.
5. Remove all debris that might be found on the ground.
6. Remove all layers of 6-mil polyethylene sheeting once cleared.
3.06 WORK AREA CLEARANCE

A. The work is complete when the work area is visually clean and airborne fiber levels have been reduced to the level specified below. When this has occurred, the Asbestos Contractor will notify the Project Monitor that the area is ready for clearance.

B. The number and volume of air samples taken and analytical methods used by the Project Monitor will be in accordance with applicable regulations.

C. Phase Contrast Microscopy (PCM) will be used for all type of sampling.

3.07 DISPOSAL OF ACM AND ASBESTOS CONTAMINATED WASTE

A. To prevent exceeding available storage capacity on site, remove sealed and labeled containers of asbestos waste and dispose of such containers at an authorized disposal site in accordance with the requirements of disposal authority.

B. Comply with 29 CFR 1926.1101.

C. Seal all asbestos and asbestos contaminated waste material with double thickness 6-mil, sealable plastic bags. Label the bags; transport and dispose of all in accordance with the applicable OSHA and EPA regulations. At the conclusion of the job, place all polyethylene material, tape, cleaning material and clothing in the plastic lined drum. Seal, correctly label, and dispose of as asbestos waste material.

D. Transport the bags to the approved waste disposal site. Asbestos Contractor shall obtain trip tickets at the landfill to document disposal of asbestos containing materials. A form shall be signed, not initialed, by all parties. Copies of all trip tickets shall be submitted to the Project Monitor.

E. Consider wastewater from showers and sinks to be contaminated waste and dispose of in accordance with this Section, unless water has been filtered through a 5 micron filter.

3.08 DISPOSAL OF NON-CONTAMINATED WASTE

A. Remove from the site all non-contaminated debris and rubbish resulting from demolition operations. Transport materials removed from demolished areas and dispose of offsite in a legal manner.

B. During progress of work, clean site and public properties, and dispose of waste materials, debris, and rubbish. Provide on-site containers for collection of waste materials, debris, and rubbish. Remove waste materials, debris, and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

3.09 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

A. After asbestos abatement work and decontamination is complete, relocate objects moved to temporary locations in the course of the work to their former positions. Re-secure mounted objects removed in the course of the work in their former positions and assure that they are in working order.
3.10 UNIT PRICES

A. All quantities listed in 3.01 are approximate. It's the Asbestos Contractor's responsibility to inspect the site and confirm condition and quantities prior to the submission of his/her bid package. It is also the Asbestos Contractor’s responsibility to review the demolition drawings, notes and phasing configurations.

B. The contractor must include in his/her bid the entire scope of work listed in 3.01. The Contractor must agree and accept all unit prices listed below. Means and methods of removal will be at the discretion of the contractor with prior approval by the onsite monitor and designer.

C. Units prices listed below are inclusive of all related costs.

<table>
<thead>
<tr>
<th></th>
<th>Addition</th>
<th>Deduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pipe and Hard Joint Insulation</td>
<td>$20.00 per LF</td>
<td>$16.00 per LF</td>
</tr>
<tr>
<td>2. Transite Panels</td>
<td>$5.00 per SF</td>
<td>$4.25 per SF</td>
</tr>
<tr>
<td>3. Electrical Wire</td>
<td>$4.00 per LF</td>
<td>$3.25 per LF</td>
</tr>
</tbody>
</table>

END OF SECTION
Ammar Dieb
Universal Environmental Consultants
12 Brewster Rd.
Framingham, MA 01702

Dear Ammar Dieb,

The enclosed analytical results have been obtained by using EPA 600/R-93/116 or EPA 600/M4-82-020. Calibrated Visual Estimate (CVE) is used by ProScience for the determination of the percentage of asbestos and other components in the sample. Point Counting is recommended when the sample contains less than 10% asbestos by CVE. Friable materials found to be less than 1% by CVE are automatically point counted (400 points) at no additional charge. ProScience recommends further analysis by a gravimetric method for non-friable materials that are less than 1% by CVE.

The Quality Control data related to the samples analyzed is available upon client's written request. ProScience Analytical Services Inc., assumes no responsibility for potential sample contamination that may have occurred during the sample collection process or erroneous data provided by the client.

The enclosed results may not be used under any circumstances as product endorsement by any US government agency including NIST/NVLAP.

All Laboratory records are retained for at least three years unless otherwise directed in writing by the client. The actual samples are retained for a period of two months and written request is necessary in order to be retained for a longer period of time. All analytical results and records are considered strictly confidential and will not be released under any circumstances to anyone except the actual client. The analytical results included in this report apply only to the items tested.

If you have any questions please contact the Laboratory Manager or the Laboratory Director.

Sincerely,

Patricia Weakley, Optical Asbestos Manager
Aimee Cormier, Laboratory Director

Enclosure:
Version 2
LAB BATCH ID: B 107417  CLIENT: PROJECT ID: N/A
Client Ref: Brooks Elementary School. New Bedford. MA
CT ID# PH-0209; MA ID# AA000156; ME ID# LB-055; ME ID# LA-056; NVLAP Lab Code 200090-0;
RI ID # AAL-093; VT ID# AL016876

November 20, 2017
<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Color</th>
<th>Asbestos %</th>
<th>Non-Asbestos %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Black</td>
<td>CHR AMO CRO ACT TRE ANT FBG MNW CEL HAR SYN OTH NON</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 0 0 0 0 0 75 0 0 0 0 0 25</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>Lap Flashing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td>High Roof near Chimney</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td>Is asbestos present? No. Analyzed: Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Color</th>
<th>Asbestos %</th>
<th>Non-Asbestos %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Yellow</td>
<td>CHR AMO CRO ACT TRE ANT FBG MNW CEL HAR SYN OTH NON</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 0 0 0 0 0 98 0 0 0 0 0 2</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>Core Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td>High Roof Metal Panels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td>Is asbestos present? No. Analyzed: Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Asbestos Codes: CHR = Chrysotile AMO = Amosite CRO = Crocidolite ACT = Actinolite TRE = Tremolite ANT = Anthophyllite
Non-Asbestos Codes: FBG = Fiberglass MNW = Mineral Wool CEL = Cellulose HAR = Hair SYN = Synthetic OTH = Other NGN = Non-Fibrous Minerals

Note: To create a unique lab sample ID, use the Batch # and the Sample ID (example: [Batch #] - [Sample ID]).

* All results are in percentage.

Analyst: Patricia Weakley
# CHAIN OF CUSTODY

**Universal Environmental Consultants**

12 Brewster Road  
Framingham, MA 01702  
Tel: (508) 628-5486 - Fax: (508) 628-5488  
adieb@uec-env.com

Town/City: New Bedford, MA  
Building Name: Brooks Elementary School

<table>
<thead>
<tr>
<th>Sample</th>
<th>Result</th>
<th>Description of Material</th>
<th>Sample Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Lap Flashing</td>
<td>Highest near chimney</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Core Materials</td>
<td>High Roof metal panels</td>
</tr>
</tbody>
</table>

Reported By: Gary Beach  
Date: 11/16/17  
Due Date: 2/4/18

Received By: Phil R. Smith  
Date: 11/17/17 8:00 AM
FINAL REPORT
FOR LIMITED
ASBESTOS CONTAINING MATERIALS IDENTIFICATION
SURVEY
AT THE
ELIZABETH CARTER BROOKS SCHOOL
NEW BEDFORD, MASSACHUSETTS

PROJECT NO: 217 364.00

SURVEY DATE:
September 14, 2017

SURVEY CONDUCTED BY:
UNIVERSAL ENVIRONMENTAL CONSULTANTS
September 18, 2017

Mr. Jeffery R. Davis  
Principal  
Johnson Roberts Associates  
15 Properzi Way  
Somerville, MA  02143  

Reference: Asbestos Containing Materials Identification Survey  
Elizabeth Carter Brooks School, New Bedford, Massachusetts

Dear Mr. Davis:

Thank you for the opportunity for Universal Environmental Consultants (UEC) to provide professional services.

Enclosed please find the report for limited Asbestos Containing Materials Identification Survey at the Elizabeth Carter Brooks School, New Bedford, Massachusetts.

Please do not hesitate to call should you have any questions.

Very truly yours,

Universal Environmental Consultants

Ammar M. Dieb  
President

UEC:\217 364.00\REPORT.DOC

Enclosure
1.0 INTRODUCTION:

Universal Environmental Consultants (UEC) has been providing comprehensive asbestos services since 2001 and has completed projects throughout New England. We have completed projects for a variety of clients including commercial, industrial, municipal, and public and private schools. We maintain appropriate asbestos licenses and staff with a minimum of twenty five years of experience.

UEC was contracted by Johnson Roberts Associates to conduct a limited Asbestos Containing Materials Identification Survey at the Elizabeth Carter Brooks School, New Bedford, MA in select areas scheduled for renovation.

The scope of work included the inspection of accessible ACM, collection of bulk samples from materials suspected to contain asbestos and determination of types of ACM found for remediation. Bulk samples analyses for asbestos were performed using the standard Polarized Light Microscopy (PLM) in accordance with Environmental Protection Agency (EPA) standard. Bulk samples were collected by a Massachusetts licensed asbestos inspector Mr. Leonard J. Busa (AI-030673) and analyzed by a Massachusetts licensed laboratory AmeriSci, Weymouth, MA.

Samples results are attached.

2.0 FINDINGS:

The regulations for asbestos inspection are based on representative sampling. It would be impractical and costly to sample all materials in all areas. Therefore, representative samples of each homogenous area were collected and analyzed or assumed. All suspect materials were grouped into homogenous areas. By definition a homogenous area is one in which the materials are evenly mixed and similar in appearance and texture throughout. A homogeneous area shall be determined to contain asbestos based on findings that the results of at least one sample collected from that area shows that asbestos is present in an amount greater than 1 percent.

The survey was limited and therefore, additional ACM may be found during any renovation or demolition activities.

Number of Samples Collected
Forty two (42) bulk samples were collected from the following materials suspected of containing asbestos:

Type and Location of Material

1. Interior sill for exterior window
2. Interior sill for exterior window
3. Glazing caulking for window in wood door at boy’s room
4. Glazing caulking for window in wood door at classroom 7
5. Glue daub for 1’ x 1’ acoustical tile at teacher’s room
6. Glue daub for 1’ x 1’ acoustical tile at hallway by classroom 4
7. 1’ x 1’ Acoustical tile at hallway by classroom 4
8. 1’ x 1’ Acoustical tile at hallway by boiler room
9. Glue daub for 1’ x 1’ acoustical tile at hallway by boiler room
10. Glue daub for 1’ x 1’ acoustical tile at hallway by nurse
11. Vertical caulking in CMU at hallway by boy’s room
12. Vertical caulking in CMU/column at boiler room
13. Grey 9” x 9” vinyl floor tile at S-1
14. Mastic for grey 9” x 9” vinyl floor tile at S-1
15. Grey 9” x 9” vinyl floor tile at hallway by boiler room
16. Mastic for grey 9” x 9” vinyl floor tile at hallway by boiler room
17. Mastic for grey 9” x 9” vinyl floor tile at storage room
18. Boiler insulation at boiler room
19. Boiler insulation at boiler room
20. Boiler insulation at boiler room
21. Duct insulation at boiler room
22. Duct insulation at boiler room
23. Duct insulation at boiler room
24. Pipe insulation at boiler room
25. Pipe insulation at boiler room
26. Pipe insulation at boiler room
27. Vertical caulking between column and CMU at boiler room
28. Exterior window framing caulking
29. Exterior window framing caulking
30. Exterior residue white caulking on brick
31. Exterior window glazing caulking
32. Exterior window glazing caulking
33. Interior glazing caulking for exterior window
34. Exterior door framing caulking
35. Exterior door framing caulking
36. Exterior caulking in slate sill
37. Exterior caulking in slate sill
38. Exterior horizontal caulking between brick and overhang
39. Exterior horizontal caulking between brick and overhang
40. Exterior exposed flashing
41. Exterior exposed flashing
42. Interior framing caulking for exterior window

Sample Results

<table>
<thead>
<tr>
<th>Type and Location of Material</th>
<th>Sample Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Interior sill for exterior window</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>2. Interior sill for exterior window</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>3. Glazing caulking for window in wood door at boy’s room</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>4. Glazing caulking for window in wood door at classroom 7</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>5. Glue daub for 1’ x 1’ acoustical tile at teacher’s room</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>6. Glue daub for 1’ x 1’ acoustical tile at hallway by classroom 4</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>7. 1’ x 1’ Acoustical tile at hallway by classroom 4</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>8. 1’ x 1’ Acoustical tile at hallway by boiler room</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>9. Glue daub for 1’ x 1’ acoustical tile at hallway by boiler room</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>10. Glue daub for 1’ x 1’ acoustical tile at hallway by nurse</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>11. Vertical caulking in CMU at hallway by boy’s room</td>
<td>5% Asbestos</td>
</tr>
<tr>
<td>12. Vertical caulking in CMU/column at boiler room</td>
<td>2% Asbestos</td>
</tr>
<tr>
<td>13. Grey 9” x 9” vinyl floor tile at S-1</td>
<td>5% Asbestos</td>
</tr>
<tr>
<td>14. Mastic for grey 9” x 9” vinyl floor tile at S-1</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>15. Grey 9” x 9” vinyl floor tile at hallway by boiler room</td>
<td>5% Asbestos</td>
</tr>
<tr>
<td>16. Mastic for grey 9” x 9” vinyl floor tile at hallway by boiler room</td>
<td>No Asbestos Detected</td>
</tr>
<tr>
<td>17. Mastic for grey 9” x 9” vinyl floor tile at storage room</td>
<td>No Asbestos Detected</td>
</tr>
</tbody>
</table>
18. Boiler insulation at boiler room 20% Asbestos
19. Boiler insulation at boiler room 23% Asbestos
20. Boiler insulation at boiler room 25% Asbestos
21. Duct insulation at boiler room 35% Asbestos
22. Duct insulation at boiler room 30% Asbestos
23. Duct insulation at boiler room 40% Asbestos
24. Pipe insulation at boiler room 25% Asbestos
25. Pipe insulation at boiler room 20% Asbestos
26. Pipe insulation at boiler room 5% Asbestos
27. Vertical caulking between column and CMU at boiler room 5% Asbestos
28. Exterior window framing caulking 4% Asbestos
29. Exterior window framing caulking 6% Asbestos
30. Exterior residue white caulking on brick 5% Asbestos
31. Exterior window glazing caulking <1% Asbestos
32. Exterior window glazing caulking No Asbestos Detected
33. Interior glazing caulking for exterior window No Asbestos Detected
34. Exterior door framing caulking 3% Asbestos
35. Exterior door framing caulking 4% Asbestos
36. Exterior caulking in slate sill 5% Asbestos
37. Exterior caulking in slate sill 3% Asbestos
38. Exterior horizontal caulking between brick and overhang 4% Asbestos
39. Exterior horizontal caulking between brick and overhang 5% Asbestos
40. Exterior exposed flashing 10% Asbestos
41. Exterior exposed flashing 15% Asbestos
42. Interior framing caulking for exterior window 5% Asbestos

**Observations and Conclusions:**
All ACM that might be disturbed must be removed by a Massachusetts licensed asbestos abatement contractor under the supervision of a Massachusetts licensed project monitor prior to any renovation or demolition activities.

1. Vertical caulking in CMU was found to contain asbestos.
2. Grey 9” x 9” vinyl floor tile was found to contain asbestos.
3. Boiler insulation was found to contain asbestos.
4. Duct insulation was found to contain asbestos.
5. Pipe insulation was found to contain asbestos.
6. Vertical caulking between column and CMU was found to contain asbestos.
7. Exterior window framing caulking was found to contain asbestos.
8. Exterior residue white caulking on brick was found to contain asbestos.
9. Exterior window glazing caulking was found to contain asbestos.
10. Exterior door framing caulking was found to contain asbestos.
11. Exterior caulking in slate sill was found to contain asbestos.
12. Exterior horizontal caulking between brick and overhang was found to contain asbestos.
13. Exterior exposed flashing was found to contain asbestos.
14. Interior framing caulking for exterior window was found to contain asbestos.
15. Insulation/rope inside boilers was assumed to contain asbestos.
16. Soft ceiling plaster was previously found to contain asbestos.
17. Transite ceiling in the crawl space was previously found to contain asbestos.
18. All remaining suspect materials were found not to contain asbestos. Hidden ACM may be found during renovation and demolition activities.
3.0 DESCRIPTION OF SURVEY METHODS AND LABORATORY ANALYSES:

Asbestos samples were collected using a method that prevents fiber release. Homogeneous sample areas were determined by criteria outlined in EPA document 560/5-85-030a. Bulk material samples were analyzed using PLM and dispersion staining techniques in accordance with EPA method 600/M4-82-020.

Inspected By:

Leonard J. Busa
Asbestos Inspector
(AI-030673)
4.0 LIMITATIONS AND CONDITIONS:

This report has been completed based on visual and physical observations made and information available at the time of the site visits, as well as an interview with the Owner’s representatives. This report is intended to be used as a summary of available information on existing conditions with conclusions based on a reasonable and knowledgeable review of evidence found in accordance with normally accepted industry standards, state and federal protocols, and within the scope and budget established by the client. Any additional data obtained by further review must be reviewed by UEC and the conclusions presented herein may be modified accordingly.

This report and attachments, prepared for the exclusive use of Owner for use in an environmental evaluation of the subject site, are an integral part of the inspections and opinions should not be formulated without reading the report in its entirety. No part of this report may be altered, used, copied or relied upon without prior written permission from UEC, except that this report may be conveyed in its entirety to parties associated with Owner for this subject study.
FACSIMILE TELECOPY TRANSMISSION

To: Ammar Dieb  
Universal Engineering Corporation  
Fax #: (508) 628-5488  
Email: adieb@uec-env.com

From: Ella Babayeva  
AmeriSci Job #: 217092617  
Subject: PLM 48 hour Results  
Client Project: Elizabeth Brooks Elementary; New Bedford, MA

Date: Saturday, September 16, 2017  
Time: 18:35:28

Number of Pages: [8]  
(including cover sheet)

CONFIDENTIALITY NOTICE: Unless otherwise indicated, the information contained in this communication is confidential information intended for use of the individual named above. If the reader of this communication is not the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is prohibited. If you have received this communication in error, please immediately notify the sender by telephone and return the original message to the above address via the US Postal Service at our expense. Samples are disposed of in 60 days or unless otherwise instructed by the protocol or special instructions in writing. Thank you.

Certified Analysis  Service 24 Hours A Day • 7 Days A Week  Competitive Prices
visit our web site - www.amerisci.com

Boston • Los Angeles • New York • Richmond
# PLM Bulk Asbestos Report

**Universal Engineering Corporation**  
Attn: Ammar Dieb  
12 Brewster Road  
Framingham, MA 01702

---

**AmeriSci Job #** 217092617  
**Date Received** 09/15/17  
**Date Examined** 09/16/17  
**P.O. #**  
**RE:** Elizabeth Brooks Elementary; New Bedford, MA  
**Page 1 of 8**

## Client No. / HGA

<table>
<thead>
<tr>
<th>Lab No.</th>
<th>Asbestos Present</th>
<th>Total % Asbestos</th>
<th>Location</th>
<th>Analyst Description</th>
<th>Asbestos Types:</th>
<th>Other Material:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 217092617-01</td>
<td>No</td>
<td>NAD</td>
<td>Hall By Cafe - Interior Window Sill For Exterior Window</td>
<td>Black, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Asbestos Types:</td>
<td>Other Material:</td>
</tr>
<tr>
<td>2 217092617-02</td>
<td>No</td>
<td>NAD</td>
<td>Teacher's Room - Int. Win. Sill For Ext. Win.</td>
<td>Grey, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Asbestos Types:</td>
<td>Other Material:</td>
</tr>
<tr>
<td>3 217092617-03</td>
<td>No</td>
<td>NAD</td>
<td>Boy's Rm By S-3 - Gl For Win In Wood Bathroom Door</td>
<td>Yellow, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Asbestos Types:</td>
<td>Other Material:</td>
</tr>
<tr>
<td>4 217092617-04</td>
<td>No</td>
<td>NAD</td>
<td>C'mn #7 - Gl For Win In Wood Bathroom Door</td>
<td>Yellow, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Asbestos Types:</td>
<td>Other Material:</td>
</tr>
<tr>
<td>5 217092617-05</td>
<td>No</td>
<td>NAD</td>
<td>Teacher's Room - Glue Daub For 1 X 1 Pressed Wood Ceiling Tile</td>
<td>Brown, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Asbestos Types:</td>
<td>Other Material:</td>
</tr>
</tbody>
</table>

See Reporting notes on last page
<table>
<thead>
<tr>
<th>Client No. / HGA</th>
<th>Lab No.</th>
<th>Asbestos Present</th>
<th>Total % Asbestos</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>217092617-06</td>
<td>No</td>
<td>NAD</td>
</tr>
<tr>
<td></td>
<td>Location: Hall By Cm #4 - Glue Daub For 1 X 1 Pressed Wood Ceiling Tile</td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td><strong>Analyst Description:</strong> Brown, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Asbestos Types:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>217092617-07</td>
<td>No</td>
<td>NAD</td>
</tr>
<tr>
<td></td>
<td>Location: Hall By Cm #4 - 1 X 1 Pressed Wood Ceiling Tile #6</td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td><strong>Analyst Description:</strong> Light Brown, Homogeneous, Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Asbestos Types:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>217092617-08</td>
<td>No</td>
<td>NAD</td>
</tr>
<tr>
<td></td>
<td>Location: Hall By Boiler Rm - 1 X 1 Pressed Wood Ceiling Tile</td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td><strong>Analyst Description:</strong> Light Brown, Homogeneous, Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Asbestos Types:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>217092617-09</td>
<td>No</td>
<td>NAD</td>
</tr>
<tr>
<td></td>
<td>Location: Hall By Boiler Rm - Glue Daub For Pressed Wood Ceiling Tile</td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td><strong>Analyst Description:</strong> Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Asbestos Types:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>217092617-10</td>
<td>No</td>
<td>NAD</td>
</tr>
<tr>
<td></td>
<td>Location: Hall By Nurse - Glue Daub For Pressed Wood Ceiling Tile</td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td><strong>Analyst Description:</strong> Brown, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Asbestos Types:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>217092617-11</td>
<td>Yes</td>
<td>5 %</td>
</tr>
<tr>
<td></td>
<td>Location: Hall By Boy's Rm By S-3 - Vertical Caulk In CMU</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Analyst Description:</strong> Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Asbestos Types:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Other Material:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See Reporting notes on last page
## PLM Bulk Asbestos Report
### Elizabeth Brooks Elementary; New Bedford, MA

<table>
<thead>
<tr>
<th>Client No. / HGA</th>
<th>Lab No.</th>
<th>Asbestos Present</th>
<th>Total % Asbestos</th>
<th>Analyst Description</th>
<th>Other Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>217092617-12</td>
<td>Yes</td>
<td>2 %</td>
<td>Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Chrysotile 2.0 %, Anthophyllite &lt;1 %, Non-fibrous 98 %</td>
</tr>
<tr>
<td></td>
<td>Location: Boiler Rm - Vertical Caulk In CMU/Column</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>217092617-13</td>
<td>Yes</td>
<td>5 %</td>
<td>Grey, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Chrysotile 5.0 %, Non-fibrous 95 %</td>
</tr>
<tr>
<td></td>
<td>Location: S-1 - 9&quot; Grey VT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>217092617-14</td>
<td>No</td>
<td>NAD</td>
<td>Black, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Non-fibrous 100 %</td>
</tr>
<tr>
<td></td>
<td>Location: S-1 - Mastic For 9&quot; Grey VT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>217092617-15</td>
<td>Yes</td>
<td>6 %</td>
<td>Grey, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Chrysotile 6.0 %, Non-fibrous 94 %</td>
</tr>
<tr>
<td></td>
<td>Location: Hall By Boiler Rm - 9&quot; Grey VT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>217092617-16</td>
<td>No</td>
<td>NAD</td>
<td>Black, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Non-fibrous 100 %</td>
</tr>
<tr>
<td></td>
<td>Location: Hall By Boiler Rm - Mastic For 9&quot; Grey VT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>217092617-17</td>
<td>No</td>
<td>NAD</td>
<td>Black, Homogeneous, Non-Fibrous, Bulk Material</td>
<td>Non-fibrous 100 %</td>
</tr>
<tr>
<td></td>
<td>Location: Storage By Teacher's Rm - Mastic For 9&quot; VT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See Reporting notes on last page
<table>
<thead>
<tr>
<th>Client No. / HGA</th>
<th>Lab No.</th>
<th>Asbestos Present</th>
<th>Total % Asbestos</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>217092617-18</td>
<td>Yes</td>
<td>20 %</td>
</tr>
<tr>
<td></td>
<td>Location: Boiler #1 Boiler Room - Boiler Insulation</td>
<td>by CVES</td>
<td>on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: White, Homogeneous, Fibrous, Bulk Material</td>
<td>by Ella Babayeva</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 15.0 %, Amosite 5.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 80 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>217092617-19</td>
<td>Yes</td>
<td>23 %</td>
</tr>
<tr>
<td></td>
<td>Location: Boiler #1 Boiler Room - Boiler Insulation</td>
<td>by CVES</td>
<td>on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: White, Homogeneous, Fibrous, Bulk Material</td>
<td>by Ella Babayeva</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 18.0 %, Amosite 5.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 77 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>217092617-20</td>
<td>Yes</td>
<td>25 %</td>
</tr>
<tr>
<td></td>
<td>Location: Boiler #2 Boiler Room - Boiler Insulation</td>
<td>by CVES</td>
<td>on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: White, Homogeneous, Fibrous, Bulk Material</td>
<td>by Ella Babayeva</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 20.0 %, Amosite 5.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 75 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>217092617-21</td>
<td>Yes</td>
<td>35 %</td>
</tr>
<tr>
<td></td>
<td>Location: Rear #2 Boiler Room - Duct Insulation</td>
<td>by CVES</td>
<td>on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: OffWhite, Homogeneous, Fibrous, Bulk Material</td>
<td>by Ella Babayeva</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 35.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 65 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>217092617-22</td>
<td>Yes</td>
<td>30 %</td>
</tr>
<tr>
<td></td>
<td>Location: Rear #2 Boiler Room - Duct Insulation</td>
<td>by CVES</td>
<td>on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: OffWhite, Homogeneous, Fibrous, Bulk Material</td>
<td>by Ella Babayeva</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 30.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 70 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>217092617-23</td>
<td>Yes</td>
<td>40 %</td>
</tr>
<tr>
<td></td>
<td>Location: Rear #2 Boiler Room - Duct Insulation</td>
<td>by CVES</td>
<td>on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: OffWhite, Homogeneous, Fibrous, Bulk Material</td>
<td>by Ella Babayeva</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 40.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 60 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See Reporting notes on last page
<table>
<thead>
<tr>
<th>Client No. / HGA</th>
<th>Lab No.</th>
<th>Asbestos Present</th>
<th>Total % Asbestos</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>217092617-24</td>
<td>Yes</td>
<td>25 %</td>
</tr>
<tr>
<td></td>
<td>Location: Htg. Boiler Room - Pipe Insulation</td>
<td>by CVEs</td>
<td>by Ella Babayeva on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: Grey, Homogeneous, Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Amosite 25.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 75 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>217092617-25</td>
<td>Yes</td>
<td>20 %</td>
</tr>
<tr>
<td></td>
<td>Location: Htg. Boiler Room - Pipe Insulation</td>
<td>by CVEs</td>
<td>by Ella Babayeva on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: Grey, Homogeneous, Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Amosite 20.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 80 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>217092617-26</td>
<td>Yes</td>
<td>5 %</td>
</tr>
<tr>
<td></td>
<td>Location: Domestic Boiler Room - Pipe Insulation</td>
<td>by CVEs</td>
<td>by Ella Babayeva on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: OffWhite/Grey, Heterogeneous, Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 5.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Cellulose 90 %, Non-fibrous 5 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>217092617-27</td>
<td>Yes</td>
<td>5 %</td>
</tr>
<tr>
<td></td>
<td>Location: Boiler Room - Vert. Caulk Between Column &amp; CMU</td>
<td>by CVEs</td>
<td>by Ella Babayeva on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 5.0 %, Anthophyllite &lt;1. %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 95 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>217092617-28</td>
<td>Yes</td>
<td>4 %</td>
</tr>
<tr>
<td></td>
<td>Location: Rear Wing Exterior - Win. Fr.</td>
<td>by CVEs</td>
<td>by Ella Babayeva on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 4.0 %, Anthophyllite &lt;1. %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 96 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>217092617-29</td>
<td>Yes</td>
<td>6 %</td>
</tr>
<tr>
<td></td>
<td>Location: Kitchen - Win. Fr.</td>
<td>by CVEs</td>
<td>by Ella Babayeva on 09/16/17</td>
</tr>
<tr>
<td></td>
<td>Analyst Description: Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asbestos Types: Chrysotile 6.0 %, Anthophyllite &lt;1. %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Material: Non-fibrous 94 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See Reporting notes on last page
# PLM Bulk Asbestos Report

**Elizabeth Brooks Elementary; New Bedford, MA**

<table>
<thead>
<tr>
<th>Client No. / HGA</th>
<th>Lab No.</th>
<th>Asbestos Present</th>
<th>Total % Asbestos</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>217092617-30</td>
<td>Yes</td>
<td>5 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>by Ella Babayeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>on 09/16/17</td>
</tr>
<tr>
<td><strong>Analyst Description:</strong> White, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Asbestos Types:</strong> Chrysotile 5.0 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Material:</strong> Non-fibrous 95 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>217092617-31</td>
<td>Yes</td>
<td>Trace (&lt;1 %)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>by Ella Babayeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>on 09/16/17</td>
</tr>
<tr>
<td><strong>Analyst Description:</strong> White, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Asbestos Types:</strong> Chrysotile &lt;1. %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Material:</strong> Non-fibrous 100 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>217092617-32</td>
<td>No</td>
<td>NAD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>by Ella Babayeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>on 09/16/17</td>
</tr>
<tr>
<td><strong>Analyst Description:</strong> White, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Asbestos Types:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Material:</strong> Non-fibrous 100 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>217092617-33</td>
<td>No</td>
<td>NAD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>by Ella Babayeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>on 09/16/17</td>
</tr>
<tr>
<td><strong>Analyst Description:</strong> White, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Asbestos Types:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Material:</strong> Non-fibrous 100 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>217092617-34</td>
<td>Yes</td>
<td>3 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>by Ella Babayeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>on 09/16/17</td>
</tr>
<tr>
<td><strong>Analyst Description:</strong> Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Asbestos Types:</strong> Chrysotile 3.0 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Material:</strong> Non-fibrous 97 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>217092617-35</td>
<td>Yes</td>
<td>4 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>by Ella Babayeva</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>on 09/16/17</td>
</tr>
<tr>
<td><strong>Analyst Description:</strong> Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Asbestos Types:</strong> Chrysotile 4.0 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Material:</strong> Non-fibrous 96 %</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See Reporting notes on last page
## PLM Bulk Asbestos Report

### Elizabeth Brooks Elementary; New Bedford, MA

<table>
<thead>
<tr>
<th>Client No. / HGA</th>
<th>Lab No.</th>
<th>Asbestos Present</th>
<th>Total % Asbestos</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>217092617-36</td>
<td>Yes</td>
<td>5 %</td>
</tr>
<tr>
<td>Location:</td>
<td>Random - Caulk In Slate Sill</td>
<td></td>
<td>(by CVES)</td>
</tr>
<tr>
<td>Analyst Description:</td>
<td>Tan, Homogeneous, Non-Fibrous, Bulk Material</td>
<td></td>
<td>by Ella Babayeva</td>
</tr>
<tr>
<td>Asbestos Types:</td>
<td>Chrysotile 5.0 %</td>
<td></td>
<td>on 09/16/17</td>
</tr>
<tr>
<td>Other Material:</td>
<td>Non-fibrous 95 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 37               | 217092617-37    | Yes              | 3 %              |
| Location:        | Random - Caulk In Slate Sill |                 | (by CVES)        |
| Analyst Description: | Tan, Homogeneous, Non-Fibrous, Bulk Material |                 | by Ella Babayeva |
| Asbestos Types:  | Chrysotile 3.0 % |                 | on 09/16/17      |
| Other Material:  | Non-fibrous 97 % |                 |                  |

| 38               | 217092617-38    | Yes              | 4 %              |
| Location:        | Front - Horizontal Caulk Between Brick & Overhang |                 | (by CVES)        |
| Analyst Description: | Tan, Homogeneous, Non-Fibrous, Bulk Material |                 | by Ella Babayeva |
| Asbestos Types:  | Chrysotile 4.0 % |                 | on 09/16/17      |
| Other Material:  | Non-fibrous 96 % |                 |                  |

| 39               | 217092617-39    | Yes              | 5 %              |
| Location:        | Kindergarten - Horizontal Caulk Between Brick & Overhang |                 | (by CVES)        |
| Analyst Description: | Tan, Homogeneous, Non-Fibrous, Bulk Material |                 | by Ella Babayeva |
| Asbestos Types:  | Chrysotile 5.0 % |                 | on 09/16/17      |
| Other Material:  | Non-fibrous 95 % |                 |                  |

| 40               | 217092617-40    | Yes              | 10 %             |
| Location:        | Rear Wing - Exposed Flashing @ Missing Slate Sill |                 | (by CVES)        |
| Analyst Description: | Black, Homogeneous, Non-Fibrous, Bulk Material |                 | by Ella Babayeva |
| Asbestos Types:  | Chrysotile 10.0 % |                 | on 09/16/17      |
| Other Material:  | Cellulose 5 %, Non-fibrous 85 % |                |                  |

| 41               | 217092617-41    | Yes              | 15 %             |
| Location:        | Rear Wing, Exterior - Exposed Flashing At Missing Slate Window Sill |         | (by CVES)        |
| Analyst Description: | Black, Homogeneous, Fibrous, Bulk Material |                 | by Ella Babayeva |
| Asbestos Types:  | Chrysotile 15.0 % |                 | on 09/16/17      |
| Other Material:  | Cellulose 5 %, Non-fibrous 80 % |                |                  |

See Reporting notes on last page
# PLM Bulk Asbestos Report

**Elizabeth Brooks Elementary; New Bedford, MA**

<table>
<thead>
<tr>
<th>Client No. / HGA</th>
<th>Lab No.</th>
<th>Asbestos Present</th>
<th>Total % Asbestos</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>217092617-42</td>
<td>Yes</td>
<td>5 %</td>
</tr>
</tbody>
</table>

**Location:** Storage By Teacher's Room, Exterior - Interior Window Frame Caulk For Exterior Window

**Analyst Description:** Tan, Homogeneous, Non-Fibrous, Bulk Material

**Asbestos Types:** Chrysotile 5.0 %

**Other Material:** Non-fibrous 95 %

---

**Reporting Notes:**

* NAD/NSD = no asbestos detected; NA = not analyzed; NA/PS = not analyzed/positive stop, (SOF-V) = Sprayed On Fireproofing containing Vermiculite; (SM-V) = Surfacing Material containing Vermiculite; PLM Bulk Asbestos Analysis by EPA 600/M4-82-020 per 40 CFR 763 (NVLAP 200546-0), ELAP PLM Method 198.1 for NY friable samples, which includes the identification and quantitation of vermiculite or 198.6 for NOB samples or EPA 400 pt ct by EPA 600/M4-82-020 (NY ELAP Lab 11480); Note: PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. NAD or Trace results by PLM are inconclusive, TEM is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos-containing in NY State (also see EPA Advisory for floor tile, FR 59,146,38970,8/1/94) National Institute of Standards and Technology Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the lab. This PLM report relates ONLY to the items tested. AIHA-LAP, LLC Lab ID 102843, RI Cert AAL-094, CT Cert PH-0186, Mass Cert AA000054.

Reviewed By: ___________________________ END OF REPORT
**CHAIN OF CUSTODY**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Result</th>
<th>Description of Material</th>
<th>Sample Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Interior window sill for exterior window</td>
<td>Hall by Park</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Exterior window sill for exterior</td>
<td>Teachers Room</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Glue for wood, Bathroom door</td>
<td>Ferguson by 3-3</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Glue for wood, Bathroom door</td>
<td>Ground floor</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Glue, double for 1x1 PWAT</td>
<td>Teachers room</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Glue, double for 1x1 PWAT</td>
<td>Hall by Ferguson</td>
</tr>
<tr>
<td>7</td>
<td>1x1 PWAT</td>
<td>1x1 PWAT</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1x1 PWAT</td>
<td>Hall by Ferguson</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Glue, double for PWAT</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Glue, double for PWAT</td>
<td>Hall by Nose</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Metal casement window</td>
<td>Hall by Ferguson by 5-3</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Metal casement window, column</td>
<td>Boiler Room</td>
</tr>
<tr>
<td>13</td>
<td>9&quot; gge. vt</td>
<td>9&quot; gge. vt</td>
<td>5-1</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Mastic #13</td>
<td>5-1</td>
</tr>
<tr>
<td>15</td>
<td>9&quot; gge. vt</td>
<td>9&quot; gge. vt</td>
<td>Hall by Ferguson</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>Mastic #15</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>Mastic for 9&quot; vt</td>
<td>Storage by Teacher's room</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>Boiler insulation</td>
<td>Boiler #1, Boiler Room</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>(B)</td>
<td>Boiler #1</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>(B)</td>
<td>Boiler #2</td>
</tr>
</tbody>
</table>

Reported By: [Signature] Date: 9/14/17 Due Date: 9/28/17

Received By: [Signature] Date: 9/15/17
# CHAIN OF CUSTODY

**Universal Environmental Consultants**
12 Brewster Road
Framingham, MA 01702
Tel: (508) 628-5486 - Fax: (508) 628-5488
adleb@uec-env.com

**Town/City:** New Bedford, MA  
**Building Name:** Elizabeth Burns Elementary

<table>
<thead>
<tr>
<th>Sample</th>
<th>Result</th>
<th>Description of Material</th>
<th>Sample</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>(PL)</td>
<td>Duct insulation</td>
<td>rear #2</td>
<td>Building</td>
</tr>
<tr>
<td>22</td>
<td>(PL)</td>
<td></td>
<td>rear #2</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>(PL)</td>
<td></td>
<td>rear #2</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>(PL)</td>
<td>Pipe insulation</td>
<td>hq</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>(PL)</td>
<td></td>
<td>hq</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>(PL)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>(PL)</td>
<td>Vanderbilt between columns</td>
<td>conv</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td>Rain fr.</td>
<td>rear wing</td>
<td>EXTERIOR</td>
</tr>
<tr>
<td>29</td>
<td></td>
<td>Rain fr.</td>
<td>Kitchen</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>Residue white caulk on brick (origin?)</td>
<td>courtyard</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td></td>
<td>Thick window glaze</td>
<td>random</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
<td>Thick window fr.</td>
<td>random</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td>Interior window gl. for exterior win.</td>
<td>hall along core</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Door fr caulk</td>
<td>Door #11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Door fr</td>
<td>Door #14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td></td>
<td>Caulk in slate sill</td>
<td>random</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td></td>
<td>Caulk in slate sill</td>
<td>random</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td></td>
<td>Horizontal caulk between brick &amp; auxiliary</td>
<td>Kindergarten</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>Exposed flashing &amp; missing slate sill</td>
<td>receiving</td>
<td></td>
</tr>
</tbody>
</table>

**Reported By:** [Signature]
**Date:** 9-4-12  
**Due Date:** 8-1-13

**Received By:** [Signature]
**Date:** 9-15-17 11:28
## CHAIN OF CUSTODY

**Universal Environmental Consultants**
12 Brewster Road
Framingham, MA 01702
Tel: (508) 628-5486 - Fax: (508) 628-5488
adieb@uec-env.com

### Sample Information

<table>
<thead>
<tr>
<th>Sample</th>
<th>Result</th>
<th>Description of Material</th>
<th>Sample Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td></td>
<td>Exposed flashing &amp; missing shims window sill, corner - exterior</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td></td>
<td>Interior window frame crack for exterior window, exterior</td>
<td></td>
</tr>
</tbody>
</table>

Town/City: **ACTON, MA**
Building Name: **Elizabeth Brooks Elementary**

---

**Reported By:** [Signature]
Date: **9-14-17**

**Date:** **9-15-17**

**Received By:** [Signature]
Date: **9-15-17**

**Due Date:** **48 hr**
SECTION 024119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300 ALTERNATES, for alternates which may affect the work of this SECTION.

C. The Drawings indicate the general extent, only, of the demolition, removals, and alteration work to be performed. Prior to commencing any demolition and removals work, carefully examine all conditions as they exist at the project, and verify with the Architect the actual extent of the demolition and removals work. Be fully responsible for removing all existing materials which would otherwise interfere with the proper installation or function of the new work, whether or not such existing materials or conditions have been indicated, such work being performed without additional cost to the Contract; and perform the required demolition, removals, and alteration work, except where specifically noted to the contrary in the various trade SECTIONS of the Specifications, in which cases the specific trades shall perform such designated segments of the demolition and removals work.

1.02 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building.

B. Related Sections:
   1. Section 013543 – Environmental Procedures
   2. Section 022820 – Asbestos Remediation
   3. Section 026000 – Excavation and Removal of Underground Oil Tank
   4. Section 075113 – Built-Up Asphalt Roofing

1.03 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. Remove and Protect for Installation by Others: Detach items from existing construction and protect on-site for installation by others.
C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 RELATED WORK

A. Disconnecting, capping, and otherwise making inactive, all existing mechanical and electrical services in the various areas where demolition and removal work is required; and removing, relocation, and re-installing existing mechanical and electrical items to the extent specifically noted in the designated Sections within Divisions 22, Plumbing, 23, HVAC, and Division 26, Electrical.

B. Drilling, coring, and cutting of holes (where largest dimension thereof does not exceed 12 inches), for piping and conduits: Sections within Divisions 22, Plumbing, 23, HVAC, 26, and Division Electrical, 27.

C. Patching of holes cut in existing materials and surfaces under the work of this Contract: By trades responsible for furnishing and installing similar new materials.

1.05 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.06 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and noise control. Indicate proposed locations and construction of barriers and temporary egress paths.

B. Schedule of Selective Demolition Activities that includes but is not limited to the following:
   1. Detailed sequence of selective demolition and removal work, with start and end dates for each activity. Include roofing work, and any other exterior envelope penetrations.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Work in the street, the public ways, and/or work outside the limit of work line shown on the plans.

C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.
1.07 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.08 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.09 FIELD 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.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is expected that some hazardous materials will be encountered in the Work.
   1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

E. Storage or sale of removed items or materials on-site is not 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.

1.10 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. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.
PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

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/ASSE A10.6 and NFPA 241.


PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

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. Perform a review of 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 building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
3.02  UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove electrical, plumbing, and HVAC systems, equipment, and components indicated to be removed.
   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
   f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

3.03  PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.04  PROTECTION

A. 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. Comply with requirements for access and protection specified in Section 015000 "Construction Facilities and Temporary Controls."

B. 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. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
3. Cover and protect furniture, furnishings, and equipment that have not been removed.
4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in DIVISION 1 General Requirements.

C. Protection Schedule: Protect the following items in place, remove temporary protections when work is complete, then clean and repair any damage that may have occurred to return items to their pre-construction condition. Additional work may be required elsewhere in the Documents for these noted items.

1. All items noted in the Documents to remain.

3.05 SELECTIVE DEMOLITION, GENERAL

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.
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 decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner or reinstallation.
4. Protect items from damage during transport and storage.
C. Removed and Reinstalled Items:

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.

3.06 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.08 CLEANING

A. 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.
ELIZABETH BROOKS ELEMENTARY:
WINDOW/EXTERIOR DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts
SECTION 02 60 00
EXCAVATION AND REMOVAL OF UNDERGROUND OIL TANK

PART I - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

C. The Drawings indicate the general extent, only, of the demolition, removals, and alteration work to be performed. Prior to commencing any demolition and removals work, carefully examine all conditions as they exist at the project and verify with the Architect the actual extent of the demolition and removals work. Be fully responsible for removing all existing materials which would otherwise interfere with the proper installation or function of the new work, whether or not such existing materials or conditions have been indicated, such work being performed without additional cost to the Contract; and perform the required demolition, removals, and alteration work, except where specifically noted to the contrary in the various trade SECTIONS of the Specifications, in which cases the specific trades shall perform such designated segments of the demolition and removals work.

1.02 RELATED WORK UNDER OTHER SECTIONS
A. Asbestos Remediation
B. Environmental Procedures

1.03 DESCRIPTION
A. Provide all labor, equipment and materials necessary to demolish, uncover, excavate, clean, remove, disconnect and dispose of the existing one underground fuel storage tank (UST) and any associated piping.

B. Remove and dispose of all sludge and solid waste in the tank. All remaining oil in the tank shall be loaded by the Contractor and transferred to other properties within the City.

C. Excavate, stockpile, load, transport and dispose of contaminated soil (if any). Contaminated soil shall be determined by testing. It is the Contractor’s responsibility to perform cleaning up of the area after removal of stock piled soil from the site. The Contractor MUST include in his/her bid the removal and disposal of 500 cubic yard of contaminated soil. Addition will be based on $145.00 per cubic yard and deduction will be based on $120.00 per cubic yard.

D. Protect existing utilities from damage.

E. Arrange and pay for all licenses, permits, inspections and tests as required.
ELIZABETH BROOKS ELEMENTARY:
WINDOW/EXTERIOR DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

1.04 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

B. Measurements, and dimensions, under which the work is to be performed are believed to be correct to the best of the Owner's and Designer's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found herein.

1.05 SUBSURFACE SOIL DATA AND SITE CONDITIONS

A. Soil Data

1. It is the obligation of the Contractor to examine the site, to verify all dimensions in the field, to review any pertinent data available, and to employ all other means at his disposal to familiarize himself completely with conditions existing at the site. At his own expense, the Contractor may take whatever borings or explorations he deems necessary.

2. It is the Contractor's sole responsibility to make interpretations and draw conclusions with respect to the character of the materials to be encountered and their impact upon his work based on his knowledge of the area and of construction techniques. Neither the Owner nor the Designer assumes any responsibility.

B. Utilities - The Contractor shall visit the premises to familiarize himself thoroughly with all details of the work and of working conditions, to verify all dimensions in the field, and to advise the Engineer of any discrepancy before performing any work. The Contractor shall consult official records of existing utilities, both surface and subsurface, and their connections, and shall fully inform himself of all existing conditions and limitations as they apply to his work and of the extent and character of the work required under this section and its relation to all other construction work.

C. Utilities Left-In-Place - Existing utilities found on the project site, which are to remain shall not be disturbed or damaged. Provisions for protection of same shall be made in accordance with the requirements of authorities having jurisdiction over same.

1.06 PERMITS, CODES, AND SAFETY REGULATIONS

A. All work shall conform to the Specifications and comply with applicable codes and regulations.

B. Comply with rules, regulations, laws, and ordinances of all authorities having jurisdiction, including but not limited to, Massachusetts Department of Environmental Protection (DEP), and the State of Massachusetts. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be without additional cost to the Owner.

C. Comply with the provisions of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration, United States Department of Labor.
D. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein.

E. The Contractor shall not close or obstruct any street, sidewalk, or passageway. The Contractor shall so conduct his operations as to interfere as little as possible with the use ordinarily made of all roads, driveways, sidewalks, or other facilities near enough the work to be affected thereby. Parking areas shall be limited to those areas so designated by the Owner.

1.07 REFERENCES

A. OSHA Construction and Earthwork Standards.
B. Massachusetts 310 CMR 9.00 - Tank and Containers
C. Massachusetts 527 CMR 30.00 - Hazardous Waste Regulations
D. Massachusetts 310 CMR 40.00 - Massachusetts Contingency Plan

1.08 SUBMITTALS

A. Prior to the start of work, the Contractor shall submit a written work plan, to the Owner or his representative, describing the proposed work schedule/sequence for removal of the tank, including, but not necessarily limited to, descriptions of steps to be taken for protection of existing utilities, anticipated schedule, the location of the stockpile for any contaminated soils that may be excavated, the end disposal site for any residual oils and/or sludge removed from the tank and the anticipated disposal site for contaminated soils that are encountered.

A. Prior to the start of work, the Contractor shall provide proof that tank removal permits have been obtained from the local fire department.

C. It is the Contractor’s responsibility to obtain the services of a Licensed Site Professional (LSP) to oversee the removal process and to collect soil samples for analysis (48-hours results) by the contractor at no additional cost to the owner. The Contractor shall submit all results to the engineer within 24-hours.

D. Within 24 hours of any off-site disposal of tank, sludge, oil or soil, the Contractor shall provide the Owner with copies of all associated manifests, Bills of Lading and tank disposal permits. It is the Contractor’s responsibility to obtain the services of a LSP to sign the Bills of Lading (BOL).

1.09 HEALTH AND SAFETY PLAN

A. Contractor shall maintain a health and safety plan (HASP) in compliance with OSHA standards defined in 29 CFR 1910.120.

B. Contractor’s employees or subcontractor’s employees will be cleaning the UST and AST and or handling petroleum or VOC impacted soil or groundwater shall be required to have OSHA 40-hour health and safety training as required.
1.10 HAZARDOUS WASTE LICENSES

A. Contractor or subcontractor, whichever shall be transporting the waste material from the tank cleaning, shall have a currently valid hazardous waste transporter license for the Commonwealth of Massachusetts and any other state for which the transporter shall pass on its way to a licensed receiving facility. The contractor shall provide copies of the licenses to the Engineer prior to commencement of the work.

B. Contractor shall provide the Engineer with the name and address of all licensed receiving facilities to be used for this project, one week prior to the commencement of on-site activities or sooner.

PART 2 - PRODUCTS

2.01 EXISTING CONDITIONS

A. Existing fuel oil storage system consists of one 10,000-gallon underground steel fuel oil storage tank and associated piping.

B. Protection of Existing Facilities;

1. The Contractor's attention is directed towards the possible existing of sewer and electrical conduit.
2. Prior to any excavations, the Contractor shall carefully uncover the existing utilities for inspection by the Owner or his representative. Hand excavation shall be used to the degree necessary to protect the utilities from damage.
3. The Contractor shall take all necessary precautions to protect existing utilities during completion of the work. Any damage caused to the utilities shall be the responsibility of the Contractor and shall be repaired at the Contractor's expense.
4. The Contractor shall take all necessary precautions to protect existing structures from damage during execution of the work. Any damage caused to structures shall be the responsibility of the Contractor and shall be repaired at the Contractor's expense.

2.02 PERMITS AND NOTIFICATIONS

A. The Contractor shall obtain all permits and perform all notifications required to complete the work.

B. The Contractor shall obtain a "Dig safe Number".

C. Removal of the tank shall comply with all aspects of 527 CMR 9.00 and the local fire department requirements as summarized below:

1. Forty-eight (48) hours prior to the proposed removal of all tank, written notice shall be sent to the Local Fire Department. The notice shall include the following information:
   a. The address of the site from which the tank is to be removed and the name and address of the owner of the property;
   b. The name and address of the company, which will remove the tank;
   c. The name and address of the company, which will perform the site survey at the time the tank is removed.
   d. The name and address of the facility, which will receive the tank.
2. Within seventy-two (72) hours of the tank removal off-site, the facility receiving the tank shall notify the local Fire Department of its receipt in accordance with 527 CMR 9.10, 9.14, and 9.15.

3. Following the completion of removal of the tank, a report from the company making a survey of the site shall be sent to the local Fire Department. Such report shall state the condition of the tank at the time of its removal and the condition of the soil from which the tank has been removed.

D. If any odor or visual evidence of a leak or underground petroleum is encountered in the tank hole, all reporting or other actions required by federal, state or local regulations should be identified to the Owner or his representative.

PART 3 - EXECUTION

3.01 REMOVAL OF THE TANK

A. Prior to initiating excavations, the Contractor shall thoroughly inspect the fuel system to determine that all products have been drained from pipes and removed from the tank, to the maximum degree possible.

B. Prior to removal of the tank, all pipe lines connected to the tank shall be fully exposed, purged free of product and disconnected at both ends. All pipes penetrating the building shall be cut and temporarily plugged at the inside edge of the building wall. All existing pipes that are cast into or under concrete or cannot be readily removed shall be plugged at both ends with concrete. All other pipes shall be fully removed. All pipes left in place shall be approved by the Owner or his representative prior to plugging.

C. All vent lines attached to the side of buildings shall be carefully removed so as to minimize damage to the walls.

D. Before uncovering, removing or disconnecting the tank the contents shall be pumped out as completely as possible by using a suction hose extended to the tank bottom. All product and sludge shall be removed from the tank prior to removal of the tank from the ground. The Contractor shall be responsible for the disposal of all product and sludge removed from the tank.

E. Following cleaning and before any cutting, the tank shall be purged free of vapors by adding crushed solid carbon dioxide (dry ice) in the amount of at least 15 pounds per 1000 gallons of tank capacity, evenly distributed over the tank bottom.

F. Existing tank shall be excavated sufficiently to allow removal of the tank with removal of a minimum amount of soil.

G. All removed pipes and tank shall be purged, cleaned and rendered gas free for safe, off-site disposal at an approved disposal site.

H. No fire or open flame shall be allowed in the removal area, during the entire tank removal procedure.
I. No person shall enter the tank without first testing the tank for an explosive atmosphere or without the use of self-contained breathing equipment. All other appropriate closed vessel entry procedures shall be followed at all times.

J. The outside of all removed tank and pipes shall be cleaned of soil and any product, prior to removal from the site.

K. All residual product, sludge and cleaning water shall be containerized for off-site disposal within 24 hours of completion of the tank removal process.

L. Any product released during removal of the tank shall be contained and absorbed using pads, booms and speedy dry, as needed. All costs associated with cleaning up a release, which occurred during the removal of the tank, shall be the responsibility of the Contractor.

M. Following removal of the tank and all necessary excavations, the Contractor shall completely police the area and collect and remove from the site all debris generated by execution of the work. Oily debris shall not be placed in the Owner's trash disposal containers.

3.02 EXCAVATION OF SOIL

A. All excavated soils shall be separated into stockpiles of contaminated soils (if any) and uncontaminated soils.

B. All excavated contaminated soils shall be stockpiled on sheet polyethylene as directed by the Owner or his representative.

C. A six (6) inch sand berm should be constructed around any stockpiles of contaminated soils using clean sandy backfill to contain any runoff during storage.

D. The containment dike shall be constructed prior to placement of the polyethylene and polyethylene shall be placed over the top of the dike, extending to the outside edge of the dike.

E. The stockpile of contaminated soils shall be completely covered with sheet polyethylene, which shall then be secured in place so as to eliminate movement.

F. Following excavation of all contaminated soils, the Contractor shall obtain representative soils samples from the stockpile of contaminated soils. Samples obtained shall then be analyzed for determination and approval of final disposal. Analysis methods and frequency of analysis shall be performed as follows:
   1. Contaminated soil stockpile;
      a. Total Petroleum Hydrocarbons (TPH) - 1 representative analysis from the stockpile and an additional 1 per each additional 100 cubic yards.
      b. Flash point - 1 representative analysis.
      c. Polychlorinated Biphenols - 1 representative analysis.
      d. E.P. Toxic Metals - 1 representative analysis.
      e. Reactivity Sulfide - 1 representative analysis.
      f. Reactivity Cyanide - 1 representative analysis.
      g. Water Reactivity - 1 representative analysis.
      h. PH - 1 representative analysis.
i. Total Lead and Barium - 1 representative analysis.

j. Volatile Organic Compounds - 1 representative analysis and an additional 1 per each additional 100 cubic yards.

2. Appropriate Chain-of-Custody forms shall be provided for all samples and resultant analyses.

3. Testing results shall be returned to the Owner or his representative within fourteen (14) calendar days of the stockpile sampling.

4. Soil shall be removed off-site to an approved facility, under proper BOL, within 30 days of stock piling.

END OF SECTION
ELIZABETH BROOKS ELEMENTARY:
WINDOW/EXTERIOR DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON-TEXT PAGE
SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300 ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. Labor, materials, equipment, services and transportation required to complete cast-in-place concrete work shown on Drawings, as specified herein, or both, including but not limited to items noted below.

1. Furnishing and installation of concrete housekeeping pads and foundations for mechanical, plumbing, and electrical equipment.
2. Furnishing and installation of new exterior doorway landings.
3. Installation of items furnished by other sections (such as anchors, sleeves, bolts and plates), and required to be cast into concrete.
4. Patching of concrete floors or walls where concrete is removed by demolition for new work, new equipment or utilities.
5. Repairs of exposed to view portions of the cast-in-place concrete structure, including walls, columns, beams, flat plate roof slabs, and exterior overhangs, where rebar has expanded and spalled the concrete surface.
6. Unless specifically excluded, furnishing and installation of any other items of cast-in-place concrete work indicated on drawings, specified, or obviously needed to make work of this Section complete.

1.03 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 055000, Miscellaneous Metals
2. Section 061100, Rough Carpentry
3. Section 230000, HVAC
4. Section 310000, Earthwork

1.04 SUBMITTALS

A. Concrete Constituents:

1. Submit to Architect a detailed list of concrete materials, and corresponding sources,
proposed for use in concrete for this project.
2. See paragraph 2.02.B below for submittal of strength information related to mix design.
3. When high-range water reducing admixtures will be used for water-cement ratios equal to or less than 0.45, submit information from manufacturer and batching plant on dosage amounts; timing of dosage(s) (e.g., in plant, at site, repeat dosages, etc.); initial and final slumps; quality control of dosing and mixing.
4. Tests for approval of concrete mixtures shall be paid for by Contractor.

B. Concrete patching materials.

C. Concrete repair materials.

1. Samples: Color samples for initial selection.

   a. Provide tinted samples of the approved concrete repair mortar to match the existing concrete to be repaired for selection by the Architect.
   b. Surface preparation sample: Prepare surfaces of existing concrete and any exposed reinforcing in accordance with the specification and manufacturer's instructions for approval by the Architect.
   c. Using initial color selections, install color sample or samples on the building in a place designated by the Architect. The Architect will review samples when they are completely cured. Modify coloring and repeat samples as directed by the Architect.

D. Methods of Construction: Submit to Architect, prior to starting work, description of methods, sequence of construction, and type of equipment proposed for use for performing cast-in-place concrete work. Architect's review is only for the effects of methods on permanent structure. This submission shall not relieve Contractor of his responsibility for providing structural design for methods and equipment, and the necessary methods, equipment, workmanship, and safety precautions.

E. Shop Drawings: Submit to Architect detailed Shop Drawings, including erection drawings and schedules.

1. Reinforcement Drawings: prepare in accordance with ACI SP-66 Detailing Manual and show following: elevations; dimensions of concrete work with specified reinforcement clearances; ledges, brackets, openings, sleeves or other items furnished by other Sections, where interference with reinforcement may occur; bending diagrams; assembly diagrams; splices and laps of reinforcement; temperature and shrinkage reinforcement; construction joint reinforcement; and shapes, dimensions, grade designations, and details of reinforcement and accessories. Show dowels with concrete work to be placed first and for connection to existing construction where required.
2. Formwork Drawings: schedules of placement; construction joints and control joints with methods of forming; general arrangement, sizes and grades of lumber and wood panels; alignment and layout of form ties for exposed concrete: location of embedded items and pockets. Submittal is for verification of joint and surface appearance. Comply with ACI 303-91 Guide to Cast-in-Place Architectural
Concrete Practice where exposed concrete or special architectural treatment is required on the Drawings. This submission does not relieve Contractor of his responsibility for providing structural design for formwork and the proper methods, equipment, workmanship and safety precautions.

3. Architect's checking is only a review for conformance with the design concept of the project and compliance with the information given in the contract documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating this work with that of all other trades; coordinating this work with existing construction; and performing the work in a safe and satisfactory manner.

4. Do not proceed with fabrication of material or performance of work until corresponding item on Shop Drawing has been reviewed by Architect.

F. Samples: Submit to Architect samples and/or descriptive literature of materials, products, and methods as noted herein, and as otherwise requested by Architect: concrete constituents including admixtures; form ties (including cones) and spreaders; accessories for reinforcement; reglets; non-shrink cement grout; inserts; form release agents, and waterstops.

1. Do not proceed with fabrication of material/product or performance of work until Sample has been approved by Architect.

G. Concrete Curing and Protection: Submit to Architect detailed methods proposed for curing and protecting concrete in normal, cold and hot conditions.

H. Mill Test Certification: Submit to Architect prior to delivery of reinforcing steel or concrete to job site, certified mill test reports of reinforcing steel and cement, (including names and locations of mills and shops, and analyses of chemical and physical properties), properly correlated to concrete to be used in this project. This submittal is for information and file record.

I. Corrective Work: Submit to Architect drawings showing details of any proposed corrective work prior to performing corrective work.

J. Affidavit: Submit to Architect, on request by Architect, manufacturer's and/or supplier's and/or installer's affidavit stating that material or product provided complies with Contract Documents.

1.05 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. Except as otherwise specified herein, perform work in accordance with specifications noted below, including latest editions of applicable specifications, codes, and standards cited therein, and latest applicable addenda and supplements. Keep copies of these items available in shop and field.

2. "Building Code Requirements for Reinforced Concrete" (ACI 318-05), American Concrete Institute.
3. "Specifications for Structural Concrete for Buildings" (ACI 301-05), American...
Concrete Institute.
5. "Standard on Hot Weathering" (ACI 305-R89), American Concrete Institute.
6. "Standard on Cold Weather Concreting" (ACI 306-R88), American Concrete Institute.
9. "Manual of Concrete Practice 1997", Volumes 1 through 5, American Concrete Institute for ACI Standards and Recommended Practices referred to in this Section.
11. The International Concrete Repair Institute (ICRI), Technical Guidelines.

B. Any material or operation specified by reference to published specifications of manufacturer or published standard shall comply with said specification or standard. In case of conflict between referenced specifications, most stringent requirement shall govern. In case of conflict between referenced specifications and Project Specifications, Project Specifications shall govern unless otherwise indicated by Architect in writing.

1.06 SUBSTITUTIONS

A. Substitutions for member sizes, type(s) of concrete, details or any other modifications proposed by Contractor will be considered by Architect only under following conditions:

1. That request has been made in writing and accepted prior to submission of Shop Drawings.
2. That there is a substantial cost advantage or time advantage to Owner; or that proposed revision is necessary to obtain required materials or methods at proper times to accomplish work in time scheduled.
3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by Architect, including documentation of cost reductions or of savings in time to complete work.

PART 2 - PRODUCTS

2.01 CONCRETE CONSTITUENTS

A. Cement: shall be domestic-made Portland Cement, free from water soluble salts or alkalies which will cause efflorescence on exposed surfaces. Portland Cement shall be Type II, ASTM C150. Do not use air entraining cements. Use only one brand of cement for each type of cement throughout project. No visual variations in color shall result in exposed concrete.

B. Fly Ash: ASTM C618, Type C of F; fly ash shall not exceed 25% of cement content by weight.
C. Granulated Blast Furnace Slag: ASTM A989 Grade 120.

D. Normal weight Fine Aggregate: shall be washed, inert, natural sand conforming to ASTM C33 and following additional requirements:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Retained Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>0 – 5</td>
</tr>
<tr>
<td>#16</td>
<td>25 – 40</td>
</tr>
<tr>
<td>#50</td>
<td>70 – 87</td>
</tr>
<tr>
<td>#100</td>
<td>93 – 97</td>
</tr>
</tbody>
</table>

Fineness Modulus: 2.80 (Plus/Minus 0.20)

Organic Plate 2 maximum

Silt: 2.0 percent maximum

Mortar Strength: 100 percent minimum compression ratio

Soundness: 5 percent max. loss, magnesium sulfate, five cycles

E. Normal weight Coarse Aggregate: shall be well-graded crushed stone or washed gravel conforming to ASTM C33 and following additional requirements:

<table>
<thead>
<tr>
<th>Designated Size (inches)</th>
<th>3</th>
<th>2</th>
<th>1-1/2</th>
<th>1</th>
<th>¾</th>
<th>½</th>
<th>3/8</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM (+/- 0.2)</td>
<td>7.95</td>
<td>7.45</td>
<td>7.20</td>
<td>6.95</td>
<td>6.70</td>
<td>6.10</td>
<td>5.50</td>
</tr>
<tr>
<td>Organic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silt</td>
<td></td>
<td></td>
<td>1.0 percent maximum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soundness</td>
<td></td>
<td></td>
<td>5 percent maximum loss, magnesium sulfate, five cycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Maximum designated sizes for normal weight coarse aggregate to be used in concrete sections shall be as noted below, except that sizes shall also be chosen in conjunction with required clearances.
a. One and one-half inches for sections over ten inches in thickness.  
b. One inch for sections more than eight and up to ten inches in thickness.  
c. Three-quarter inch for sections more than three and up to eight inches in thickness.  

F. Water: shall be from approved source, potable, clean and free from oils, acids, alkali, organic matter and other deleterious material.

G. Admixtures:

1. Water-reducing admixture: Shall comply with ANSI/ASTM C494, Type A and contain no more than 0.05% chloride ions.
   b. "Eucon WR-75"; The Euclid Chemical Co.
   c. "Pozzolith 220N"; Master Builder's Co.
   d. Or approved equivalent conforming to ASTM C494.

2. High-Range Water Reducing (HRWR) admixture (Super Plasticizer): shall comply with ASTM C494, Type F or Type G and contain not more than 0.05% chloride ions:
   b. "Daracem 100"; W.R. Grace & Co.
   c. "Eucon 37"; Euclid Chemical Co.
   d. "Sikament"; Sika Chemical Corp.
   e. "Rheobuild-1000"; Master Builder's Co.
   f. Or approved equivalent.

   b. "Airmix or Perma-Air"; The Euclid Chemical Co.
   c. "MB-VR"; Master Builder's Co.
   d. Or approved equivalent.

4. Evaporation retarder: use water-based monomolecular film; use one of the following with flatwork containing corrosion inhibitor or silica fume admixture:
   b. "Euco-bar"; Euclid Chemical Co.
   c. Or approved equivalent.

5. Water-reducing Set Retarders: shall conform with ASTM C494 Type D and may be used when ambient temperatures exceed 80 degrees F. Use one of the following or equivalent:
   b. "Eucon Retarder"; Euclid Chemical Co.
   c. Pozzolith 100-XR"; Master Builders.
6. Accelerator admixture: Non-chloride and non-corrosive accelerators shall conform to ASTM C494 Type C and may be used when temperatures are below 50 degrees F. Use one of the following or equivalent:

   a. "Daraset"; W.R. Grace
   b. "Accelguard 80"; Euclid Chemical Co.
   c. "Pozzutec 20"; Master Builders.

7. Prohibited admixtures: Calcium chloride, thiocyanates and admixtures containing more than .05% chloride ions are not permitted.

2.02 CONCRETE MIXTURES

A. Proportion concrete on the basis of previous field experiences or laboratory trial batches with the materials to be employed in the work. However, mixtures shall have the limiting quantities or values listed below for each strength concrete with coarse aggregate less than 1½ inches.

<table>
<thead>
<tr>
<th>Compressive Strength at 28 days PSI</th>
<th>Maximum Allowable Net Water Content</th>
<th>Min. Cement Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight 4000</td>
<td>5.75</td>
<td>0.51</td>
</tr>
<tr>
<td>3000</td>
<td>6.50</td>
<td>0.58</td>
</tr>
</tbody>
</table>

1. Maximum allowable net water content is the total water in the mix at the time of mixing, including free water on aggregate.
2. Consider any fly ash or blast furnace slag as part of the cement content for purposes of establishing cement factor and w/c ratio.

   a. Fly Ash/Portland Cement Replacement: Fly ash, in proportions not greater than 25% by weight of the total amount of cementitious materials. Cement content and/or water-cement ratio for mixes containing fly ash shall be based on the total weight of cementitious materials (Portland Cement plus fly ash).
   b. Granulated Blast Furnace Slag/Portland Cement Replacement:

      1) Granulated blast furnace slag may be substituted for Portland Cement in proportions ranging from 25 to 33% by weight of the total amount of cementitious materials. Cement content and/or water-cement ratio for mixes containing blast furnace slag shall be based on the total weight of cementitious materials. (Portland Cement plus blast furnace slag.)
   c. When combined, the total of fly ash and granulated blast furnace slag
substituted for Portland Cement shall not exceed 33% by weight of the total amount of cementitious materials.

3. Use maximum water-cement equal to 0.45 for concrete subject to freezing and thawing, repeated surface wetting or deicers.
4. Use High-Range Water Reducing admixture for water-cement ratios equal to or less than 0.45.

B. Field Experience Method: When a concrete production facility has a record of consecutive strength tests that were made within the past 12 months, compute standard deviations and the required average compressive strength in accordance with ACI 301 Paragraph 3.9.1 and 3.9.2.

1. Analysis of standard deviation, average compressive strength and proposed concrete proportions shall be performed by Testing Agency paid by the Contractor. The mix design shall be by the Contractor.
2. Submit proposed concrete proportions and supporting documentation to Architect.

C. When an acceptable record of field test results is not available, base concrete proportions on trial mixtures meeting the following restrictions:

1. Use the combination of materials proposed for use in the work.
2. Make trial mixtures having proportions and consistencies suitable for the proposed work using at least three different water-cement ratios that will produce a range of strengths encompassing those required for the proposed work.
3. Design trial mixtures to produce a slump within 1 inch of the maximum permitted, and for air-entrained concrete, within 0.5 percent of the maximum allowable air content. Report the temperature of freshly mixed concrete in the trial mixtures.
4. For each proposed mixture, make and cure at least three compressive test cylinders for each age in accordance with ASTM C192. For normal weight concrete, each change of water-cement ratio shall be considered a new mixture. Test the cylinders for strength in accordance with ASTM C39 at 28 days or at a specified earlier or later age.
5. From the results of these cylinder tests, plot a curve showing the relationship between compressive strength and the water-cement ratio for normal weight concrete.
6. From this curve, the water-cement ratio for normal weight concrete for the concrete to be used in the proposed work, shall be selected to produce an average compressive strength 1200 psi higher than the specified strength. The cement content and mixture proportions to be used shall be such that the selected water-cement ratio is not exceeded when slump is the maximum permitted. Maintain proper cement content, slump, and air content.

D. Admixtures

1. Use air entrainment admixture in concrete exposed to exterior environment and in accordance with manufacturer's written instructions. Interior protected concrete may be air entrained for improved workability. See ACI 301 Table 3.4.1 for required air content except that minimum for all sizes of aggregate shall be 6 percent in exterior environment. Interior protected slab-on-grade concrete may not have air content.
entainment admixtures.

2. Use water reducing admixture in concrete and in accordance with manufacturer's written recommendations and instructions.

3. Use high-range water reducing (HRWR):
   a. In concrete with water-cement ratios equal to or less than 0.45, but do not exceed 8 inches slump. In concrete for slab-on-grade, a mid-range water reducer may be used instead of adding water with a maximum slump of 6 inches.
   b. In concrete where anticipated slump losses in transit prevent proper pumping, placing and finishing. Use HRWR instead of adding water at the site. Do not exceed 8 inches slump.

E. Slump shall be in accordance with Part 3 of this Section.

F. Normal weight concrete shall have an air-dry weight not exceeding 150 lbs. per cubic foot.

   1. Design 28-day strengths as shown in the Structural Drawings.

G. Any deviation from approved mix design will not be allowed without written approval of Architect. Cost of any additional testing by Testing Agency associated therewith shall be paid for by Contractor.

2.03 FORM MATERIALS

A. Exposed-to-View Surfaces:

   1. Use new and unused Class 1 B-B High Density Overlaid Plyform, exterior grade, not less than five-ply, and not less than 5/8-inch thick conforming to U.S. Product Standard P-1-83. Design and maintain forms in accordance with instructions in American Plywood Association (APA) Manual "Concrete Forming" (Form No. V345N/Revised June 87/5000).

B. Form Release Agent: Use a non-staining and non-emulsifiable type. Form release agent shall not impart any stain to concrete nor interfere with adherence of any material to be applied later to concrete surfaces.

2.04 REINFORCEMENT AND ACCESSORIES

A. Welded Wire Fabric: shall conform to ASTM A185.

B. Reinforcement Accessories: Reinforcement accessories shall include spacers, chairs, ties, slab bolsters, clips, chair bars, and other devices for properly assembling, placing, spacing, supporting, and fastening reinforcement. Tie wire shall be annealed wire of sufficient strength for intended purpose, but not less than No. 18 gage. Bar supports shall conform to Chapter 3, "Bar Supports" or CRSI Manual of Standard Practice. Supports touching interior formed surfaces exposed to view shall be CRSI Class 1, plastic protected.
2.05 RELATED MATERIALS

A. Vapor Barrier: Provide vapor barrier over prepared base material beneath slabs on ground. Use only materials which have a moisture transmission rate of less than 0.01 grains per square foot per hour and meet the requirements of ASTM E1745 and ASTM E1643. Use polyethylene sheet not less than 15 mils thick or approved equivalent such as the following:

1. “Premoulded Membrane” by WR Meadows
2. “Vapor Guard” by Griffolyn (Reef Industries)
3. “15 mil Stego Wrap” by Stego Industries

B. Non-shrink Grout: Use CRD-C 621, factory pre-mixed grout, Type D, non-metallic, such as one of the following or an approved equivalent:

1. "Masterflow 928"; Master Builders.
2. "Euco-NS"; Euclid Chemical Co.

C. Non-slip Aggregate Finish: Use fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rust-proof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

D. Absorptive Cover: Use burlap cloth weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

E. Moisture-retaining Cover: Use one of the following, complying with ANSI/ASTM C 171:

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

F. Curing Compounds: Verify that products listed below meet regulations of jurisdiction for Volatile Organic Compounds (VOC) emissions. Notify Architect if listed products do not comply and submit information about equivalent products that do comply.

1. Curing and Sealing Compound: Use a clear acrylic type conforming to ASTM C309, Type I, Class B. Use one of the following or equivalent where concrete surfaces will remain exposed.
   a. "Masterkure"; Master Builders.
   b. "Super Rez Seal"; Euclid Chemical Co.
   c. "Dress & Seal #30"; L & M
   d. "Intex"; W.R. Meadows

2. Curing and Hardening Compound: Use colorless solution containing 35% of a 42-degree Baume sodium silicate solution. Use where shown on drawings. Use one of
the following or equivalent:

a. "Chem-Hard"; L & M
b. "Eucosil" Euclid Chemical Co.
c. "Cure-hard"; W.R. Meadow

3. Dissipating Resin Curing Compound: Use a dissipating resin type compound, conforming to ASTM C309, Type I. The film must chemically break down in a two-to-four-week period. Use one of the following or equivalent where concrete surfaces will receive other materials:

a. "Kurez DR"; Euclid Chemical Co.
b. "3100"; W.R. Meadows
c. "Cure Resin"; L & M

G. Bonding Agent, Patching Mortar: Cementitious slurry containing polymer-modified latex admixture, such as one of the following:

1. "SikaTop 121, 122 or 123"; Sika Corporation
2. "Flexcon"; Euclid Chemical Co.
3. "Everbond"; L & M

H. Expansion Bolts: Use hot-dipped galvanized bolt conforming to Federal Spec. FF-S-325, Group II, Type 4, Class 1. Allowable pullout and shear values shall be based on ASTM E 488 test methods. See Drawings for diameters, edge distances, embedments and center-to-center spacings. Use one of the following or equivalent approved by Architect:

1. "Kwik Bolt II"; Hilti Inc.
2. "Red Head Trubolt Wedge Anchor"; ITW Ramset/Redhead.

I. Cementitious Structural Repair Mortar: shall be a single-component cementitious, fiber-reinforced, micro-silica enhanced, polymer-modified mortar and shall have the following properties as determined by laboratory testing.

1. Compressive Strength, ASTM C109............. 17 MPa (2500 psi) @ 1 day
   ............................................................ 41 MPa (6000 psi) @ 7 days
   ............................................................ 46.5 MPa (6750 psi) @ 28 days
2. Flow, ASTM C928........................................ 56%
3. Bond Strength, ASTM C882 (Modified) ....... 5 MPa (700 psi) @ 1 day
   ............................................................ 17.5 MPa (2550 psi) @ 28 days
4. Modulus of Elasticity, ASTM C469.............. 16.8 GPa (2.44 x 106 psi)
5. Drying Shrinkage, ASTM C157.................... -0.083 % (830 µ strain)
6. Flexural Strength, ASTM C348 .................... 4.5 MPa (675 psi) @ 1 day
   ............................................................ 10 MPa (1450 psi) @ 28 days
7. Freeze-Thaw Resistance, ASTM C666 .......... 112 % RDM @ 300 cycles
   .................................................................................. (Procedure A)
8. Meadow-Crete GPS; W. R. Meadows, or equal.
9. Bonding agent: As recommended by the Manufacturer
10. Curing compound: As recommended by the Manufacturer
PART 3 - EXECUTION

3.01 INSPECTION

A. Examine work prepared by other trades to receive work of this Section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.02 HANDLING, STORAGE, AND PROTECTION OF MATERIALS

A. Handle and store materials separately in such manner as to prevent intrusion of foreign matter, segregation, or deterioration. Do not use foreign materials or those containing ice. Remove improper and rejected materials immediately from point of use and from the site. Cover materials, including steel reinforcement and accessories, during construction period. Stockpile concrete constituents properly to assure uniformity throughout project.

3.03 ERECTION OF FORMWORK

A. Set and maintain formwork to insure complete concrete work within tolerance limits listed in ACI 301, Table 4.3.1.

B. At construction joints, overlap and clamp forms (using gaskets if necessary) to prevent offsets or loss of mortar at joints.

C. Before reusing form materials, thoroughly clean surfaces that will be in contact with freshly cast concrete, repair damaged areas and withdraw projecting nails. Recoop form with release agent. Re-use of form material for architecturally exposed concrete shall be subject to approval by Architect.

3.04 PLACING OF REINFORCEMENT

A. Place reinforcement in accordance with requirements of CRSI "Placing Reinforcing Bars".

B. Place reinforcement in accordance with ACI 117 (Tolerances) and with Contract Documents and secure firmly in position by wire ties, chairs, spacers, and hangers, each of type approved by Architect.

C. At time concrete is placed, reinforcement shall be free of excessive rust, scale, or other coatings that will destroy or reduce bond. Paint reinforcement expected to be exposed to weather for a considerable length of time with a heavy coat of cement grout. Protect stored materials so as not to bend or distort bars in any way. Bars that become damaged will be rejected.

3.05 INSTALLATION OF EMBEDDED ITEMS

A. Conform to requirements of ACI-318, paragraph 6.3, "Conduits and Pipes Embedded in Cast-in-Place Concrete"
in Concrete", and as specified below.

B. Install steel sleeves, furnished by other trades, at locations shown on the drawings.

C. Install anchor bolts for column baseplates in accordance with AISC Code of Standard Practice, Paragraph 7.5 and the following: Use setting plate templates. Maintain elevations and plan locations of bolt groups within one-quarter inch of the locations shown on the drawings. Place individual bolts in a bolt group within one-eighth inch of center-to-center dimensions shown on the drawings.

3.06 MIXING, CONSISTENCY, AND DELIVERY OF CONCRETE

A. Use ready-mixed concrete produced by plant acceptable to Architect. Hand or site mixing shall not be done. Batch constituents, including admixtures, at central plant. Admixtures shall be premixed in solution form and dispensed as recommended by manufacturer.

B. Concrete shall arrive at the job site at a slump of 2 to 3 inches and at the time of deposit shall be as follows:

<table>
<thead>
<tr>
<th>Portion of Structure</th>
<th>S L U M P</th>
<th>Maximum Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recommended</td>
<td>Maximum Range</td>
</tr>
<tr>
<td>Walls, Columns</td>
<td>4&quot;</td>
<td>3&quot; - 5&quot;</td>
</tr>
<tr>
<td>Slabs, Beams</td>
<td>3&quot;</td>
<td>2&quot; - 4&quot;</td>
</tr>
</tbody>
</table>

1. If high-range water reducing admixture (superplasticizer) is used, it may be added at the job site after verifying that the delivery slump is 2 to 3 inches. Maximum slump after adding HRWR shall be 8 inches.

2. For normalweight concrete, water may be added at the site only to make up water withheld at the plant. Batching plant shall document on the driver's delivery ticket any water withheld at the plant. When water has not been withheld and slump is too low for proper handling of concrete, use HRWR to bring slump within specified range.

C. Transport ready mixed concrete to site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Discharge at site within one and one-half hours after cement was first introduced into mix. Do not use concrete with a temperature greater than 85 degrees F. Central mixed concrete shall be plant mixed a minimum of five minutes. Agitation shall begin immediately after premixed concrete is placed in truck and shall continue without interruption until discharged. Transit mixed concrete shall be mixed at mixing speed for at least ten minutes immediately after charging truck followed by agitation without interruption until discharged.

D. Do not retemper (mixing with or without additional cement, aggregates, or water) concrete which has partially hardened.
3.07 PLACING CONCRETE

A. If concrete pumping is proposed, refer to "Submittals, Concrete Constituents", in this Section for requirements. If lightweight concrete pumping is proposed, use a pipe diameter of 5 inches. Concrete may be placed into the pump at the maximum but not more than the specified slump.

B. Remove water and foreign matter from forms and excavations and, except in freezing weather or as otherwise directed, thoroughly soak wood forms just prior to placing concrete. Place no concrete on frozen soil and provide adequate protection against frost action during freezing weather.

C. Do not place concrete having slump outside of allowable slump range. The loss of slump between pump and discharge end of pipeline shall not exceed two inches.

D. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid rehandling. Deposit no partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and U-shaped design as to insure continuous flow in chute. Do not use flat (coal) chutes. Use metal or metal lined chutes with different portions having approximately the same slope. Slope shall not be less than 25 degrees nor more than 45 degrees from horizontal. Use a baffle or spout at the discharge end of the chute to prevent segregation. If discharge end of chute is more than five feet above surface of concrete in forms, use spout with its lower end at surface of deposit. When operation is intermittent, discharge chute into hopper. Do not allow concrete to flow horizontally over distances exceeding five feet.

E. Place concrete in such manner as to prevent segregation and accumulations of hardened concrete on forms or reinforcement above mass of concrete being placed. To achieve this end, use suitable hoppers, spouts with restricted outlets and tremies as required.

F. During and immediately after depositing, compact concrete in accordance with ACI 309 by means of internal type mechanical vibrators or other tools to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or "pumping" of air. Vibrators used for normalweight concrete shall operate at speed of not less than 7,000 rpm and be of suitable capacity. Do not use vibrators to move concrete. Keep at least one vibrator on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrators shall be operable and on site prior to starting placement.

G. Place vertical lifts not to exceed 18 inches. Vibrate through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone pockets, honeycomb, and segregation.

H. Deposit concrete continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section. If section cannot be placed continuously between planned construction joints, as specified, introduce a joint and additional reinforcement.
so as to preserve structural continuity. Notify Architect in any such case.

I. Cold joints, particularly in exposed concrete, including "honeycomb", are unacceptable. If they occur in concrete surfaces exposed to view, Architect will require that entire section in which blemish occurs be removed and replaced with new materials at Contractor's expense.

J. Clean chutes, hoppers, spouts, adjacent work, etc. before and after each run; discharge water and debris outside form.

3.08 CONCRETE FINISHES

A. Finish of Formed Surfaces:

1. Smooth Form Finish: For formed concrete surfaces exposed-to-view and surfaces that are to be covered with a coating material applied directly to concrete, such as waterproofing, dampproofing paint. This is the as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of joints and with a systematic pattern of ties with set-back cones. Grout tie holes; remove and rub smooth fins or other projections. Surfaces remaining exposed-to-view shall have uniform color and texture acceptable to the Architect.

3.09 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Start curing before concrete has dried and immediately after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Keep concrete surface continuously wet by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.

1. Provide moisture curing by any of the following methods at Contractor's option:

a. Covering with water.
b. Continuous water-fog spray.
c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-cover curing as follows:

a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide curing compound as follows:
   
a. Apply specified curing compound to exterior and exposed interior concrete slabs as soon as final finishing operations are complete (within 2 hours) and to formed surfaces immediately after forms are removed.
   
b. Apply uniformly in two continuous operations at right angles to each other by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
   
c. Use dissipating resin type curing compounds on surfaces which are to be covered with finish or coating material applied directly to concrete, such as liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials. If curing compound is not compatible with coating materials, moisture or moisture-cover curing shall be used.

D. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   
   2. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

E. Hot weather placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

   1. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
   
   2. Wet forms thoroughly before placing concrete.

F. Keep permanent temperature record showing date and outside temperature for concreting operations. Take thermometer readings at start of work in morning, at noon, and again late in afternoon. Record locations of concrete placed during these periods so any effect temperatures may have had on construction can be correlated. Distribute copies of temperature record daily to Architect.
3.10 REMOVAL OF FORMWORK, SHORING AND RESHORING

A. Contractor shall be responsible for proper removal of formwork shoring, and reshoring. Comply with ACI 347 for shoring and reshoring in multi-story construction.

B. Remove vertical forms as soon as concrete has attained sufficient strength to support its own weight and their removal can be done without damage to the concrete. Apply curing compound immediately after removing forms.

C. Keep horizontal forms and supports in place for not less than minimum periods of time noted below or until concrete has reached 60 percent of its specified strength.
   1. Soffits of beams or girders shall remain in place until concrete has attained 600 day-degrees.
   2. Forms of floor slabs shall remain in place until concrete has reached 400 day-degrees.
   3. Definition of day-degrees: Total number of days or fractions of days times mean daily air temperature at surfaces of concrete; where concrete surface is protected by insulated blankets or formwork, temperature may be taken under the blankets or formwork. For example, five days at temperature of 60 degrees F. equals 300 day-degrees. Days or fractions of days in which temperature is below 50 degrees F. shall not be included in calculation of day-degrees.

D. When forms are removed, place reshores at same time as stripping operations so that no unshored area is larger than one-fourth of a slab panel. Allow no live load on slab when stripping and shoring are being done.

E. Field cure test cylinders under same conditions as concrete they represent in order to verify minimum strengths for form removal. Such cylinders and testing shall be at the Contractor's expense.

3.11 ACCEPTANCE AND REPAIRING OF CONCRETE SURFACES

A. Intent of this Specification is to require forms, mixtures of concrete, and workmanship so that concrete surfaces will require no patching, except for plugging of tie holes.
   1. Remove and replace architectural concrete with surface defects exceeding the limitations of ACI 301, Section 13.3.1 or having honeycombs, excessive air voids (bugholes), mismatched coloring, pour lines or sand streaking. The standard of acceptability shall be the surface quality of the approved test panel; or, where no test panel has been made, the standard of unacceptability shall be the photographs shown with paragraphs 7.6 and 7.7 or ACI 309R-87 "Guide for Consolidation of Concrete".
   2. Where patching is acceptable to Architect, procedure shall comply with ACI 301-96, Chapter 9 and Section 13.6 and as described below.

B. Clean and dampen tie holes and fill solid with patching mortar immediately after form removal.
C. Do not patch defective concrete and honeycombed areas unless examined and approval is given by Architect. If such approval is received by contractor, areas involved shall be chipped down square and at least one inch deep to sound concrete by means of cold chisels or pneumatic chipping hammers. If honeycomb exists around reinforcement, chip to provide clear space at least three-quarter inch wide all around steel to ensure proper bond thereto. Repairs thicker than one and one-half inches shall be built-up on successive days, each layer of one and one-half inches being applied as described in ACI 301-96 Chapter 9. Use specified bonding agent.

D. Remove and replace patches which become crazed, cracked, or sound hollow upon tapping, at Contractor's expense.

3.12 CLEANING

A. Clean concrete surfaces of objectionable stains as determined by the Architect. Do not use materials containing acid in any form or methods which will damage "skin" of concrete surfaces. Architect may reject any exposed-to-view concrete with damaged "skin".

3.13 INSPECTION AND TESTING

A. Inspection and testing of cast-in-place concrete work will be performed by an independent Testing Agency, under a separate contract with the Owner. Materials and workmanship shall be subjected to inspection and testing in mill, shop and/or field by testing Agency and shall be subjected to periodic observation by the Architect. Such inspection and testing shall not relieve Contractor of his responsibility to provide his own inspection, testing, and quality control as necessary to furnish materials and workmanship in accordance with requirements of these Contract Documents.

B. Requirements of this section are written for the purpose of securing best workmanship and end result. Certain deviations may be desirable under certain project conditions, however, and may be allowed after examination by and upon written approval of Architect. Any such approved deviation shall not be construed as a waiver of requirements of Specifications.

C. Notify Construction Manager, Architect and Testing Agency prior to start of any phase of concrete work so as to afford them reasonable opportunity to schedule site visit. Such notification shall be made at least 36 hours in advance.

D. Facilitate inspection and testing by Testing Agency. Furnish Testing Agency upon request with:

1. Information as to time and place of shipments of materials to plant and project site.
2. Free and safe access and assistance for testing materials and proper facilities for inspection of work in plant and at proper site.
3. Covered box large enough to contain twenty-four standard concrete cylinders. At temperatures below 60 degrees F., box shall be electrically heated to maintain inside temperature of 60 to 80 degrees F. Place cylinders in box immediately after molding and cover with moist burlap until delivery to laboratory, 24 to 72 hours after molding.

E. Promptly replace concrete materials or redo work which has been rejected by Architect and/or Testing Agency, either at plant or at job site, to satisfaction of Architect and/or Testing Agency and at no expense to the Owner.

F. Correct, or remove and replace concrete work which does not meet requirements of Contract Documents for aesthetic appearance as directed by Architect. Criteria for acceptance shall be based on a mockup preapproved by the Architect. Cost of such correction or removal and replacement shall be at Contractor's expense.

G. Sampling and testing for quality assurance during placement of concrete may include the following, as directed by Architect. Samples will be made at the point of discharge from the ready-mix truck.

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
   a. Slump: ASTM C143; one test for each concrete load and one test for each set of compressive strength test specimens.
   b. Air Content: ASTM C173, volumetric method for lightweight or normalweight concrete; ASTM C231 pressure method for normalweight concrete; one for each set of compressive strength test specimens.
   c. Concrete Temperature: Test hourly when air temperature is 40 degrees F. (4 degrees C.) and below, and when 80 degrees F. (27 degrees C.) and above; and each time a set of compression test specimens made.
   d. Compression Test Specimen: ASTM C31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required. One set of cylinders shall be taken for every 50 cubic yards or fraction thereof.

2. Compressive Strength Tests: ASTM C39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 5,000 sq. ft. of surface area placed; one specimen tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
   a. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, Architect may direct Contractor to evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete or to redesign the mix.
   b. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
   c. Test results will be reported in writing to Architect, Construction Manager and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete
mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

d. Additional Tests: The testing agency will make additional tests of in-place concrete when test results show specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect or Construction Manager.

e. Testing Agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed, including load testing. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

3.14 CONCRETE REPAIRS SURFACE PREPARATION

A. Examination: Examine surfaces to receive repair mortar. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected. Have surface preparation sample approved in writing prior to beginning work.

B. Surface Preparation:

1. Reinforcing Steel:

   b. Completely expose all reinforcing steel, ensuring a minimum clearance of 3/4-inch (19 mm) behind reinforcing steel.
   c. Remove loose scale and corrosion deposits and clean steel to white metal by abrasive blasting.

2. Primer:

   a. Apply the first coat to the cleaned steel promptly after cleaning. Let first coat dry for 10 to 15 minutes and then apply second coat.
   b. Allow primer coat to dry and stiffen for 1 to 2 hours before application of mortar.

3. Concrete Substrate:

   b. Mechanically abrade existing substrate to remove all unsound concrete, but do not use excessive force, which may cause micro-fracturing.
   c. Ensure substrate is structurally sound and free of any contaminants that will adversely affect bond of mortar.
   d. Prepared surface must be dust-free and have a sufficient profile to ensure adequate mechanical lock.
   e. Saw cut perimeter of repair zone to a depth of 1/4-inch (6.4 mm) to avoid feather-edging.
   f. Ensure entire repair zone has a minimum thickness of 1/4-inch (6.4 mm).
3.15 CONCRETE REPAIRS

A. Mixing

1. Mix complete bags using a mortar-type mixer, in accordance with manufacturer's instructions.
2. Pour 3 1/2 to 3 3/4 U.S. quarts (3.30 to 3.54 L) of water per 50 lb. (22.7 kg) bag of material into mixer and slowly add the mortar.
3. Mix for 3 to 5 minutes or until homogeneous and lump-free. Ensure not to over mix.

B. Samples

1. After initial color samples have been approved by the Architect, install sample concrete repair in a location on the building agreed upon by the Architect.
2. Complete sample of surface preparation and rebar cleaning, and do not commence with the concrete repair samples until surface preparation samples are approved in writing.
3. After surface preparation samples are approved, install concrete repair samples in the color mix approved, and notify the Architect when samples are fully cured.
4. Adjust the color, and install additional samples as directed by the Architect. Samples may remain as part of the final work with approval of the Architect.

C. Machine Placement

1. Using low-pressure, wet spray equipment, follow industry standard nozzle procedures for removal of rebound, spray angle, compaction behind reinforcing steel.
2. Cut surface face to desired configuration.
3. Finish with a wood, steel, or sponge float.
4. Do not re-temper or over-work.
5. Follow ACI 305-R89 “Standard on Hot Weathering” or ACI 306-R88 “Standard on Cold Weather Concreting” when applicable.

D. Hand Placement

1. Compact mortar into properly prepared substrate prior to bulk placement.
2. Apply mortar up to 3-inches (76.2 mm) horizontally and vertically and 2-inches (50.8 mm) overhead, dependent on patch size and configuration.
3. Finish surface with a wood or steel trowel, or a sponge float.
4. Do not re-temper or over-work.
5. Follow ACI 305-R89 “Standard on Hot Weathering” or ACI 306-R88 “Standard on Cold Weather Concreting” when applicable.
E. Curing

1. Cure mortar immediately following application in accordance with ACI 308.
2. Apply a water-based curing compound at the specified rate based on manufacturer’s recommendation.

END OF SECTION
SECTION 042000
UNIT MASONRY

PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS.

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER'S CHECK or CASHIER'S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.03 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
B. Perform the following:

1. Perform all cutting of holes, in the various materials furnished and installed hereunder, where the largest dimension of the hole is required to be 12 inches or more, as required to accommodate piping, ducts, conduits, and penetrating mechanical and electrical fixtures, accessories, equipment, and items of other trades; from drawings templates, and/or instructions furnished by the trade requiring same.

2. Perform patching of all openings in existing interior masonry walls which have been exposed by demolition procedures. Use only materials which match the surrounding masonry in type, size finish color, and from all other respects, in the performance of the patching work, all such materials being subject to approval by the Architect.

3. Perform patching of all holes in masonry which have been cut to accommodate penetrating items under the work of this Contract. Use only materials which match the surrounding masonry in type, size finish color, and from all other respects, in the performance of the patching work, all such materials being subject to approval by the Architect.

   a. Perform patching of holes, cracks and losses within exposed to view existing masonry using salvaged masonry where possible, or new masonry and mortar to match existing. Salvage and clean any stone facing materials removed under Section 024119, Selective Demolition, for reuse as patching material.

C. Related Sections:

1. Section 024119 "Selective Demolition" for removing large sections of existing masonry walls.
2. Section 055000 Miscellaneous Metals for furnishing steel lintels for unit masonry.
3. Section 075419, Roofing and Flashing for sheet metal flashing associated with roofing.

1.04 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.05 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Slate sills, showings sizes, and installation details, including flashings.

C. Samples for Verification: For each type and color of the following:

1. CMUs.
2. Face brick, in the form of straps of five or more bricks.
4. Colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Separate samples shall be required for new building, church and original library.
5. Weep holes.
6. Accessories embedded in masonry.

1.07 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.
   a. Include data on material properties.
   b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   c. For exposed brick, include test report for efflorescence according to ASTM C 67.
   d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Grout mixes. Include description of type and proportions of ingredients.
4. Reinforcing bars.
5. Joint reinforcement.
6. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.

Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Cast stone Products."

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

   a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.

   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
1.09 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost.
or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

2. No cold-weather work shall be permitted on the existing historic buildings.


1.11 SEQUENCING/SCHEDULING

A. Perform masonry restoration work in the following sequence:
   1. Clean existing masonry.
   2. Repair, replace and rebuild all damaged masonry.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3050 psi.
   2. Density Classification: Normal weight, unless otherwise indicated.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
2.03 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
3. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Restoration Brick, conforming to ASTM C-216, Grade SW, in red range to match existing, as approved by the Architect.

1. Face brick for patching existing masonry: Salvaged existing face brick, cleaned, whole and prepared for use under this SECTION. Supplement salvaged brick with new restoration brick to match in size, texture, color and range.

2. Common Brick used for back-up brick for patching existing masonry and not exposed to view wythes in multi-wythe walls: Brick shall conform to the requirements of AASHTO Specification M91 Grade MM, solid bodied, clay or shale durable brick, rectangular in section and substantially straight edges and square corners, in nominal size indicated for Face Brick.

2.04 SLATE

A. Slate Sills: Slate sills shall match existing slate sills in size, color, thickness, and finish.

B. Specifications are based upon the following: "Winchester Black" slate, 1-inch thick x 4 1/2-inches deep, nominal, in lengths to align with centerlines of windows, as shown on the Drawings.

C. Finish: Natural slate shall have square, honed face and honed edges where exposed, and a gauged back.

2.05 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.
C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients. Custom mixes only for historic buildings.

D. Sand: Clean, washed uniformly well graded, conforming to ASTM C144-542, 100% passing a No. 8 sieve with not more than 35% passing a No. 50 sieve, and with a fineness modulus maintained at 2.25 plus-or-minus 0.10, light in color, and obtained from a single source.

E. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand.
   2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.


H. Water: Potable.

2.06 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
   1. Interior Walls: Hot-dip galvanized, carbon steel.
   2. Exterior Walls: Hot-dip galvanized, carbon steel.
   5. Wire Size for Veneer Ties: 0.187-inch diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   7. Provide in lengths of not less than 10 feet.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.07 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   3. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.
B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.

2.08 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing. Extend at least 3 inches into wall and out to exterior face of wall.
4. Fabricate through-wall flashing with sealant stop where indicated. Extend at least 3 inches into wall and out to exterior face of wall. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.

B. Flexible Flashing: Use one of the following, or equal:

1. Asphalt-Coated Copper Flashing: 7-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

   a. Products: Subject to compliance with requirements, provide one of the following, or equal:

      1) Dayton Superior Corporation, Dur-O-Wal Division; Copper Coated Thru-Wall Flashing.
      2) Hohmann & Barnard, Inc.; H & B C-Coat Flashing.
      3) Phoenix Building Products; Type ACC-Asphalt Bituminous Coated.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use flexible flashing.
D. Solder and Sealants for Sheet Metal Flashings:
   1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
   2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.09 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from [styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805] [or] [PVC, complying with ASTM D 2287, Type PVC-65406] and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use the following unless otherwise indicated:
   1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
      a. Products: Subject to compliance with requirements, provide one of the following, or equal:
         1) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
         2) Heckmann Building Products Inc.; No. 85 Cell Vent.
         3) Hohmann & Barnard, Inc.; Quadro-Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Products: Subject to compliance with requirements, provide one of the following, or equal:
      a. Advanced Building Products Inc.; Mortar Break II.
      b. Archovations, Inc.; CavClear Masonry Mat.
      c. Mortar Net USA, Ltd.; Mortar Net.
   2. Provide one of the following configurations:

UNIT MASONRY
042000 - 10
a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches or dimpled surface designed prevent clogging with mortar droppings.

2.10 MASONRY CLEANERS

A. Use water and brushes to clean down new masonry.

B. For removal of surface soil, tar, paint, loose cementitious coatings:
   1. Special purpose paint, tar and stain removers as manufactured by SureKlean or Hydroclean


2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. For exterior masonry, use portland cement-lime mortar.
   4. For reinforced masonry, use portland cement-lime mortar.
   5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type S.
   3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

C. Grout for Unit Masonry: Comply with ASTM C 476.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed, or factory blend cubes.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/8 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

   1. Install compressible filler in joint between top of partition and underside of structure above, unless otherwise noted on Drawings.
   2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078400, Firestopping.

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.06 CAVITY WALLS

A. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

B. Comply with the requirements for air barrier to insure the air barrier remains undamaged during construction.

C. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.07 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Space anchors as indicated, but not more than 16 inches o.c. vertically and 32 inches o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.09 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
C. No steel lintels are required at jack arches. Jack arches shall be designed to support the load of masonry above. Where jack arches require reinforcing to span openings shown on the Drawings, provide adjustable concealed lintel system.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.
3. Space weep holes 16 inches o.c.
4. Cover cavity side of weep holes with plastic insect screening.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

UNIT MASONRY
042000 - 16
3.13 REPAIRING, POINTING, AND CLEANING - NEW WORK

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
5. Clean cast stone trim to comply with stone supplier's written instructions.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:
   1. Metal ladders.
   2. Miscellaneous steel brackets and connectors for items of finish carpentry, to the extent indicated, including clip angles and handrail brackets. Steel framing and supports for mechanical and electrical equipment.
   3. Wall mounted brackets for the support of exterior HVAC equipment.
   4. Steel tube guard railings attached to roof deck, galvanized.
   5. Welded in place steel lintels—install as indicated on the drawings.
   6. Steel framing and supports for applications where framing and supports are not specified in other Sections.

B. Products furnished, but not installed, under this Section:
   1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete, galvanized when used on the exterior.
   2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
   3. Loose steel lintels.

C. Related Sections:
   1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
   2. Section 102113 “Toilet Partitions” for installation of toilet compartments.

1.03 PERFORMANCE REQUIREMENTS

A. The following are hereby made a part of this SECTION by reference thereto:
1. American Iron and Steel Institute applicable standards.
5. American Society for Testing and Materials applicable standards and tests specified herein.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Paint and primer products.
   2. Liquid zinc coating.
   3. Hydraulic cements.

B. Certification: Written and signed certification from the firm performing the hot-dip galvanizing and passivating processing work, stating that all hot-dip galvanizing meets all requirements specified herein, that each piece has been stamped accordingly, and that the passivating treatment has been applied to all galvanized items designated to be painted.

C. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

MISCELLANEOUS METALS
055000 - 2
1.08 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.03 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
2.04 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Provide stainless-steel fasteners for fastening aluminum.

C. Provide stainless-steel fasteners for fastening stainless steel.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

F. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

G. Lag Screws: ASME B18.2.1.

H. Wood Screws: Flat head, ASME B18.6.1.


J. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Tnemec 10-99 Metal Primer, Rust-Oleum 1069 Heavy Duty Rust Inhibitive Red Primer, or equal.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Galvanizing compound Z.R.C., as manufactured by Z.R.C. Chemical Products Company, or equal, applied in two coats to a total dry film thickness of not less than 3 mils.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

MISCELLANEOUS METALS
055000 - 4
H. Concrete: Comply with requirements for Cast-in-Place Concrete, included on the Structural Drawings, for installing for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.06 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
6. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches on centers, unless otherwise indicated.
2.07 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Fabricate units from slotted channel framing where indicated.

D. Furnish inserts for units installed after concrete is placed.

E. Galvanize miscellaneous framing and supports where indicated.

F. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.08 RAILINGS

A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

   1. Rails, Posts and Picket Infill: As shown on the drawings

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

   1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:

   1. By inserting prefabricated elbow fittings of radius indicated.

D. Close exposed ends of railing members with prefabricated end fittings.

E. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

F. Connect posts to roof deck with fully welded anchor plates, and expansion bolts, unless otherwise indicated. Insure that guard rail assemblies are water tight, and no weeps are added that would allow water to penetrate the guard rail assemblies.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
1. For galvanized railings, provide galvanized ferrous-metal fittings, brackets, fasteners, and sleeves. Galvanize anchors embedded in exterior masonry and concrete construction.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.09 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

D. Galvanize exterior miscellaneous steel trim.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

D. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2.12 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe. Cut ends of bollards square and straight.
   1. Utility Bollards: Utility bollards for power and water supplies at the State Police Trailer shall be 6 by 6 by 3/16-inch tube steel square bollards.

B. Hot-dip galvanized steel bollards.

C. Concrete fill and footings: Per requirements for Cast-in-Place Concrete, included on the Structural Drawings.
   1. Concrete fill shall be trowel finished and domed slightly to shed water.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
3.02 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing. Provide a troweled wash, slightly domed, to shed water, at the top of the bollard.

B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3-inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.03 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.04 ADJUSTING AND CLEANING

A. Touchup Painting: After erection of miscellaneous metal items, touch up all welds, scratches, and abrasions, using the same coatings as shop-prime coat for primed metals; and using specified liquid zinc coating for galvanized metals.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON-TEXT PAGE
SECTION 061100

ROUGH CARPENTRY

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 123000, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. Provide labor, materials, equipment, services and transportation required to complete rough carpentry work shown on the Drawings, as specified herein, or both, including but not limited to items noted below.

1. All sawn lumber joists, rafters, studs, plates, sills, blocking, nailers and curbs, etc.

2. All rough hardware, inserts, related metal components, etc. for the work of this Section, except those items specifically specified to be provided by other trades.

3. Wood grounds, furring, strapping for all trades.

4. Wood blocking as required for all trades, and for the support and reinforcement of wall and ceiling mounted items, including all Owner-supplied items.

5. Plywood backing panels for electrical and telephone equipment.

6. Plywood sheathing for walls and roofs.

7. Fire retardant wood products.


9. Framing for and attachment of temporary dust-proof, fire-proof and/or weather-proof partitions as called for elsewhere in these Specifications.

10. All temporary and/or permanent rough carpentry floors, ladders, ramps, stairs, stair covers, jamb guards, barricades, protective fencing, temporary doors, etc., required for all trades.

11. Building Felts for work of this Section, and protective papers for finished floor.
12. Wood stud reinforcement in partitions around door openings, window openings, fixed lite openings.

13. Thermal glass-fiber blanket insulation as required to fill gaps in existing exterior wall systems.

14. Spray polyurethane foam insulation as required to fill gaps, cracks, and other voids too small or inaccessible for batt insulation systems.

15. Other usual items of normal rough carpentry work indicated on the Drawings or necessary for the proper completion of the project, even though not specifically mentioned herein.

1.03 STANDARDS

A. Except as otherwise specified herein, perform work in accordance with specifications noted below, including latest editions of applicable specifications, codes, and standards cited therein, and latest applicable addenda and supplements. Copies of these items shall be kept available in shop and field.


1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 50 00, Construction Facilities and Temporary Controls

B. Section 03 30 00, Cast-In-Place Concrete

C. Section 05 50 00, Miscellaneous Metals

D. Section 06 20 00, Finish Carpentry

E. Section 07 20 00, Thermal Insulation

F. Division 8, Doors and Windows

G. Division 9, Finishes
1.05 SUBMITTALS

A. Certification:

1. Preservative treated wood: Submit certification for water-borne preservative that moisture content was reduced to 19% maximum, after treatment.

2. Fire-retardant treatment: Submit certification by treating plant that fire-retardant treatment materials comply with governing ordinances and that treatment will not bleed through finished surfaces.

1.06 STORAGE AND PROTECTION OF MATERIALS

A. Immediately upon delivery to job site, place materials in area protected from weather.

B. Store materials a minimum of 6 inch above ground on framework of blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Do not store seasoned materials in wet or damp portions of building.

D. Protect fire-retardant materials against high humidity and moisture during storage and erection.

E. Protect sheet materials from corners breaking and damaging surfaces, while unloading.

1.07 WOOD PRESERVATIVE TREATMENT

A. All rough or finish lumber or other finish wood work specified anywhere in the Contract Documents to be pressure-treated shall be pressure-treated with Wolman salts or Pentachlorophenol with paintable type carrier. The minimum shall be 0.35 pounds of preservative per cubic foot of wood. Standard pressure process shall conform to the following Federal Specifications.

1. For Wolman Salts TT-W-571

2. For Pentachlorophenol TT-W-570a (1)

3. The treating plant shall furnish a notarized certificate that all permanent details of the specifications have been met.

4. Preservative shall be tinted with a color which is easily noticeable.

5. NOTE: Do not use Pentachlorophenol preservative for wood members which will be in contact with bituminous base materials.
B. Also, brush coat or dip surfaces which are cut after treatment with a heavy brush coat of one of the above preservatives used in pressure treatment. All cut surfaces shall be so treated, not just contact area.

1.08 GRADING AND SEASONING

A. Grade Marks: Identify all lumber and plywood by official grade mark.

1. Lumber: Grade stamp to contain symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded, where applicable and condition of seasoning at time of manufacture.

   a) S-Dry: Maximum 19% moisture content.
   b) MC-15 or KD: Maximum of 15% moisture content.
   c) Dense.


   a) Type, grade, class, and Identification Index.
   b) Inspection and testing agency mark.

PART 2- PRODUCTS

2.01 MATERIALS

A. Lumber

1. Dimensions, unless specifically called out otherwise:

   a) Specified lumber dimensions are nominal.
   b) Actual dimensions conform to industry standards established by the American Lumber Standards Committee and the rules-writing agencies.


3. Surfacing: Surface four sides (S4S), unless specified otherwise.

4. Lumber, 2 in. to 4 in. thick, 2 in. to 14 in. wide.

   a) Light framing: any commercial softwood species.
i) Supports and nailers for H.M. and finished carpentry: construction grade.

ii) Plates, blocking, bracing, and nailers: standard grade.

iii) Bracing, blocking, bulk headings, and general utility purposes: utility grade.

iv) Furring and grounds: minimum grade, standard.

b) Joists, rafters, studs, plates, sills: shall have an allowable extreme fiber stress in bending for single member use of 875 psi and a Modulus of Elasticity of 1,400,000 psi.

B. Plywood

1. Plywood for floor sheathing shall be 3/4" tongue and groove plywood, APA Structural I and II.

2. Plywood for exterior wall sheathing shall be 3/4” exterior plywood, APA Structural I and II.

3. Plywood for interior wall sheathing, designated at “shear walls” shall be 1/2” exterior plywood, APA Structural I and II.

4. Plywood for roof sheathing shall be 5/8” exterior plywood, APA Structural I and II.

5. Plywood for interior works such as electrical and telephone panel boards shall be 3/4” thick and fire-retardant treated.

C. Fire-Retardant Treated Products: all lumber and plywood where shown on drawings shall be pressure treated with fire retardant chemicals and have a flame spread rating of not higher than equivalent of 25, with no evidence of significant progressive combustion when tested for 30 minutes duration under the Standard Test. Method for Fire Hazard Classification of Building Materials UL 723 NFPA 255, ASTM E84. Fire retardant treatments shall be in the accord with the following:

1. Lumber: AWPA-C20.

2. Plywood: AWPA-C27

D. Preservative Treatment: Where lumber or plywood is indicated as "Trt-Wd" or "Treated", or is specified herein to be treated, comply with applicable requirements of SPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB standards listed below. Mark each treated item with AWPB Quality Mark Requirements.
1. Pressure-treat above-ground items with water-borne preservatives complying with AWPB LP-2. After treatment, kiln-dry to a maximum moisture content of 15%. Treat indicated items and the following:

   a) Wood cants, nailers, curbs, blocking, stripping and similar members in connection with roofing, sheathing, flashing, vapor barriers and waterproofing.

   b) Wood sills, sleepers, blocking, furring, strapping and similar concealed members in contact with masonry or concrete.

2. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

E. Rough Hardware:

1. Provide and install all rough hardware and metal fastenings as shown on the Drawings, specified herein or required for proper installation of carpentry and millwork.

2. Nails, spikes, screws, bolts and similar items shall be of sizes and types to rigidly secure members in place.

   a) Minimum fastener size and spacing shall comply with Table 2103-2 (Fastener Schedule for Structure Members) and with Appendix M, (Recommended Nailing Schedule), in the Massachusetts State Building Code.

   b) Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A153).

   c) Bolts and screws shall penetrate structural substrate at least 1/2 of a wood substrate thickness, at least 3" into concrete and masonry substrates and as shown on the drawings.

F. Insulation

1. Glass-Fiber Blanket Insulation.

   a) Manufacturers: Subject to compliance with requirements, provide products by CertainTeed Corporation, Johns Manville, Owens Corning, or equal.

   b) Sustainability requirements: Provide glass-fiber blanket insulation as follows:

      1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.

      2. Low Emitting: Insulation tested according to ASTM D 5116 and shown
to emit less than 0.05-ppm formaldehyde.

2. Spray Polyurethane Foam Insulation.
   a) Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   b) Manufacturers: Subject to compliance with requirements, provide products by BASF Corporation, Dow Chemical Company, Volatile Free, Inc. or equal.
   c) Minimum density of 1.5 lb/cu. Ft., thermal resistivity of 6.2 deg F x h x sq. ft. / Btu x in. at 75 deg F.

PART 3 - EXECUTION

3.01 ROUGH CARPENTRY

A. Rough Carpentry shall generally conform to the following:

   1. Provide all necessary wood framing, blocking, nailing strips, furring strips, nailing inserts, grounds, centers for masonry, rough door bucks, fascia, and usual items of similar nature as required to frame out and to secure and properly install the work of all trades indicated. Nailing shall be in accordance with Schedules listed in Products, Rough Hardware.

B. Wood blocking, nailers, grounds, furring and strapping:

   1. Install all built-in wood blocking, screeds and furring required for all interior finish work.

   2. Blocking nailers on masonry or concrete shall be bolted with not less than 5/16" bolts not over 2'-0" o.c. except as otherwise shown. Where finish fits blocking closely, counterbore holes for heads of bolts so that no metal projects beyond the face of the blocking.

   3. Provide solid wood blocking, 2 x 6 minimum in frame walls and 3/4" plywood in furred walls, for attachment of toilet partitions grab bars, wall hooks, toilet tissue dispensers, mirrors and all other wall-mounted accessories.

   4. Provide solid wood blocking, 2 x 6 minimum in frame walls, and 3/4" plywood in furred walls, for secure attachment of wall cabinets, base cabinets, and wall-supported counter tops, and all other wall-mounted fixtures or accessories.

C. Wood stud reinforcement

   1. Provide wood stud reinforcement around all door openings, fixed lite openings, window openings, etc. as shown on the drawings. Securely fasten wood stud reinforcement to adjacent metal studs.
3.02 PLYWOOD WORK

A. Install plywood with face grain perpendicular to supports; end joints occurring over the supports.

B. Allow minimum space 1/16 in. between end joints and 1/8 inch at edge joints for expansion and contraction of panels.

C. Stagger panel end joints.

D. Nail 4 in. o.c. along panel edges, (nail to each member of double sills or plates or other multiple members) and 12” o.c. at intermediate supports.

E. Use 10d ring-shank, or spiral-thread nails.

3.03 JOISTS, BEAMS, RAFTERS, STUDS, PLATES, SILLS

A. Install in accordance with plans and details.

B. Do not support joists or rafters with toe nails or end grain nails. Use approved joist and beam hangers.

3.04 CLEAN-UP

A. Upon completion of rough carpentry work in any given area, remove all rubbish and debris from the work area and deposit in one of the on-site dumpsters; leave in broom clean condition.

END OF SECTION
SECTION 062000

FINISH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 123000, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:

1. Solid hardwood and softwood for new interior trim conditions, and miscellaneous moldings and trims.
2. Modification of existing building components (including, but not limited to the existing raised platform, doors, and doorways) as required for handicap accessibility compliance modifications.
3. New custom millwork and natural linoleum-clad particleboard countertops, including reception desk and display shelving.
4. Glass for shelves in conjunction with custom display shelving.
5. Other items of exposed to view exterior and interior solid wood, plywood; and accessory installation materials, not otherwise excluded hereunder.
6. Shop finishing of wood cabinets, casework, and trim, for transparent finish.

B. Install the following items as furnished under the designated SECTIONS:

1. Metal doors: SECTION 081113, METAL DOORS AND FRAMES.
2. Wood doors: SECTION 081400, WOOD DOORS.
3. Finish hardware, except as otherwise specified herein: SECTION 087100, DOOR HARDWARE.
4. Toilet Accessories: Section 102813, TOILET ACCESSORIES, including Owner furnished accessories.
5. Designated items of specialties: SECTION 108000, MISCELLANEOUS SPECIALTIES.
6. Interior and door signage: SECTION 101400, IDENTIFYING DEVICES Interior and door signage: SECTION 101400, IDENTIFYING DEVICES.

C. Related SECTIONS:

1. Furnishing all finish hardware, except as otherwise specifies herein: SECTION 087100, FINISH HARDWARE.
2. Plywood panelboards, concealed from view plywood sheathing, solid wood nailers, blocking, and other rough lumber; and installation of pressed steel frames: SECTION 061100, ROUGH CARPENTRY.

1.03 ACTION SUBMITTALS

A. Submit the following in accordance with the provisions of SECTION 013300, SUBMITTALS:

1. Shop drawings: Complete fabrication drawings, including large scale joinery and installation details, of all millwork, central stair guardrail assembly modifications, and the full-height enamel steel writing surface to be furnished hereunder, indicating all materials, species, thicknesses, hardware, and other pertinent data.

2. Samples:
   a. Solid wood: 6-inch length of each species and cut, in each trim profile to be used, both for paint and transparent finishes.
   b. Shop-applied transparent finishes.
   c. Plywood: 6 by 6 inches of each species and thickness required, both for paint and transparent finishes.
   d. Hardware: One of each type as requested by the Architect.

1.04 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:

2. (Premium Grade for solid mahogany, only), in the following Sections:
   a. Section 100, Lumber
   b. Section 300, Standing & Running Trim, & Rails (Interior & Exterior)
   c. Section 400A, B, & C, Architectural Cabinets
   d. Section 600, Closet and Utility Shelving
   e. Section 1700, Installation of Architectural Woodwork (Interior)

1.05 WORKMANSHIP QUALITY STANDARDS

A. Refer to the Drawings for details of interior trim, casework, shelving, and other finish carpentry and millwork items.

B. Finish all solid wood and plywood surfaces smooth, and free from all machine and tool marks that will show through the finish.

C. Set all nails with nailpunch, countersink all screwheads, fill all head depressions with wood filler, and sand filler smooth to receive applied coatings.

D. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point.

FINISH CARPENTRY
062000 - 2
E. Make a minimum of splices and joints in running trim, and where such splices and joints occur, fasten securely, with all exposed surfaces having smooth, continuous planes.

1.06 MATERIALS QUALITY STANDARDS

A. All lumber shall conform to the following standards:

1. New, dressed four sides (S4S), clear and free from warping and other defects.
2. Conform to U.S. Department of Commerce Simplified Practice Recommendations R-16 for sizes and use classifications.
3. Kiln-dried and have a moisture content not exceeding 15 percent (15%) when de-livered to the project.
4. Be in accordance with the grading rules of the lumber manufacturer's association under whose jurisdiction the species of lumber is produced.

B. Plywood shall conform to the grading requirements of the American Plywood Association.

C. No finger jointed stock is to be used for any wood elements of the work specified here-in.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

C. Stack lumber, plywood, and other panels flat with spacers between each bundle to pro-vide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.08 FIELD CONDITIONS

A. Do not install finish carpentry materials that are wet, moisture damaged, or mold dam-aged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

B. Field Measurements: Where casework 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 pro-gress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:

5. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
6. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

B. Solid Hardwood and Hardwood Plywood items designated on the Drawings to Receive Clear Finish:

1. Solid White Oak for new interior hardwood items designated on the Drawings as hardwood to receive clear finish: Clear quarter sawn White Oak, AWI Premium Grade.
2. Veneer plywood for paneling, casework and millwork, and other interior areas noted on Drawings to receive hardwood plywood for stain and clear finishes: Solid, furniture quality plain sawn White Oak plywood with veneer core and top sheets, AWI Premium Grade.

C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

D. Softwood Plywood: DOC PS 1.

E. Hardboard: ANSI A135.4.

F. Linoleum: Natural linoleum consisting of ground cork, pine resin, wood flour and natural pigments and a jute fiber backing, in colors as selected by the Architect: Marmoleum as manufactured by Forbo Industries, or equal.
2.02 INTERIOR MATERIALS

A. Solid birch and/or poplar for new wood items designated in the Drawings to be painted: Plain sawn natural birch or yellow poplar, AWI Custom Grade.
   1. Panels for paint: MDO or MDF in thicknesses shown on the drawings.

B. Solid Hardwood and Hardwood Plywood items designated on the Drawings to Receive Clear Finish:
   1. Solid Maple for new interior hardwood items designated on the Drawings as hard-wood to receive clear finish: Clear plain or rift sawn Maple, AWI Premium Grade.
   2. Veneer plywood for paneling, casework and millwork, and other interior areas noted on Drawings to receive hardwood plywood for stain and clear finishes: Solid, furniture quality plain sawn Maple plywood with veneer core and top sheets, AWI Premium Grade.

C. Plywood: Fir plywood for non-clad shelving: AA-INT-APA.

D. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

2.03 MISCELLANEOUS MATERIALS

A. Installation accessories:
   1. Glue for lamination and fabrication of wood and plywood items: Exterior Grade, Waterproof resorcinol glue.
   2. Screws: Flat head hard aluminum or stainless steel screws, of the appropriate sizes; expansion type for attaching wood and plywood to masonry; and Type "S" self-tapping bugle head screws for applying wood and plywood to metal stud-framed gypsum wallboard surfaces.
   3. Sealants: Latex, complying with ASTM C 834, Type P, Grade NF and with applicable requirements in Section 071000, Waterproofing, Dampproofing & Caulking, and recommended by sealant manufacturer and manufacturer of substrates for intended application.

B. Glass for custom display shelving: Clear, heat-tempered float glass, conforming to ASTM 1048, Kind FT, 3/8-inch thick and having smooth-ground, polished and seamed edges where exposed to view.

C. Aircraft Cable Shelf Hanging System: Stainless steel aircraft cable system, including decorative cable, swaging, clips to support glass shelving, tensioners, and attachment hardware for concrete slab and deck. Specifications are based on Hanging Systems, as manufactured by Arakawa & Co., Portland, OR, or equal products as manufactured by Gyford Productions, Reno, NV.
   1. Aircraft Cable: Solid stainless steel, 3/32-inch, 7 x 7 weave aircraft cable, in lengths as required, with fully soldered ends.
   2. Ceiling Cable Mounts: Solid stainless steel, tapered, round aircraft cable gripper, for 3/32-inch cable, with 3/8-16 threaded stud, Model SF38SET as manufactured by Arakawa & Co.
a. Concrete Anchor: 3/8-inch, 9/16-inch diameter by 1 9/16-inch long, zinc plated drop-in anchor, with 3/8-16 female thread, Confast Model DI38 as manufactured by Concrete Fastening Systems Inc., Cleveland, OH, or equal.

3. Shelf Mounts: Solid stainless steel, 25/32-inch diameter, cylindrical aircraft cable gripper, for 3/32-inch cable, for support of shelves, with set screws mounted at the bottom to attach support to shelf, in both singled sided and two-sided models; Models FRG1SS and FRG2SS as manufactured by Arakawa & Co.

4. Concrete Slab Cable Mounts: Solid stainless steel, 5/8-inch diameter, cylindrical aircraft cable gripper, for 3/32-inch cable, with a threaded base, matching female threaded base socket; Models SF23BO and SF23BSET as manufactured by Arakawa & Co. Provide with 1/4-20 concrete anchor and 1/4-20 hex head bolt for attaching to concrete slab.

a. Concrete Anchor: Same as above with the following exceptions: 1/4-20 size, Confast Model DI14, or equal.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

A. Do not deliver finish carpentry materials to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.

B. Ship and handle finish carpentry materials in a manner which will prevent damage thereto, and store all materials at a dry and safe on-site location. Store wood, plywood, and plastic laminate materials at protected interior locations, only.

3.02 FABRICATION AND INSTALLATION OF STANDING AND RUNNING TRIM

A. Fabricate and install all standing and running trim in accordance with the details on the Drawings, the approved shop drawings, and workmanship standards set forth in the AWI Quality Standards Sections 300 and 1700, for Custom Grade (Premium Grade for interior Maple standing and running trim, only).

3.03 HANGING AND FITTING OF DOORS

A. Receive, store, and be responsible for all hardware as furnished under SECTION 087100, FINISHING HARDWARE, except casework hardware specified herein.

B. Fit all hardware accurately, from templates supplied with hardware, apply securely, and adjust carefully. Except as otherwise indicated, all locksets shall be of the mortise type.

C. Perform all modifications to existing doors as required for the proper installation of new hardware. Provide all trim plates, fillers, and hardware as required by the removal of existing hardware and components to ensure that all original receiving surfaces are smooth and level with existing adjacent materials and surfaces.
D. Prior to Substantial Completion of the Contract, and before space is occupied, inspect entire limit of work area with the Architect, and see that each piece of finish hardware is un-damaged and in perfect order and that the proper key for each lock is identified.

3.04 INSTALLATION OF SPECIALTIES

A. Receive, store, and be responsible for designated items of miscellaneous specialties, as furnished under SECTION 108000, MISCELLANEOUS SPECIALTIES.

B. Perform the installation of the various specialty items in accordance with the respective manufacturers' recommendations, using fasteners which are provided with the items. To the fullest extent possible, use concealed fastening procedures. Provide any supplementary fastenings need to properly install the items.

C. Upon completion of the installation, thoroughly clean all surfaces free from handling marks, dirt, and foreign matter.

3.05 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.06 FINAL INSPECTION

A. Just prior to the completion of all work under this SECTION 062000, inspect all portions of the work and make any required adjustments or corrections to the work.

B. Repair damaged and defective cabinets, casework, and trim where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

C. Clean, lubricate, and adjust hardware.

D. Clean exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

FINISH CARPENTRY
062000 - 8
SECTION 071000

WATERPROOFING, DAMPPROOFING AND CAULKING

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER'S CHECK or CASHIER'S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 123000, ALTERNATES, for alternates which may affect the work of this SECTION.

1.03 SUMMARY

A. Section Includes:

1. Non-sagging type urethane sealant, with compressible joint bead back-up, for the following exterior joints:

   a. Perimeter joints between the following new items which penetrate exterior walls and surrounding construction:

      1. Window frames.
2. Door frames.

3. Entrance frames.

4. Other non-specified items indicated.

b. Joints between lap siding and trim and other locations within the exterior siding and trim system where shown on the drawings and recommended by the siding and trim manufacturer.

c. Other exterior joints designated on the Drawings to receive "sealant," except as otherwise specified hereunder.

2. Self-leveling type urethane sealant, with compressible joint bead back-up, for upper 1/2-inch of the following joints:

a. Between exterior walls of the building and new abutting platforms, steps, and retaining walls, except as otherwise designated on the Drawings.

b. Between metal thresholds in exterior walls and abutting dissimilar materials.

c. Between interior on-grade concrete floor slabs and interior surface of abutting concrete foundation walls.

3. Latex caulking material, with compressible joint bead back-up, for the following interior joints:

a. Perimeter joints of all items specified under Paragraph 1.02 A.1.a.

b. Other interior joints, indicated on the Drawings to receive "caulking", except as otherwise specified herein.

B. Perform all preparation of joints and surfaces receiving materials under this SECTION 071000, as required for the proper installation and performance of the various materials, including, but not necessarily limited to, the following:

1. Completely clean all joints, cracks, and surfaces, free form dirt, dust, and other matter which would adversely affect the bonding and adhesion of materials to be installed hereunder.

2. Clean and prepare, in accordance with the material manufacturer's recommendations, all surfaces specified to receive bituminous mastic materials.
3. Furnish and apply temporary masking material on each side of joints specified to receive sealant and caulking materials, as required to completely protect adjacent surfaces from damage and excess material.

1.04 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

1. Sealant materials in conjunction with gypsum drywall work: SECTION 092100, Gypsum Board Assemblies.

2. Sealant materials around items which penetrate ceramic tile, and between ceramic tile and dissimilar materials: SECTION 093013, Tiling.

3. Sealant materials as they relate to building systems commissioning: SECTION 019113 COMMISSIONING REQUIREMENTS.

1.05 PERFORMANCE REQUIREMENTS

A. Commonwealth of Massachusetts Building Code Requirements: The intent of this specification is to require compliance with 780 CMR for air leakage through exterior walls and roofs as modified by the Work.

1.06 SUBMITTALS

A. Submit the following, in accordance with the provisions of SECTION 013300, Submittal Procedures:

1. Samples:

   a. Sealants and caulking materials: 3-inch strips of each specified type, in all available colors for selection by the Architect, applied to pieces of hardboard or plywood.

   1. Compressible back-up bead: 6-inch length of specified type, 1/2 by 1/2 inch.

2. Literature: Manufacturer's product data, specifications, and application data, for each material to be furnished hereunder. Include recommendations for sealing penetrations and perimeter at air barrier membrane.

3. Certifications: Manufacturer's certification of compliance with the designated standards and specifications set forth herein for each material to be furnished hereunder, together with supporting testing data and chemical composition of each material.

4. Guarantees and warranties: Manufacturer's standard written guarantee, or warranty, for each material furnished hereunder, covering defects in materials and manufacturing workmanship.
1.07 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:

2. General Services Administration PBS 07111.
3. HUD Materials Release 628a.
4. Corps of Engineers CEGS-7111-3-82.
5. American Railway Engineering Association (Chapter 29, manual).

PART 2 - PRODUCTS

2.01 PACKAGING AND STORAGE

A. Each container and package must bear an unbroken seal and label of the manufacturer upon delivery to the site. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by the Architect and his requiring its removal from the site. Promptly furnish new material, conforming to said requirements, at no additional cost to the Contract.

1. Provide substantial weatherproof coverings for all materials stored on the site, and maintain the coverings in place until materials are actually used. Store all materials in an elevated location, away from contact with the ground, and not subject to frost or freezing.

1. Ensure that the manufacturer's recommended temperatures for storage of each material is strictly followed.

2.02 SEALANTS AND CAULKING MATERIALS

A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.
1. Products: Subject to compliance with requirements, provide one of the following products, or equal, in color as selected by the Architect:

   a. BASF Building Systems; Sonolastic NP1.
   b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
   c. Tremco Incorporated; Vulkem 116.

C. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide one of the following products, or equal, in color as selected by the Architect:

   a. BASF Building Systems; Sonolastic SL 1.
   b. Pecora Corporation; Urexpan NR-201.
   c. Sika Corporation, Construction Products Division; Sikaflex - 1CSL.
   d. Tremco Incorporated; Vulkem 45.

D. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following products, or equal, in color as selected by the Architect:

   a. BASF Building Systems; Sonolac.
   b. Pecora Corporation; AC-20+.
   c. Tremco Incorporated; Tremflex 834.

E. General: Provide sealant backings of material 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.

1. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

F. Joint preparation materials, primer, bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

2.03 MASTIC COATING MATERIAL

A. Mastic coating: Fibrated solvent-based asphalt dampproofing, brush grade, conforming to ASTM D-4479, Type II, Meadows Sealmastic Semi-Mastic, Karnak No. 83 Fibrated Dampproofing, Sonneborn Hydrocide Semi-Mastic, or equal.
PART 3 - EXECUTION

3.01 PRE-APPLICATION CONDITIONS

A. Ensure that all receiving surfaces, weather conditions, and temperatures are in conformance with the recommendations of the manufacturers of the specific materials before commencing application of same, and that such conditions can be maintained during the application period.

B. Thoroughly clean all receiving surfaces free from dirt and foreign matter which would otherwise adversely affect the application and performance of the materials. Apply primer if recommended by manufacturer of air barrier membrane material.

C. Coordinate the application of the various materials hereunder with the work of other trades responsible for applying overlaying and interfacing materials, and schedule the work so as not to delay the related work.

D. Ensure that all joints, receiving sealant and caulking materials hereunder, are clean, dry, and conform in material, size, and configuration to the recommendations of the manufacturer whose specific product is proposed be installed therein. Except for cleaning thereof, required to be performed hereunder, report all non-conforming joint conditions to the Architect, and request disposition for same. Do not commence applying the sealant and caulking materials until such disposition has been received.

E. Protect all adjacent work from damage by work performed under this SECTION 071000. Apply non-staining masking tape to exposed faces on each side of joints designated to receive sealant and caulking materials.

3.02 INSTALLATION OF SEALANTS AND CAULKING MATERIALS

A. After cleaning joints, apply primer to all joint surfaces, if so recommended by the specific sealant material manufacturer, taking care not to stain adjacent surfaces.

B. Install joint bead back-up in all joints in excess of 5/8-inch depth (from face of wall or horizontal surface, as applicable, to edge of compressible joint filler), and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances specified hereunder. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.

C. Apply self-leveling type sealant by pouring directly into joint. Apply sealant and caulking material in joint using a hand caulking gun or power gun with a gun nozzle of proper size and sufficient pressure to completely fill joints. The depth of sealant and caulking materials shall be in accordance with the recommendations of the materials manufacturer for the specific joint function but in no case exceed 1/2 inch in depth, nor less than 1/4 inch, regardless of the width of the joints; and outer edge of sealant and caulking material occurring where sides of joint are in the same plane, shall be kept back 1/8 inch from face to wall. Tool with a dry or water-wet tool, only. Do not use detergents or soapy water for tooling operations. Joints shall be given a slight concave surface. Remove masking tape immediately after tooling and/or before sealant
and caulking material has taken initial set.

D. Do not apply materials to frost-containing surfaces, or when proper conditions can not be maintained for the duration of the application and curing period.

3.03 MASTIC COATING APPLICATION

A. Apply a heavy brush coat of specified semi-mastic coating, unthinned, in a continuous unbroken film to all surfaces of steel relieving angles, steel lintels, and other structural shapes in exterior masonry walls, which will be concealed after installation of masonry and interior finishes. Do not coat steel surfaces that will be exposed to view either on the exterior or interior.

3.04 CLEANING

A. Clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this SECTION, removing all excess mastics, sealants, and caulking materials and solvents that will not damage the surfaces in any way.

END OF SECTION
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON-TEXT PAGE
SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation, in conjunction with wood stud assemblies, insulation laid over suspended drywall construction ceilings and soffits, for various locations indicated on the Drawings.

2. Acoustical glass-fiber blanket insulation in wood stud interior walls, and for various other locations indicated on the Drawings indicating insulation in conjunction with framing of gypsum drywall assemblies with the exception of thermal batt insulation noted above.

3. Spray polyurethane foam insulation where shown on the Drawings and as required to fill gaps, cracks and other voids too small of inaccessible for batt or other specified insulation systems.

4. Vapor retarders applied to interior flanges of framing studs in new and existing exterior walls, after installation of insulation in conjunction therewith, where covered directly by gypsum drywall.

5. Fire resistant vapor retarders, applied to interior faces of framing, after installation of insulation in conjunction therewith, and in other exposed locations not covered directly by gypsum drywall.

B. Related Sections:

1. Section 074213, Insulated Metal Wall Panels for manufactured insulating wall panels.

2. Section 075100, Built-Up Asphalt Roofing for rigid insulation in conjunction with roofing.

3. Sections 092100, Gypsum Board Assemblies and 061100, Rough Carpentry for wood-framed assemblies.

4. Section 078400, Firestopping for firesafing batt insulation, and other firesafing materials, packed around all pipes, ducts, conduits, and similar items, which penetrate fire-rated partitions, for the full partition thickness at such penetration locations; and packed around similar items which penetrate concrete floors and roof decks.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
1.04 INFORMATIONAL SUBMITTALS
A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.05 QUALITY ASSURANCE
A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.01 FOAM-PLASTIC BOARD INSULATION
A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

   1. Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured by the Dow Chemical Company, or equal product by one of the following:
      a. DiversiFoam Products.
      b. Owens Corning.

   2. Type VI, 25 psi.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.02 GLASS-FIBER BLANKET INSULATION
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers, or equal:
B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
   1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
   2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.03 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers, or equal:
      a. BASF Corporation.
      b. Dow Chemical Company
      c. Volatile Free, Inc.
   2. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.04 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
   1. Products: Subject to compliance with requirements, provide products by one of the following manufacturers, or equal:
      a. Raven Industries Inc.; DURA-SKRIM 6WW.

B. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft., with maximum permeance rating of 0.1317
perm (7.56 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively, per ASTM E 84.

1. Products: Subject to compliance with requirements, provide products by one of the following manufacturers, or equal:
   a. Raven Industries Inc.; DURA-SKRIM 2FR.
   b. Reef Industries, Inc.; Griffolyn T-55 FR.

C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

D. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

2.05 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Products: Subject to compliance with requirements, provide products by one of the following manufacturers, or equal:
   a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
   b. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030-inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

1. Products: Subject to compliance with requirements, provide products by one of the following manufacturers, or equal:
   a. AGM Industries, Inc.; SC150.
   b. Gemco; S-150.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates: As recommended by the anchor manufacturer. Two 1/2 inches staples per anchor plate, set on opposite sides of spindle, and driven completely, is also acceptable.
PART 3 - EXECUTION

3.01 PREPARATION
   A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL
   A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
   B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
   C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
   D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF BELOW-GRADE INSULATION
   A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
      1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.
   B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
      1. If not otherwise indicated, extend insulation a minimum of 48 inches in from exterior walls.

3.04 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION
   A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
   B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
      1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
      2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
      3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.05 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.06 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.07 PROTECTION

A. 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 is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION
SECTION 074213

INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:

1. Foamed-insulation-core metal wall panels.

B. Related Requirements:

1. Section 075100, Built-Up Asphalt Roofing, for roofing and flashing tie-ins.
2. Section 077100, Roof Specialties, for gutters and downspouts, installed over Insulated Metal Wall Panels.
3. Section 084523, Translucent Fiberglass Wall Panels, for translucent fiberglass wall panels inserted into Insulated Metal Wall Panels.
4. Section 085113, Aluminum Windows, for windows inserted into Insulated Metal Wall Panels.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's Project Manager, metal panel Installer, metal panel manufacturer's representative, and installers whose work interfaces with or affects metal panels, including installers of windows, translucent panels, roofing, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.
   1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.
1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

   1. Build mockup of typical metal panel assembly, full height, including a minimum of three panels, including one corner, supports, attachments, and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if approved in writing by the Architect.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.09 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.
1.10 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 72:

1. Wind Loads: 35 psf.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations 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.

E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

2. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
3. Potential Heat: Acceptable level when tested according to NFPA 259.
4. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

2.02 MANUFACTURERS

A. To establish a standard of quality, design, and function desired, specifications have been based on KS Optimo, as manufactured by Kingspan Insulated Panels, Inc., Deland, FL, or equal products as manufactured by the following:

1. MBCI, a Division of NCI Group, Inc.; Lewisville, TX.
2. ATAS International, Inc., Allentown, PA.

B. Source Limitations: Obtain insulated metal wall panels system components, including primary and secondary framing, from single source from single manufacturer.

2.03 FOAMED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
   a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
   b. Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D 1622.
   c. Compressive Strength: Minimum 20 psi (140 kPa) when tested according to ASTM D 1621.
   d. Shear Strength: 26 psi (179 kPa) when tested according to ASTM C 273/C 273M.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with thermally-broken tongue-and-groove panel edges; designed for sequential, vertical installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

1. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Nominal Thickness: 22 gauge, at both interior and exterior face sheets.
   b. Exterior Finish: Three-coat fluoropolymer, 0.8 mil primer with 0.8 mil Kynar 500 (70 percent) solid color coat and 0.8 mil clear coat.
      1) Color: As selected by Architect from manufacturer's full range.
      2) Profile: Flat
      3) Texture: Smooth
   c. Interior Finish: Siliconized polyester.
      1) Color: As selected by Architect from manufacturer's full range.
      2) Profile: Linear striations nominal 0.0625-inch deep by 3/4-inches wide at 3 inches on center.
      3) Texture: Manufacturer's standard, non-directional stippled, stucco, or stone embossed

4. Panel Thickness: 4.0 inches.
5. Thermal-Resistance Value (R-Value): 7.2 per inch at 75°F according to ASTM C518.
6. Heat Transfer Coefficient (U-factor): 0.40 per inch at 75°F according to ASTM C 1363. Tested specimen must include at least two engaged side joints.
2.04 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Backer Board: Hardboard complying with ANSI A135.4, Class 1 tempered, 1/4 inch thick unless otherwise indicated.

D. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

E. Panel Fasteners: Self-tapping screws designed to withstand design loads, in cadmium plated steel with neoprene washer, as recommended by the manufacturer. Provide any exposed fasteners with heads matching color of metal panels with factory-applied coating. Provide 12-gauge stainless steel clips for use in conjunction with fasteners, as recommended by the manufacturer.

F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
2.05 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

   a. Size: As recommended by SMACNAs "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.06 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective 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 same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat,
and apply coating to exposed metal surfaces to comply with coating and resin manufacturers’ written instructions.

2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

3. Concealed Finish: Apply pretreatment and manufacturer’s standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.03 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistant barriers and flashings that will be concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.
   1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Section 071000 "Waterproofing, Dampproofing & Caulking."

3.04 INSULATED METAL WALL PANEL INSTALLATION

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
   1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
   2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
   3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
   4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
   6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.

1. Install clips to supports with self-tapping fasteners.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

B. Metal wall panels will be considered defective if they do not pass test and inspections.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.06 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On
completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213
SECTION 075100

BUILT-UP ASPHALT ROOFING

PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS.

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER'S CHECK or CASHIER'S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Work to be done under this Section 075100, Built-Up Asphalt Roofing, includes all the work included in Section 077100, Roof Specialties.

C. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.03 SUMMARY

A. Section Includes:

1. Selective demolition and removal of existing roofing as required to complete the work.
2. Patching of existing built-up asphalt roofing, which may also include the following, as required:
a. Substrate board.
b. Roof insulation.

3. Flashing new penetrations, vents, and curb-mounted equipment, as shown on the Drawings.
4. Temporary roofing.
5. The work of Section 077100, Roof Specialties, is included in this Section.

B. Section includes the cutting and removal of sections of existing roofing as required to complete the work.

C. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking, and for wood-based, structural-use roof deck panels.
2. Section 077100 "Roof Specialties" for premanufactured metal copings, roof edge fasciae, gravel stops, counterflashings, gutters, and downspouts.

1.04 DEFINITIONS


1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and roofing terminations.
3. Flashing details at penetrations.
4. Insulation-fastening patterns for corner, perimeter, and field-of-roof locations.
5. Tie-in with adjoining roofing.

C. Samples for Verification: For the following products:

1. Flashing Sheet: Samples of manufacturer's standard colors for selection by Architect.
2. Aggregate surfacing material in gradation and color to match existing, only if existing gravel needs to be supplemented.

D. Work plan for patching and isolated re-roofing work: Include staging area, material storage (on ground and on roof) temporary protective measures and plans for removing existing roofing, cleaning and prepping substrate and re-roofing and/or patching in the same day.
E. Temporary Roofing Submittal: Product data and description of temporary roofing system.

   1. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer stating acceptance of the temporary roof and that its inclusion does not adversely affect the new roofing system's resistance to fire and wind.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:

      a. Submit evidence of compliance with performance requirements.

   2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For roof insulation, tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

   1. Fastener pull-out test report.

F. Sample Warranties: For manufacturer's special warranties.

G. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations.

   1. Submit before Work begins.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer, stating that existing roof warranty has not been affected by Work performed under this Section.
1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer.
   1. Protect stored liquid material from direct sunlight.
   2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
   1. Store in a dry location.
   2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.

B. Existing Roofing System: Built-up asphalt.

1.11 WARRANTY

A. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system, such as roofing membrane, and base flashing, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

B. Owner will occupy portions of building immediately below reroofing area, during portions of the Work period.
   1. Conduct reroofing so Owner's operations are not disrupted.
   2. Provide Owner with not less than 72 hours' written notice of activities that may affect Owner's operations.
   3. Coordinate work activities daily with Owner so Owner has adequate advance notice to place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.

C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

E. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to 35 lbs./sf for uniformly distributed loads.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
   1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746/C 3746M, ASTM D 4272/D 4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897, per Massachusetts Building Code, 780 CMR, Ninth Edition.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency.
   1. Identify products with appropriate markings of applicable testing agency.
E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
   1. Identify products with appropriate markings of applicable testing agency.

2.02 MANUFACTURERS

A. Source Limitations: Obtain components for roofing system from same manufacturer as roofing membrane or manufacturer approved by roofing membrane manufacturer.

2.03 ROOFING MEMBRANE SHEET MATERIALS

A. Base Sheet: ASTM D 4601/D 4601M, Type I, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

B. Base Sheet: ASTM D 2626/D 2626M, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.


2.04 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 2178/D 2178M, Type IV, asphalt-impregnated, glass-fiber felt.

B. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668/D 1668M, Type I.

C. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

2.05 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D 41/D 41M.

B. Roofing Asphalt: ASTM D 312/D 312M, Type III.

2.06 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with other roofing components.
   1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
C. Roof Vents: As recommended by roof membrane manufacturer.
   1. Size: Not less than 4-inch (100-mm) diameter.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

E. Cold-Applied Polymer-Modified Asphalt Adhesive: Roof membrane manufacturer's standard solvent- and asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing system, base flashings, and aggregate surfacing adhesive.

F. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required by roofing manufacturer for application.

G. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.

I. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.07 VAPOR RETARDER

A. Polyethylene Film: ASTM D 4397, 10 mils (0.25 mm) thick, minimum, or match existing, with maximum permeance rating of 0.13 perm (0.04 metric perm).
   1. Adhesive: Manufacturer's standard lap adhesive, FM Global approved for vapor-retarder application.

2.08 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roof membrane manufacturer.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) minimum density, 25psi (173kPa) minimum compressive strength, square edged.
   1. Thermal Resistance: R-value of 5.0 per inch (25 mm).
   2. Size: 48 by 96 inches (1219 by 2438 mm).
   3. Thickness:
      a. Base Layer: 1-1/2 inches (38 mm), or match existing.
      b. Upper Layer: Match existing.
2.09 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and accepted by roofing manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.

2. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Insulation Cant Strips: ASTM C 728, perlite insulation board.

E. Wood Nailer Strips: Comply with requirements in Section 061000 "Rough Carpentry."

F. Tapered Edge Strips: ASTM C 728, perlite insulation board.

G. Joint Tape: 6- or 8-inch-wide, coated, glass fiber.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F 2170.

   a. Test Frequency: One test probe per each 1000 sq. ft., or portion thereof, of roof deck, with not less than three test probes.

   b. Submit test reports within 24 hours of performing tests.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.02 PREPARATION

A. Protection of In-Place Conditions:
   1. Protect existing roofing system that is not to be reroofed. Unless otherwise approved, provide the following temporary roof protection:
   2. Loosely lay 1-inch-minimum thick, EPS insulation over existing roofing in areas not to be reroofed.
      a. Loosely lay 15/32-inch plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of 1 inch.
   3. Limit traffic and material storage to areas of existing roofing that have been protected.
   4. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
   5. Comply with requirements of existing roof system manufacturer's warranty requirements.

B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.

C. Shut off rooftop utilities and service piping before beginning the Work.

D. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.
   1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

E. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

F. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.
   1. Prevent debris from entering or blocking roof drains and conductors.
      a. Use roof-drain plugs specifically designed for this purpose.
      b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
   2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.
      a. Do not permit water to enter into or under existing roofing system components that are to remain.

G. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions.
   1. Remove sharp projections.

H. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

I. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m), and allow primer to dry.

J. Perform fastener-pullout tests according to roof system manufacturer's recommendations.

1. Submit test result within 24 hours of performing tests.
   a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.03 ROOFING DEMOLITION

A. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.

B. Remove aggregate ballast from roofing. Store aggregate ballast for reuse in manner not to exceed structural loading limitations of roof deck.

C. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing using a power broom.

D. Where indicated on Drawings, remove existing roofing down to concrete deck and immediately check for presence of moisture.

1. Survey exposed substrate that is to remain using electrical capacitance/impedance testing according to ASTM D 7954/D 7954M.
   a. Prepare survey report indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.

2. Remove wet or damp materials below existing roofing and above deck as directed by Architect.
   a. Removals, beyond the limits indicated on or required by the Work shown on, the Contract Documents, is paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

3. Inspect wood blocking, curbs, and nailers for deterioration and damage.
   a. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
   b. Removals, beyond the limits indicated on or required by the Work shown on, the Contract Documents, is paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

4. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry.
a. Remove unadhered bitumen, unadhered felts, and wet felts.

5. Remove excess asphalt from steel deck that is exposed by removal of wet or damp materials.
   a. A maximum of 15 lb/100 sq. ft. (0.72 kg/sq. m) of asphalt is permitted to remain on steel decks.

E. Remove fasteners from deck or cut fasteners off slightly above deck surface.

3.04 ROOFING INSTALLATION, GENERAL

A. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.

1. Remove and discard temporary seals before beginning work on adjoining roofing.

B. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

C. Asphalt Heating:

1. Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.
2. Circulate asphalt during heating.
   a. Do not raise asphalt temperature above equiviscous temperature range more than one hour before time of application.

3. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating.
4. Do not heat asphalt within 25 deg F (14 deg C) of flash point.
5. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
   a. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

D. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing components or adjacent building construction.

3.05 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.
1. Tightly butt substrate boards together.

3.06 VAPOR RETARDER INSTALLATION

A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.
   1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
   2. Continuously seal side and end laps with adhesive.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.07 INSULATION INSTALLATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install one lapped base sheet course and mechanically fasten to substrate according to roofing membrane manufacturer's written instructions.

D. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane with vertical surfaces or angle changes greater than 45 deg (14 deg C).

E. Installation Over Concrete Decks:
   1. Install base layer of insulation with end joints staggered not less than 12 inches in adjacent rows.
      a. Make joints between adjacent insulation boards not more than 1/4 inch in width.
      b. Fill gaps exceeding 1/4 inch with insulation.
      c. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

   2. Install upper layers of insulation, with joints of each layer offset not less than 12 inches from previous layer of insulation.
      a. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
      b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
      c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
d. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.
   1) Trim insulation so that the flow of water is not restricted.

e. Fill gaps exceeding 1/4 inch with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

3.08 BUILT-UP ROOFING MEMBRANE INSTALLATION

A. Install roofing according to roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA’s "Quality Control Guidelines for the Application of Built-up Roofing" and as follows:

1. Base Sheet: One.
2. Number of Ply Sheets: Three.

B. Coordinate installation of roofing, so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches and 6 inches, respectively.

D. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:

1. Adhere to substrate solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer.

E. Install three ply sheets, starting at low point of roof.

1. Align ply sheets without stretching.
2. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane.
   a. Shingle in direction to shed water.
3. Extend ply sheets over and terminate above cants.
4. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.
5. Install ply sheets without wrinkles, tears, and free from air pockets.

F. Aggregate Surfacing: After installing and testing roofing, base flashing, and stripping, promptly apply flood coat to roof surface with 60 lb/100 sq. ft. (3.0 kg/sq. m) of hot roofing asphalt. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:

1. Aggregate Weight: 300 lb/100 sq. ft. (15 kg/sq. m).
2. If aggregate surfacing is delayed, promptly apply glaze coat of hot roofing asphalt at a rate of 10 lb/100 sq. ft. (0.5 kg/sq. m).

3.09 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer Sheet Application: Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt.
3. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above built-up roofing and 4 inches (100 mm) onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing.

D. Install liquid flashing system according to manufacturer's recommendations.

1. Extend liquid flashing not less than 3 inches (76 mm) in all directions from edges of item being flashed.
2. Embed granules, matching color of roof membrane, into wet compound.

E. Install stripping according to roofing system manufacturer's written instructions, where metal flanges and edgings are set on roofing membrane.

1. Flashing Sheet Stripping: Install flashing sheet stripping in a continuous coating of asphalt roofing cement, in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C), and extend onto roofing membrane, in cold-applied adhesive, or in cold-applied polymer-modified adhesive.
3.10 FIELD QUALITY CONTROL

A. Perform the following tests:

1. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
   a. Perform tests before overlying construction is placed.
   b. Flood to an average depth of 1-inch with a minimum depth of 1/2-inch and not exceeding a depth of 2-inches.
   c. Flood each area for 24 hours.
   d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

1) Cost of retesting is the responsibility of the Contractor.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing components that do not comply with requirements, repair substrates, and repair or reinstall roofing to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075100
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON-TEXT PAGE

BUILT-UP ASPHALT ROOFING
075113 - 16
SECTION 077100

ROOF SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The work of this Section, 077100, Roof Specialties is part of the work of Section, 075100, Built-Up Asphalt Roofing.

C. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 075100, Built-Up Asphalt Roofing for roof demolition and patching.
3. Section 071000 "Waterproofing, Dampproofing, & Caulking" for field-applied sealants between roof specialties and adjacent materials.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

E. Samples for Verification:
   1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
   2. Include copings, roof-edge flashings, and roof-edge drainage systems made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

F. Field constructed mock-ups: Provide the following mock-ups of sheet metal item installation for review and approval of the Architect prior to the installation of the work item. Specific location of each mock-up is to be selected by the Architect. Repeat mock-ups until approval is obtained.
   1. 10-foot length of metal gutter, rake and eave drips, downspout, reinforcing, hangers, and typical brackets.

G. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

H. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Sample Warranty: For manufacturer's special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.
1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.08 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075100, Built-Up Asphalt Roofing.

B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
2.02 ROOF-EDGE SPECIALTIES

A. Canted Roof-Edge Fascia and Gravel Stop: Two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

1. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick.
   a. Surface: Smooth, flat finish.
   b. Finish: Three-coat fluoropolymer.
   c. Color: As selected by Architect from manufacturer's full range.

2. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

2.03 ROOF-EDGE DRAINAGE SYSTEMS

A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1/2 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Aluminum Sheet: 0.050 inch thick.
2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
4. Gutter Supports: Gutter hanging straps and leading edge reinforcing to be 1-inch by 1/8-inch solid aluminum, with a mill finish.
5. Fasteners:
   a. Bolts, for fastening gutter hanging straps through gutter and leading edge reinforcing: 1/4-20 by 1 1/4-inch round- or pan head, with matching nuts, stainless steel.
   b. Lag bolts for fastening gutter hanging straps to wood blocking: 1/4 by 1 1/2 min, hex head lag screws, 2 per gutter strap, stainless steel, with neoprene washers.

6. Gutter Accessories: Wire basket type, formed from No. 14 B&S gauge stainless steel wire, with top of bonnet slightly below top edge of gutter, and fitting snugly into leader tube.

B. Downspouts: Plain rectangular complete with mitered elbows, manufactured from metal and finish to match gutters. Furnish with metal hangers, from same material as downspouts, and stainless steel anchors.

C. Splash Blocks: Precast concrete formed splash blocks.

D. Aluminum Finish: Three-coat fluoropolymer.
1. Color: As selected by Architect from manufacturer's full range.

2.04 REGLETS AND COUNTERFLASHINGS

A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflushing pieces, from the following exposed metal:

1. Formed Aluminum: 0.050 inch thick.
2. Corners: Factory mitered and soldered.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

B. Counterflushings: Manufactured units of heights to overlap top edges of base flushings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flushings with joints lapped, or in conjunction with existing through-wall-flashing, from the following exposed metal:

1. Formed Aluminum: 0.032 inch thick.

C. Aluminum Finish: Mill finish.

2.05 MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.06 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum.

2.07 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Series 300 stainless steel.
B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.


2.08 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

   a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

   b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.03 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.


1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.04 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch centers.
2. Interlock face-leg drip edge into continuous cleat anchored to substrate at 24-inch. Anchor back leg of coping with screw fasteners and elastomeric washers at 24-inch.

3.05 ROOF-EDGE SPECIALITIES INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.06 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

1. Provide elbows at base of downspouts at grade to direct water away from building.

3.07 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.08 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100
SECTION 078400

FIRESTOPPING

PART 1  GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Furnish and install firestopping in the following locations, in accordance with MGL 780 CMR:

1. In concealed wall spaces, concealed spaces at the ceiling and floor or roof levels of combustible framed spaces, in voids created by expansion joints, whether with or without expansion joint covers, connections between horizontal and vertical spaces, at ceiling and floor openings, in voids behind interior and exterior architectural trim in excess of 20 feet in length, and in voids behind combustible finishes and trim.

B. Firestop penetrations in rated wall, roof and floor assemblies wherever they occur using a sealant or filler rated at the same or higher than the assembly.

C. Perform all preparation of joints and surfaces receiving materials under this SECTION 078400, as required for the proper installation and performance of the various materials, including, but not necessarily limited to, the following:

1. Completely clean all joints, cracks, and surfaces, free from dirt, dust, and other matter which would adversely affect the bonding and adhesion of materials to be installed hereunder.

2. Clean and prepare, in accordance with the material manufacturer's recommendations, all surfaces specified to receive bituminous mastic materials.

3. Furnish and apply temporary masking material on each side of joints specified to receive sealant and caulking materials, as required to completely protect adjacent surfaces from damage and excess material.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

1.04 DESIGN REQUIREMENTS

A. Devices and materials shall meet the hourly fire resistance ratings required by the Project as determined by UL 263, UL 1479, UL 2079, ASTM E 119 or ASTM E 814 and be listed and detailed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide, or the Omega Point Laboratories Listings Directory.

1. Exception: Where no listed designs exist that meet the requirements of a specific project condition, submit details and manufacturer’s written recommendations for a design meeting the requirements. Include evidence of engineering judgment and extrapolation from listed designs.

1.05 SUBMITTALS

A. Submittals Package: Submit the following items specified below the same time as a package:
   1. Product Data.
   2. Samples.
   3. Quality Control Submittals.
   4. Firestop Schedule.

B. Product Data: Catalog sheets, specifications and installation instructions for each firestop device and material.
   1. Indicate design number for each firestop proposed to be used which is detailed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide, or the Omega Point Laboratories Listings Directory.
   2. State the specific locations where each firestop system is proposed to be installed.

C. Samples: One of each product if requested.

D. Quality Control Submittals:
   1. Design Data: Show details and include engineering information and manufacturer’s written recommendations required under Design Requirements Article for each proposed firestop if other than a design detailed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide, or the Omega Point Laboratories Listings Directory.
      a. State the specific locations where each firestop is proposed to be installed.

E. Firestop Schedule: Submit schedule itemizing the following:
   1. Manufacturer’s product reference numbers and/or drawing numbers.
   2. UL, Inchcape Testing Services, Factory Mutual Research Corp., or Omega Point Lab design number.
   3. Location of firestop material.
   4. Penetrating Item Description/Limits: Material, size, insulated or uninsulated, and combustibility.
   5. Maximum allowable annular space or maximum size opening.
   6. Wall type construction.
   7. Floor type construction.
   8. Hourly Fire resistance rating of wall or floor.
   10. T rating, if available.

NOTE: Firestop Schedule is for information only, and will not be acted on for approval.
1.06 QUALITY ASSURANCE

A. Container/Package Labels: Include manufacturer’s name and identifying product number, date of manufacturer, lot number, shelf life (if applicable), qualified testing and inspecting agency classification marking, curing time, and mixing instructions for multi-component materials.

B. Field-Constructed Sample Installations: Prior to installing firestopping, erect sample installations for each type through-penetration firestop system indicated in the Firestop Schedule to verify selections made and to establish standard of quality and performance by which the firestopping work will be judged.
   1. Build sample installations to comply with the following requirements, using materials indicated for final installations.
      a. Locate sample installations on site at locations where directed.
      b. Obtain Director’s Representative’s acceptance of sample installations before start of firestopping installation.
      c. Retain and maintain sample installations during construction in an undisturbed condition.
      d. Accepted sample installations in an undisturbed condition at time of substantial completion of Project may become part of completed firestopping work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping materials to the Site in original, new unopened containers or packages bearing manufacturer’s printed labels.

B. Store and handle firestopping materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, etc.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Temperature: Do not install firestopping materials when ambient or substrate temperatures are outside limits permitted by manufacturer of firestopping materials.
   2. Humidity and Moisture: Do not install the Work of this Section under conditions that are detrimental to the application, curing, and performance of the materials.
   3. Ventilation: Provide sufficient ventilation wherever firestopping materials are installed in enclosed spaces. Follow manufacturer’s recommendations.

1.09 SEQUENCING AND SCHEDULING

A. Leave exposed those firestopping installations that are to be concealed behind other construction until the Architect and Building Inspector have examined each installation.

1.10 REFERENCES

B. UL 1479 Fire Tests of Through-Penetration Firestops.
E. ASTM E 814 Method of Fire Tests of Through-Penetration Fire Stops.
F. 780 CMR 720.0 Firestopping and Draftstopping.

1.11 DEFINITIONS

A. UL Fire Resistance Directory: Product directory published yearly, with supplements, by Underwriters Laboratories Inc., containing listings and classifications in effect as of the published date for product categories covered by UL.

B. Inchcape Directory of Listed Products: Product directory published yearly by Inchcape Testing Services containing listings which reflect certifications granted for materials, products, systems and equipment which have been tested by Inchcape Testing Services to recognized governing standards.

C. Omega Point Laboratories Listings Directory: Product Directory published yearly by Omega Point Laboratories, Inc. containing listed building products, materials, and assemblies which have been tested by Omega Point Laboratories to recognized governing standards.

D. Factory Mutual Approval Guide: Product directory published yearly, with supplements, by Factory Mutual Research Corp., containing listed building products, materials, and assemblies which have been tested by Factory Mutual Research Corp., to recognized governing standards.

E. F-Rating: Prohibits flame passage through the system and requires acceptable hose stream test performance.

F. T-Rating: Prohibits flame passage through the system and requires the maximum temperature rise on the unexposed surface of the wall or floor assembly, on the penetrating item and on the fill material not to exceed 325 degrees F above ambient, and requires acceptable hose stream test performance.

PART 2 PRODUCTS

2.01 FIRESTOPPING JOINTS AND THROUGH-PENETRATIONS IN ASSEMBLIES


1. For firestopping systems exposed to view, furnish products with flame-spread values of less than 25 and smoke developed values less than 50, as determined per ASTM E 84.

2. For penetrations for piping services below ambient temperature, furnish moisture-resistant through-penetration firestop systems.

3. For penetrations involving insulated piping, furnish through-penetration firestop systems not requiring removal of insulation.

B. Accessories: Components required to install fill materials as recommended by the firestopping manufacturer for particular approved fire rated system.

2.02 FIRESTOPPING TO PREVENT THE SPREAD OF FIRE
A. Firestop concealed spaces to prevent the free passage of flame and products of combustion through concealed spaces or openings in the event of fire, in accordance with 780 CMR.

B. Firestopping materials: All firestopping shall consist of approved noncombustible materials securely fastened in place. Firestops of approved noncombustible materials or of materials of two thicknesses of one-inch lumber with broken lap-joint, or one thickness of 23/32-inch wood structural panel with joints backed by 23/32-inch wood structural panel, or of two-inch lumber installed with tight joints, shall be installed in open spaces of wood framing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine existing through-penetrations of floors, walls, partitions, ceilings and roofs in the Work areas.

B. Examine existing junctures, control joints, and expansion joints in the Work areas.

3.02 PREPARATION

A. Clean out openings immediately before installation of through-penetration firestopping. Comply with recommendations of firestopping manufacturer and the following requirements:
   1. Remove foreign materials from surfaces of openings, and from penetrating items that could interfere with adhesion of firestopping.
   2. Clean opening and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.

B. Protection:
   1. Protect surfaces adjacent to through-penetration firestops with non-staining removable masking tape or other suitable covering to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or that would be caused by cleaning methods used to remove smears from firestopping materials.

C. Substrate Priming:
   1. Prime substrates in accordance with the firestopping manufacturer’s printed installation instructions using recommended products and methods.
   2. Do not allow primer to spill or migrate onto adjoining exposed surfaces.

3.03 INSTALLATION OF THROUGH PENETRATION FIRESTOPS

A. Use through-penetration firestop devices, forming materials, and fill, void or cavity materials to form through-penetration firestops to prevent the passage of flame, and limit temperature rise of the unexposed surface as detailed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide, or the Omega Point Laboratories Listings Directory.

   1. Where applicable design is not detailed in the Directories, use forming materials and fill, void or cavity material to form through-penetration firestop in accordance with
approved printed details and installation instructions from the company producing the forming materials and fill, void or cavity material.

B. Provide through-penetration firestop systems with F ratings that shall equal or exceed the fire resistance rating of the penetrated building construction.

C. Provide through-penetration firestop systems with T ratings, in addition to F ratings, at floors where the following conditions exist:

1. Where firestop systems protect penetrations located outside the wall cavities.

2. Where firestop systems protect penetrations located outside fire resistive shaft

3. Through-penetration firestop systems protecting floor penetrations require a T-rating of at least 1 hour, but not less than the required floor fire-resistance rating.

D. Firestop through-penetrations associated with the new Work.

E. Firestop through-penetration of partitions identified on the Construction Work Drawings as smoke partitions and fire rated assemblies.

F. Firestop through-penetrations of floors, walls, partitions, ceilings, and roofs in accordance with the fire resistance rating assigned to the walls, partitions, floors, ceilings, and roofs on the Drawings.

3.04 CLEANING

A. Clean off excess fill materials and sealants adjacent to penetrations by methods and cleaning materials recommended by manufacturers of firestopping products and of products in which penetrations occur.

B. Remove masking tape as soon as practical so as not to disturb the bond of the firestopping with the substrate.

C. Protect firestopping during and after curing period from contact with contaminating substances, or damage resulting from adjacent Work.

D. Cut out and remove damaged or deteriorated firestopping immediately, and install new materials as specified in firestop schedule.

END OF SECTION
SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal frames.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Glazing" for glass view panels in hollow metal frames.
3. Division 08 Section "Door Hardware".
4. Division 08 Section "Access Control Hardware".
5. Division 09 Sections Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel frame supplier in order to prepare frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each frame design.
2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
3. Locations of reinforcement and preparations for hardware.
4. Details of anchorages, joints, field splices, and connections.
5. Details of accessories.
6. Details of moldings, removable stops, and glazing.
7. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.04 QUALITY ASSURANCE

A. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

   
a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

C. Fire-Rated, Borrowed-Light 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, based on testing according to NFPA 257. Provide labeled glazing material.

D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective frames.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CECO Door Products (C).
2. Curries Company (CU).
3. Steelcraft (S).

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 38 percent.

D. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral vinyl weatherstripping.


1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:
   
a. CECO Door Products (C) – Thermal Break TQB Series.
   
b. Curries Company (CU) – Thermal Break TQ Series.
   
D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.04 FRAME ANCHORS

A. Jamb Anchors:
   
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.05 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal components.

2.06 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.
2.07 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.08 FABRICATION

A. Fabricate hollow metal work 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. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Frames:

1. Shipping Limitations: 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.

2. Welded Frames: Weld joints continuously through full throat width of frames, including rabbets, soffits, and stops; grind, fill, dress, and make smooth, flush, and invisible.

   a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreaders are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.

5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

9. Jamb Anchors: Provide number and spacing of anchors as follows:

   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
      3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

D. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.09 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap frames to receive non-template, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. 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 post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 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 hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113
SECTION 081400
WOOD DOORS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Furnish the following, for installation under the designated SECTIONS:

1. Flush, factory finished, solid core, wood-veneer faced doors, complete with glazing cut-outs therein, where indicated, for hardware-machining and installation under Section 062000, Finish Carpentry.

2. Wood glazing beads, loosely attached to glazing cut-outs in doors for removal and permanent installation under Section 088000, Glass and Glazing.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

1. Furnishing of finish hardware: Section 087100, Finish Hardware.

2. Pressed steel frames for doors: Section 081100, Metal Doors and Frames.


1.04 SUBMITTALS

A. Submit the following, in accordance with the provisions of Section 013300, Submittal Procedures:

1. Shop drawings: Include a complete schedule of wood doors to be furnished hereunder, coordinated with the schedule contained in the Contract Drawings; dimensioned elevations of each door, indicating cut-outs, glazing and otherwise, and louvers therein; and large scale details showing construction of each type door.

2. Samples: Include corner section of each specified type door, showing core construction and joinery, in specified veneers. Provide samples of additional wood species available, as requested by the Architect.

3. Certification: Written statement, certified and signed by the door manufacturer, verifying that the doors proposed to be furnished meet or exceed the requirements specified herein.
4. Warranties: Two copies of standard warranty from door manufacturer, signed by an officer of the manufacturer, covering all doors furnished hereunder for the lifetime of the original installation. Said coverage shall include repairs and replacement in kind, of doors found to be defective, and warranty shall clearly state all terms and conditions for such coverage.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.

1. Warranty shall be in effect during the following period of time from date of Substantial Completion:

   a. Interior Doors: Five years.

PART 2 - PRODUCTS

2.01 WOOD DOORS

A. General: conform to the requirements set forth in the designated Sections of the Architectural Woodwork Institute Quality Standards, and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, glazing cut-outs in doors, and other characteristics of doors to be furnished hereunder.

B. Flush wood doors: Construction conforming to A.W.I, Section 1300, Custom Grade, Type SLC-5, having staved lumber core, plain- or rift-sawn American White Oak veneer faces, solid, plain or rift sawn American White Oak edges and glazing beads in indicated glazing cut-outs.

   a. Interior Doors: Interior doors shall be 1-3/4 inch nominal solid, rift-sawn American White Oak, AWI Premium grade.

C. Glazing bead attachments: Stainless steel, or cadmium-plated steel, oval-head wood screws and cup washers pre-finished to match the door finish, loosely attached in pre-drilled and countersunk holes in the beads.

2.02 FACTORY FINISHING


1. Finish faces and all four edges of doors, including mortises and cutouts. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish for Wood Doors: Comply with requirements indicated for grade, finish system, staining effect, and sheen:
1. Grade: Premium.
2. Finish: Manufacturer's standard finish with performance requirements comparable to AWI System TR6 catalyzed polyurethane.
3. Staining: Match approved sample for color.
4. Effect: Open-grain finish.
5. Sheen: Semigloss, 60 percent.

2.03 PACKAGING

A. Carefully pack each door with non-staining moistureproof covering and spacers, prior to shipping, in a manner which will protect the doors against damage in transit.

B. Apply marking on each package, indicating door opening number, matching those indicated on the approved Door Schedule.

PART 3 - EXECUTION

3.01 INSTALLATION OF DOORS

A. Wood doors will be machined for hardware and installed under the work of Section 062000, Finish Carpentry.

B. Glazing beads will be removed and re-installed during glazing operations under the work of Section 088000, Glass and Glazing.

END OF SECTION
SECTION 081613

FIBERGLASS DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:

1. Fiberglass Reinforced Plastic (FRP) Doors

B. Related Requirements:

1. Section 081113, Hollow Metal Doors and Frames.
2. Section 081400, Wood Doors.
3. Section 084213, Aluminum-Framed Entrances.
4. Section 087100, Door Hardware, including retractable latch hardware, where indicated.
5. Section 088000, Glass and Glazing.
6. Section 099100, Painting.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

2. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the fiberglass door supplier in order to prepare the doors to receive the finish hardware items.

B. Shop Drawings: Include the following:

1. Door schedule indicating the specific reference numbers as used on the Drawings, with columns noting door type, frame type, size, handing, accessories and hardware.
2. Elevations of each door design.
3. Details of doors, including vertical and horizontal edge details and material thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of accessories.
6. Details of moldings, removable stops, and glazing.
7. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:
   1. Provide one corner section sample of a manufactured door, which represents all aspects of the typical manufacturing process, including molded-in gelcoat color, face plate construction, and other structural details.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Manufacturer’s installation instructions.

D. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Include recommended methods and frequency for maintaining optimum condition of fiberglass doors and frames under anticipated traffic and use condition, for inclusion in Operation and Maintenance Manual.

B. Include certificate of warranty for door and frame listing specific door registration numbers.

C. Include hardware data sheets and hardware manufacturer’s warranties.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Referenced Standards:
   2. Society of Automotive Engineers (SAE).
   3. International Building Code, Plastics (Chapter 26).
   4. UL Standards for Safety UL10B / UL10C, UBC 7-2.
   5. ANSI A250.4 1,000,000 cycle test.
C. Installer Qualifications: Experienced installer who has completed fiberglass door installations similar in material, design, and extent to those indicated, for a minimum of three (3) years, and whose work has resulted in a record of successful performance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and other manufactured items so as not to be damaged or deformed. Package for protection during transportation and handling.

B. Doors shall be stored in the original container on edge, out of inclement weather for protection against the elements.

C. Handle doors in strict accordance with manufacturer’s recommendations.

1.08 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installations to be performed according to manufacturers' written instructions and warranty requirements.

1.09 COORDINATION

A. Coordinate fiberglass door installation with new aluminum entrance frames, new and modified hollow metal frames, and finish hardware.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Warp, separation or delamination, and expansion of the core.
   b. Deterioration beyond normal weathering.

2. Warranty Period: Ten (10) years from date of Substantial Completion.

3. All fiberglass doors and frames have a lifetime guarantee against failure due to corrosion.
PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 72:

1. Wind Loads: 35 psf.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Door Properties

2. Successfully completed 1,000,000 cycles test in accordance with:
   c. NWWDA TM-7 Test Method to Determine the Physical Endurance of Wood Doors and Associated Hardware Under Accelerated Operating Conditions.
3. Comply with the following ASTM Tests:
   a. ASTM E 1886, Impact and Cycling, Large Missile Impact
   b. ASTM E 1996, Specifications for Performance of Exterior Doors
   c. ASTM C 518, Heat Transfer
   d. ASTM D 1761, Mechanical Fasteners

C. Laminate Properties

1. Door face plate is a minimum of 0.125-inch thick fiberglass reinforced plastic molded into one continuous sheet starting with a 25 mil resin-rich gelcoat layer resin integrally molded with multiple layers of 1.5 oz. sq ft fiberglass mat and one layer of 18 oz per square yard fiberglass woven roving saturated with special resin. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass resin.
2. Laminated plate evaluated in accordance with Large Missile Impact Test as per ASTM-1996-05b, Standard Specification for Performance of Exterior Windows, Curtain Wall, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.
3. Comply with the following ASTM Tests:
   a. ASTM D 638 Tensile Strength Properties of Plastic
   b. ASTM D 790 Flexural Strength Properties of Plastic
   c. ASTM D 2583 Indention Hardness of Plastics
   d. ASTM D 256 Izod Pendulum Impact Resistance
2.02 MANUFACTURERS

A. To establish a standard of quality, design, and function desired, specifications have been based on Heavy-duty, glazed and unglazed fiberglass reinforced plastic (FRP) doors, as manufactured by Chem-Pruf Door Co., Ltd., Brownsville, TX, or equal products as manufactured by the following:

1. Tiger Door, Greensburg, PA
2. Edgewater FRP Door, Neenah, WI

2.03 FRP DOORS

A. Doors: Doors shall be flush, made of fiberglass reinforced plastic (FRP) using Class 1, chemical resistant resin, with no fillers. Doors shall be 1 3/4-inch thick and of flush construction, having no seams or cracks. All fiberglass components including face plates, stiles and rails and frames must be fabricated by the same manufacturer.

B. Door Plates: Door plates shall be 0.125-inch thick minimum, molded in one continuous piece, starting with 25 mil gelcoat of the color specified, integrally molded with multiple layers of 1.5 ounces per square foot fiberglass mat and one layer of 18 ounce per square yard fiberglass woven roving. Each layer shall be individually laminated with resin as noted above. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass to resin.

C. Stiles and Rails: Stiles and Rails shall be constructed starting from the outside toward the inside, with a matrix of three layers of 1.5 ounce per square foot of fiberglass mat, minimum. The stile
and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact
dimensions of the door.

D. Core: Core material shall be polypropylene plastic honeycomb core with a non-woven polyester
veil, 180 PSI compression rated.

E. Internal Reinforcement: Internal Reinforcement shall be #2 SPF of sufficient amount to
adequately support required hardware and function of same.

F. Finish: Finish of door frame shall be identical with 25 mil resin-rich gelcoat of the specified
color integrally molded in at time of manufacture resulting in a smooth gloss surface that is
dense and non-porous. Gelcoat shall be cured within a temperature range of 120 to 170 degrees
Fahrenheit, to create a uniform surface and color throughout, and a permanent homogeneous
bond with the resin/fiberglass substrate beneath.

G. Vision Lights: Window openings shall be provided for at time of manufacture and shall be
completely sealed so that the interior of the door is not exposed to the environment. Fiberglass
retainers, which hold the glazing in place, shall be resin transfer molded with a profile that
drains away from glazing. The window retainer must match the color and finish of the door
plates with 25 mil of resin-rich gelcoat integrally molded in at time of manufacture. Mechanical
fasteners shall not be used to attach retainers.

1. Glazing Sticking: Sticking shall be angled in profile, and protrude from face of doors, not
greater than 1/4inch.

PART 3 - EXECUTION

3.01 INSTALLATION CONDITIONS

A. Verification of Conditions

1. Verify openings are correctly prepared to receive doors and frames.
2. Verify openings are correct size and depth in accordance with submittal drawings.

B. Installer's Examination

1. Door installer shall examine conditions under which construction activities of this section
are to be performed and submit a written report to general contractor if conditions are
unacceptable.
2. General Contractor shall submit two copies of the installer's report to the architect within
24 hours of receipt.
3. Installer shall not proceed with installation until all unacceptable conditions have been
corrected.
3.02 INSTALLATION

A. Doors shall be delivered at job site individually crated. Each crate to be clearly marked with the specific opening information for quick and easy identification.

B. All single doors to be shipped completely assembled in the frame with hardware installed. Double doors to be pre-hung at the factory to ensure a proper fit and that hardware functions properly, then disassembled for shipping purposes.

C. Install door opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.

D. Field alteration of doors to accommodate field conditions is strictly prohibited.

E. Site tolerances: Maintain plumb and level tolerance specified in manufacturer's printed installation instructions.

F. Fire labeled doors, frames and any associated hardware must be installed by qualified professional installers in strict accordance with manufacturer's instructions and the latest revision of NFPA 80.

3.03 ADJUSTING

A. Adjust doors in accordance with the door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.

B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instruction.

3.04 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 081613
SECTION 084213
ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, including, but not limited to 019113 COMMISSIONING REQUIREMENTS, apply to this Section.
   B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY
   A. Section Includes:
      1. Exterior door-frame units.
      2. Sidelights (fixed and operable).
      3. Transoms.
   B. Related requirements:
      1. Section 085113 “Aluminum Windows” for coordinating finish among aluminum fenestration units.
      2. Section 019113 “Commissioning Requirements” for commissioning of building systems.

1.03 ALLOWANCES
   A. Field quality-control testing is part of testing and inspecting allowance.

1.04 PREINSTALLATION MEETINGS
   A. Pre-installation Conference: Conduct conference at Project Site.

1.05 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. **Product Data:** For sealants, indicating VOC content.

3. **Laboratory Test Reports:** For sealants, indicating compliance with requirements for low-emitting materials.

**B. Shop Drawings:** For aluminum-framed entrances. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances, showing the following:
   
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

**C. Samples for Initial Selection:** For units with factory-applied color finishes. Manufacturer’s full range of colors.

**D. Samples for Verification:** For each type of exposed finish required, in manufacturer's standard sizes.

**E. Fabrication Sample:** Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
5. Flashing and drainage.

1.06 **INFORMATIONAL SUBMITTALS**

**A. Qualification Data:** For Installer and field testing agency.

**B. Energy Performance Certificates:** For aluminum-framed entrances, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance.

**C. Product Test Reports:** For aluminum-framed entrances.
D. Field quality-control reports.

E. Sample Warranties: For special warranties.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

1.09 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances that do not comply with requirements or 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. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals and other materials beyond normal weathering.
   d. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.

C. Structural: Test according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or 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.

D. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Entrance Doors:
      a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
      b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

E. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.

F. Energy Performance: Certify and label energy performance according to NFRC as follows:
   1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
   2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
   3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

G. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 MANUFACTURERS

A. Basis of Design Product: Subject to compliance with requirements:

1. Exterior (Thermal): Provide System 403I, thermal (exterior vestibule) entrances, with doors D502, thermal, as manufactured by EFCO Corporation, or comparable product by one of the following:

   a. Arch Aluminum & Glass Co., Inc.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.03 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated, and fillet welded or that incorporate concealed tie rods.

   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Wide stile; 5-inch nominal width.

   a. Provide non-removable glazing stops on outside of door.

B. Framing 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: As indicated on drawings.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
E. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209.
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, 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.
   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.04 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware".

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:
   a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.

C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Pivot Hinges: BHMA A156.4, Grade 1.

ALUMINUM-FRAMED ENTRANCES
084213 - 6
1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

E. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

   1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
   2. Exterior Hinges: Stainless steel, with stainless-steel pin.
   3. Quantities:
      a. For doors up to 87 inches high, provide three hinges per leaf.
      b. For doors more than 87 and up to 120 inches high, provide four hinges per leaf.

F. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.

G. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.


J. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

K. Cylinders: As specified in Section 087100 "Door Hardware”, BHMA A156.5, Grade 1.

   1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

L. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

M. Operating Trim: BHMA A156.6.

N. Removable Mullions: BHMA A156.3, extruded aluminum.

   1. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

O. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

P. Concealed Overhead Holders: BHMA A156.8, Grade 1.

Q. Surface-Mounted Holders: BHMA A156.16, Grade 1.
R. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

S. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
   2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

T. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

U. Silencers: BHMA A156.16, Grade 1.

V. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

W. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.05 ITEMS WITHIN STOREFRONT

A. Glazing: Insulating-Glass Units: ASTM E 2190.
   1. Type 1: Glass: ASTM C 1036, Type 1, Class 1, q3. Select quality tempered safety glass:
      a. Tint: Green
      c. Lites: two.
      d. Filling: Fill space between glass lites with argon.
      e. Low-E Coating: Pyrolytic on second surface.

B. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
   2. Exterior Skin: Aluminum.
      a. Thickness: Manufacturer's standard for finish and texture indicated.
      b. Finish: Match framing system.
      c. Texture: Smooth.
      d. Backing Sheet: 1/8-inch-thick tempered hardboard.
   3. Interior Skin: Aluminum.
      a. Thickness: Manufacturer's standard for finish and texture indicated.
      b. Finish: Matching storefront framing, color to be selected by Architect.
      c. Texture: Smooth.
      d. Backing Sheet: 1/8-inch-thick tempered hardboard.
4. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board or extruded-polystyrene board.

5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 50 or less.

C. Venting Windows: The specification for venting window within storefront are based on WV430 Storefront Vent System as manufactured by EFCO Corporation, or comparable product by one of the manufacturers list in paragraph 2.02.A., above.

1. At a minimum, the venting windows shall be as specified in Section 085113 "Aluminum Windows."

2.06 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. 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.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.07 FABRICATION

A. Form or extrude 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. 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. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.08 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range, including custom colors.

2.09 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.03 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 non-movement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: The Owner will engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on aluminum-framed entrances.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

2. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified under 084213-2.1, but not more than 0.09 cfm/sq. ft. of fixed wall area when tested in accordance with ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.

3. Water Pressure: Areas shall be tested according to ASTM E 1105 at a minimum cyclic static-air-pressure difference of 0.67 times the pressure specified under 084213-2.1, but not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.

C. Aluminum-framed entrances will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. 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 entrance door hardware.

2. Initial Maintenance Service: Beginning at Substantial Completion, provide twelve months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION
SECTION 08 45 23

INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL WALL SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section includes the insulated translucent sandwich panel system and accessories as shown and specified. Work includes providing and installing:

1. 2-3/4” thick flat factory prefabricated structural insulated translucent sandwich panels
2. Aluminum installation system
3. Aluminum sill flashing

B. Related Sections:

1. Section 024119 ‘Selective Demolition’ for removal of existing window system.
2. Section 061100 ‘Rough Carpentry’ for blocking.
3. Section 062000 ‘Finish Carpentry’ for internal trim.
4. Section 071000 ‘Waterproofing, Dampproofing & Caulking’ for sealant around perimeter assembly.
5. Section 085113 ‘Aluminum Windows’ for operable windows.

1.03 SUBMITTALS

A. Submit manufacturer’s product data. Include construction details, material descriptions, profiles and finishes of components.

B. Submit shop drawings. Include elevations and details.

C. Submit manufacturer’s color charts showing the full range of colors available for factory-finished aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.
a. Sandwich panels: 14” x 28” units  
b. Factory finished aluminum: 5” long sections

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required are:

   b. Flame Spread and Smoke Developed (UL 723) – Submit UL Card  
   c. Burn Extent (ASTM D 635)  
   d. Color Difference (ASTM D 2244)  
   e. Impact Strength (UL 972)  
   f. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)  
   g. Bond Shear Strength (ASTM D 1002)  
   h. Beam Bending Strength (ASTM E 72)  
   i. Insulation U-Factor (NFRC 100)  
   j. NFRC System U-Factor Certification (NFRC 700)  
   k. Solar Heat Gain Coefficient (NFRC or Calculations)  
   l. Condensation Resistance Factor (AAMA 1503)  
   m. Air Leakage (ASTM E 283)  
   n. Structural Performance (ASTM E 330)  
   o. Water Penetration (ASTM E 331)  
   p. 1200°F Fire Resistance (SWRI)

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location. At least three of the projects shall have been in successful use for ten years or longer.

2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.

3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 “Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems” as issued by the ICC-ES.
B. Installer’s Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

1.05 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Standard panel system shall have less than 0.01 cfm/ft² air leakage by ASTM E 283 at 6.24 PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing by ASTM E 330.

3. Structural Loads; Provide system capable of handling the following loads:
   a. Positive Wind Load: 17.5 PSF
   b. Negative Wind Load: 11.6 PSF

1.06 DELIVERY STORAGE AND HANDLING

A. Deliver panel system, components and materials in manufacturer's standard protective packaging.

B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.07 WARRANTY

A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work, which fails in materials or workmanship within one year of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering, defects in accessories, insulated translucent sandwich panels and other components of the work.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Subject to compliance with requirements, provide 2-3/4’ Insulated Translucent Fiberglass Sandwich Panel Wall System, as manufactured by the Kalwall Corporation of Manchester, NH, or comparable products by CPI Daylighting of Lake Forest, IL; Glasscorp of Charleston, SC, or equal.
2.02 PANEL COMPONENTS

A. Face Sheets

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
   a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
   b. Face sheets shall not deform, deflect or drip when subjected to fire or flame.

2. Interior face sheets:
   a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 25 and smoke developed no greater than 250 when tested in accordance with UL 723.
   b. Burn extent by ASTM D 635 shall be no greater than 1”.

3. Exterior face sheets:
   a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5° facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
   b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4” diameter, 5 lb. free-falling ball per UL 972.

4. Appearance:
   a. Exterior face sheets: Smooth 0.070” thick and crystal in color.
   b. Interior face sheets: Smooth 0.045” thick and crystal in color.
   c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core

1. Thermally-broken I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16”.

2. I-beam Thermal break: Minimum 1”, thermoset fiberglass composite.

C. Laminate Adhesive

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council “Acceptance Criteria for Sandwich Panel Adhesives”.
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.

3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:
   a. 50% Relative Humidity at 68° F: 540 PSI
   b. 182° F: 100 PSI
   c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
   d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.03 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
   1. Thickness: 2-3/4”
   2. Light transmission: 50%
   4. Panel U-factor by NFRC certified laboratory: 2-3/4” thermally broken grid 0.29.
   5. Complete insulated panel system shall have NFRC certified U-factor of .29.
   6. Grid pattern: Nominal size 12x24; pattern Shoji.

B. Standard panels shall deflect no more than 1.9” at 30 PSF in 10’ 0” span without a supporting frame by ASTM E 72.

C. Standard panels shall withstand 1200° F fire for minimum one hour without collapse or exterior flaming.

D. Thermally broken panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

2.04 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure system: thermally broken extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.

B. Sealing tape: Manufacturer’s standard, pre-applied to closure system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.

D. Finish:
   1. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected from manufacturer's standards.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer shall examine substrates, supporting structure and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. 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 recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3.03 INSTALLATION

A. Install the panel system in accordance with the manufacturer's suggested installation recommendations and approved shop drawings.

1. Anchor component parts securely in place by permanent mechanical attachment system.

2. Accommodate thermal and mechanical movements.

3. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

3.04 CLEANING

A. Clean the panel system interior and exterior, immediately after installation.

B. Refer to manufacturer's written recommendations.

END OF SECTION 08 45 23
PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER'S CHECK or CASHIER'S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.03 SUMMARY

A. Section includes aluminum windows for exterior locations, and the following:

   1. Electrically operated window control system, including controls and key switches for clerestory windows.

B. Related Requirements:

   1. Section 084213 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.
2. Section 260000 “Electrical” for power, wiring, and final connections for remote operable windows.

1.04 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to aluminum windows including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work and existing aluminum frames and windows for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to maintain a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of existing and/or new substrate and other preparatory work performed by other trades.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: For aluminum windows.

1. Scale of shop drawings shall be 1/2”=1’-0” for plans and elevations. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
2. Scale of shop drawings shall be 6”=1’-0” for details.
3. Mullion details, including reinforcement and stiffeners.
5. Expansion provisions.
6. Flashing and drainage details.
8. Thermal-break details.
11. Air & Vapor barrier tie-in connections. Include axonometric representation of installation sequence showing all materials required and method of installation, certified by the manufacturer of the air & vapor barrier tie-in system.
12. Window cleaning provisions.

   a. Include wiring diagrams for control panels and actuators. Diagrams shall indicate power supplies, low voltage wiring, switches, and power inputs.

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 and used to determine the following items. Provide P.E. stamped shop drawings and P.E. stamped calculations for all members and all connections and supports.

   b. Structural test pressures and design pressures from basic wind speeds indicated.
   c. Deflection limitations of glass framing systems.

C. Samples for selection and verification - for aluminum windows and components required, showing full range of color variations for finishes:

   1. Full-size operable window of each type of window with custom panning and sill extensions.
   2. Painted metal chips for color verification.
   3. Insect screens.
   4. Include Samples of hardware and accessories involving color selection.

D. Product Schedule: For aluminum windows. Use same designations as indicated on Drawings.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer, Installer, Professional Engineer and Testing Agency.

B. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

C. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that windows as glazed for this Project meet or exceed Code requirements for the following:

   1. U-value.
   2. Solar heat-gain coefficient.

D. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

E. Field quality-control reports. From a qualified testing and inspecting agency engaged by Contractor.

F. Sample Warranties: For manufacturer's warranties.
1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Professional Engineer Qualifications: A professional structural engineer who is legally qualified to practice in the state the 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 windows that are similar to those indicated for this Project in material, design, and extent.

D. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

E. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' 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.

F. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

   1. Provide AAMA certified aluminum windows with an attached label.

G. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to aluminum windows including, but not limited to, the following:

   1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review required testing and inspecting procedures.
   4. Coordinate interrelationship of aluminum windows with other exterior wall components.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before submittals and indicate measurements on Shop Drawings. Do not fabricate windows prior to field-verification and approval of shop drawings.
1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.
2. Structural failures including excessive deflection.
3. Water leakage, air infiltration, or condensation.
4. Faulty operation of movable sash and hardware.
5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
6. Insulating glass failure.

B. Warranty Period for Windows: Ten years from date of Substantial Completion.

C. Warranty Period for Exterior Metal Finishes: Twenty years from date of Substantial Completion.

D. Warranty Period for Glass: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

B. Aluminum Windows:

1. EFCO Corporation, 325X fixed/operable windows.
5. Or approved equal.

C. Basis of Design: EFCO Corporation, 325X fixed/operable windows in existing masonry and clerestory metal panel walls.

D. New dies, profiles, or customization of stock products will be required to adhere to the specification and detail demands of this project. The cost of any required customization shall be incorporated in the aluminum window bid. No item specified, herein, is the exclusive property of any one manufacturer.
2.02 WINDOW PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:


B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AAMA certified with label attached to each window.

C. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

2. Minimum Performance Grade: Minimum for performance class indicated.

D. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503. U values will be calculated for window type “AL14”, based on actual user size of operable and fixed portions of window type AL14, as a Basis of Design in this section and determined using a computational procedure in accordance with NFRC 100, through an independent NFRC Accredited Simulator, and based on actual user size of operable and fixed portions of window type “AL14” using a weighted average U value of the fixed and operable components as confirmed by providing a “non-residential fenestration calculation report/ bid report according to NFRC CMA procedures- actual size. Competitors window units must use the specified glazing, or equals, that achieve the minimum U- Values stated below. Submit computational reports, as described above, as proof of compliance.

1. Overall U-value: NFRC 100 maximum whole-window U-factor of 0.30.
2. Shading Coefficient: 0.41 for south and west facing windows, 0.61 for north and east facing windows.
4. Daylight transmission: 60% minimum.

E. Air Infiltration: Maximum rate of not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.

1. Maximum Rate: 0.30 (Maximum) at 6.24 psf for Projected Windows; 0.20 (Maximum) at 6.24 psf for Fixed Windows.

F. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.

ALUMINUM WINDOWS
085113 - 6
1. Test Pressure: 15 percent of positive design pressure, but not less than 8.0 lbf/sq. ft. or more than 12 lbf/sq. ft.

G. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 60 for all windows.

H. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

I. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

J. Outside-Inside Transmission Class (OITC): Rated for not less than 30 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

2.03 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Awning: Project out.
2. Hopper: Project in.
3. Fixed.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/L.S.2/A440. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact. Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, not less than 0.080 inch thickness at any location for the main frame and sash members. Minimum frame depth to suit existing.

C. Glass: Tinted and Clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.


D. Insulating-Glass Units: ASTM E 2190.

1. Type 1: Glass: ASTM C 1036, Type 1, Class 1, q3. Select quality tempered safety glass:

   a. Tint: Green
c. Lites: two.
d. Filling: Fill space between glass lites with argon.
e. Low-E Coating: Pyrolytic on second surface.

2. Type 2 (Obscure glazing units): Same as Type 1 with a non-directional, single sided, (f1) stippled pattern texture conforming to ASTM Standard C-1036, 1/4-inch thick. Patterned surface to be used for the inside of the unit.

E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

F. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

G. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Continuous clip angles on the interior side of the window frames are required to receive air barrier membrane. Coordinate installation sequence with section 072500-Air Barrier.

H. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

I. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

J. Projected Window Hardware:

1. Hinges: Non-friction type, not less than two per sash.
2. Lock: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide lever handle, cam action lift latches, and keepers unless otherwise noted below; one per jamb.
3. Limit Devices: Concealed support arms with adjustable, limited, hold-open limit devices designed to restrict sash opening to 4’’.
4. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches above floor; one pole operator and pole hanger per room that has operable windows more than 72 inches above floor.

5. For Motorized Window Actuators, see below.

K. Weather Stripping: Provide compressible weather stripping designed for permanent resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed. Full-perimeter weather stripping for each operable sash unless otherwise indicated. Material to be Manufacturer’s standard system complying with AAMA/WDMA/CSA 101/1.S.2/A440-05.

L. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.04 ACCESSORIES

A. Dividers (False Muntins): Provide extruded-aluminum divider grilles where indicated on drawings.

1. Type: Permanently located at exterior lite with matching spacer permanently located between insulating-glass lites.
2. Pattern: As indicated on Drawings.
3. Profile: As selected by Architect from manufacturer's full range.

B. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

C. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings and to suit existing conditions.

E. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings and to suit existing conditions.

F. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.05 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable
sash or ventilator. Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.

2. Finish: Match adjacent aluminum window members, or as selected by Architect.

C. Aluminum Wire Fabric: 18-by-16 mesh of 0.011-inch- diameter, coated aluminum wire.

1. Wire-Fabric Finish: Provide black, charcoal or other Architect-approved color as selected from manufacturer’s full range.

2.06 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Multiple Window Assemblies: Provide units in configurations indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation.

H. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" 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. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 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 system for all aluminum components shall be factory applied after proper preparation. Thoroughly clean all surfaces; remove all blemishes, dents, abrasions, scratches, and tool marks from surfaces which will be exposed to view.

C. Exterior Finish of all exposed aluminum furnished under this Section, shall be “Kynar 500”, “Duranar XL”, “Fluoropon”, or equal as approved. Provide a High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight).

D. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions. Custom color shall be selected by the Architect. At the exterior, one (1) color will be required for operable sashes and frames. At the interior, one (1) color will be required for operable and fixed frame. Custom colors chosen will be “non-exotic” but will include mica-metallic finish options. Minimum dry film thickness: 1.5 mils. Interior Finish: PPG Duracon in accordance with AAMA 2603 averaging 0.8 mil dry film thickness; Pencil hardness, in accordance with ASTM D3363, to be H minimum.

E. Interior Finish:


3. Color: Provide custom color as selected by Architect.

F. For Painted Finish: At concealed surfaces use AA-C40 with factory wash primer and shop coat of zinc-chromate primer, or other preparation approved by finish manufacturer.
2.09 MOTORIZED ACTUATOR SYSTEM

A. Basis of Design: Motorized Actuator System design is based on the 24VDC Sleekline Actuator 1PP (single push point) Actuator System as manufactured by Clearline Inc, North Wales, PA.

B. Source Limitations: Obtain Motorized Actuator System components from a single manufacturer.

C. Motorized Actuator: Extruded aluminum body, zinc plated double link chain, factory set for 10-inch projection, complete with window attachments and accessories as recommended by the manufacturer for the indicated application.

1. Max load in thrust: 65lbs. minimum.
2. Max load in traction: 45lbs. minimum.
3. Provide one actuator per window shown on the Drawings for power operation.
4. Screen angles (color matched to product) with opening to accommodate actuator chain, as required.

D. Stroke end:

1. Opening: pre-set electronic shut off
3. Protection degree: IP30

E. Dimensions: 16-inches long, by 4-inches deep, by 2 1/2-inches high, nominal.

F. Finish: Manufacturer's standard silver or clear anodized finish.

G. Control Panels: P/N 2220-1.14 Control Panels, as manufactured by Clearline Inc, North Wales, PA. The specified control panel can control up to 8 individual actuators, therefore two (2) complete control panels, minimum, are required to operate the windows shown on the Drawings for power operation, or as required by the manufacturer. Provide additional panels, power supplies, switches, and accessories as required to operate the windows shown on the Drawings for power operation.

H. Each Control Panel shall include:

1. 100-120VAC (input)/24VDC (output) power supply.
2. Switch/dry contact input.
3. Open and close buttons on the board.
4. Modules to be supplied with bridge connectors to limit the need for extra wiring, for multiple panel conditions.
5. Factory programmed based on approved submittals.
6. Eight (8) individual input connections, minimum, for magnetic contacts (Reed Switches).
7. LCD screen to display the status (open or closed) of each individual actuator.
8. “Group monitor” output: A form C contact rated 1A, 28VDC which may be factory programmed to close either when all the windows in the group are open or closed or when all the windows are closed.
9. Housing: NEMA type 1 painted steel enclosure with knock outs and screw cover.
10. Grounding boss with green plated grounding screw.
11. Control panel shall be capable of operating windows individually, in groups, or all.

I. Switches: 3-position, spring return to center switch, keyed switch: Manufacturer's standard, UL rated device, with two (2) keys per switch. All switches shall be keyed alike. Four (4) keyed switches are required.

J. Narrative: There are four (4) groups of four (4) motor operable windows, as shown on the Drawings. Control panels shall be mounted on the interior walls of the gym/cafeteria space, as indicated on the drawings. All keyed switches shall be mounted together, in a single location, as shown on the Drawings. Control panels shall be programmed to operate the windows to open and close, in groups of four (4), with each group of four controlled by a keyed switch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Coordinate power and control wiring for power actuated window control systems and switches, with Section 260000, Electrical wiring.
3.03 FIELD QUALITY CONTROL

A. Testing Agency: The Owner will engage a qualified testing agency to perform tests and inspections.
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
   1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A, by applying same test pressures required to determine compliance with AAMA/NWWDA 101/I.S.2 in Part 1 "Performance Requirements" Article.
   2. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
   3. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections. Remove and replace windows where test results indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain motorized window actuator system.

3.05 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113
PART 1- GENERAL

1.1 PROVISIONS INCLUDED

A. The general provisions of the Contract, including General and Supplementary Conditions and Division 1- General Requirements, apply to work specified in this Section.

1.2 SUMMARY OF WORK

A. This section specifies hardware for doors, including electro-mechanical and electronic hardware. Furnish and install hardware for doors except as listed below as “related work” or otherwise noted on door schedule or Drawings.

B. Related Work Specified in Other Sections:
1. Metal doors and frames: Section 08 11 10
2. Wood doors: Section 08 14 00
3. Fiberglass Doors: Section 08 16 13
4. Electrical power and connections to electro-mechanical and electronic hardware: Division 26 00 00

1.3 REFERENCED STANDARDS

A. National Fire Protection Association (NFPA):
1. NFPA-80 Fire Doors and Other Openings Protective

B. Door and Hardware Institute (DHI)

C. ANSI/BHMA Standards

D. Massachusetts State Building Code, 780 CMR

E. MAAB: Rules and Regulations of the Massachusetts Architectural Access Board.

F. ANSI A117.1 – Accessible and Usable Buildings and Facilities

1.4 SUBMITTALS

A. Hardware Schedules and Product Data: Submit 6 copies of a typed hardware schedule including catalog cuts in the scheduling format recommended by DHI. The Architect’s approval will not relieve the contractor of the responsibility of providing required hardware needed to complete the project.

B. Samples: Upon request from the Architect, submit 1 sample of each proposed hardware item to be used in this project. Samples remain the property of the supplier and will be returned after completion of the project.
C. Furnish templates needed by door and frame manufacturer to enable proper machining for the required template hardware.

D. Supply a complete keying schedule for approval by Architect. This should be done after keying meeting has been held with owner’s representative. Submit this keying schedule using the reference manual from DHI.

E. Submit point to point wiring diagrams no later than 10 working days after finish hardware submittal has been approved.

F. Closeout Submittals: Furnish the following for inclusion in the Owner's Operation and Maintenance Manual, specified in Section 01 77 00. Place in a binder as specified in Section 01 77 00.
   1. A final copy of the approved and as-built hardware schedule.
   2. A final copy of the approved keying schedule.
   3. Catalog cuts for each item used in the project.
   4. Parts list and numbers for each item used.
   5. Maintenance instructions for all items.

1.5 QUALITY ASSURANCE

A. Manufacturer's model numbers listed in sets are to establish the standard of quality, similar items by manufacturers other than those listed that conform to this quality standard may be accepted upon prior approval by Architect provided required data and physical samples are submitted in accordance with Section 01 63 00.

B. Hardware supplier must be engaged in regularly contracting work and be staffed to expedite the work. The firm shall have been furnishing finish hardware on similar projects in the vicinity of this project for no less than five years. The firm shall also employ a certified Architectural Hardware Consultant (AHC) to inspect periodically and direct detailing, setting, applying of architectural grade finish hardware. This person shall be a member in good standing in the Door and Hardware Institute and be part of the accreditation program. Same individual shall apply their seal to schedules and documentation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Hardware shall be delivered to the job site in the manufacturer's original packages, marked to correspond with the approved hardware schedule door numbers.

B. Provide a clean, dry, locked and lighted room with shelves exclusively used to store hardware.

C. A delivery document shall be signed by both the distributor representative and an authorized representative of the contractor after verification of the quantities delivered.

1.7 WARRANTIES

A. Supply written manufacturer’s warranties, agreeing to repair or replace door hardware which is defective in manufacture or installation, or which fails to operate in accordance with the specifications during the warranty period. Warranty periods shall be as follows:
   1. Door Closers: Minimum 10 years from date of Substantial Completion.
   2. Locks and exit devices: Minimum 5 years from the date of Substantial Completion.
Elizabeth Brooks Elementary School
Renovations
New Bedford, MA

3. Hinges butt and continuous type: Life of the installation.
4. Other hardware items including electronics: 1 year from the date of Substantial Completion.

1.8 MAINTENANCE MATERIALS

A. Fasteners: Furnish 6 extra screws or fasteners of each type size and of the same finish used for hinges, closers and exit devices in this project.

B. Exit Devices: Furnish two complete devices with exterior trim, one rim and one CVR vertical rod.

C. Closers: Furnish 2 chassis (one of each hand) and covers but one arm of every type used on this project.

D. Locksets: Furnish two secure classroom function locks.

E. Hinges: Furnish one geared hinge each type used and six hinges of same size and finish as used on this project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Continuous Geared Hinges
   - Roton/Hager
   - Bommer
   - Pemko
   - St Louis, MO
   - Landrum, SC
   - Ventura, CA

B. Butt Hinges
   - Hager Companies
   - Bommer Industries
   - McKinney
   - St Louis, MO
   - Landrum, SC
   - Scranton, PA

C. Electric Strikes
   - Trine
   - Hager Companies
   - St Louis, MO
   - Bethel, CT

D. Flush Bolts
   - Ives
   - DCI
   - New Haven, CT
   - Dexter, MI

E. Locks/Latches
   - Hager Companies
   - Sargent
   - Schlage
   - St Louis, MO
   - New Haven, CT
   - San Francisco, CA

F. Exit Devices
   - Hager Companies
   - Sargent
   - Von Duprin
   - St Louis, MO
   - New Haven, CT
   - Indianapolis, IN

G. Door Closing Devices
   - Hager Companies
   - Sargent
   - LCN
   - St Louis, MO
   - New Haven, CT
   - Princeton, IL

H. Door Operators
   - Hager Companies
   - Besam
   - Horton
   - St Louis, MO
   - New Britain, CT
   - Corpus Christi, TX

I. Door Push/Pulls
   - Hager Companies
   - Rockwood
   - Don Jo
   - St Louis, MO
   - Rockwood, IL
   - Sterling, MA

J. Protection Plates
   - Hager Companies
   - Rockwood
   - Ives
   - St Louis, MO
   - Rockwood, IL
   - New Haven, CT
# Elizabeth Brooks Elementary School Renovations New Bedford, MA

### K. Stops
- **Hager Companies** St Louis, MO
- **Rockwood** Rockwood, IL
- **Ives** New Haven, CT

### L. Thresholds & Gasketing
- **Hager Companies** St Louis, MO
- **National Guard** Memphis, TN
- **Pemko** Memphis, TN

### M. Silencers
- **Hager Companies** St Louis, MO
- **Glynn Johnson** Indianapolis, IN
- **Ives** New Haven, CT

## 2.2 MATERIALS

### A. Continuous geared hinges
Continuous geared hinges shall be manufactured by the same manufacturer of 6063-T6 anodized aluminum non-handed manufactured of three interlocking components. Door leaf and jamb leaf shall be geared together for the entire length of the hinge and joined by a cover channel. Use concealed leaves; surface applied leaves are NOT acceptable. Unexposed working metal surfaces shall be coated with TFE dry lubricant. Vertical door load shall be carried on a minimum of 32 Lubriloy RLR bearings through a full 180 degree opening. Piano type hinges are NOT acceptable. Provide a minimum of 54 flat head, undercut, self-drilling fasteners at all hinges. Provide UL ratings as required in sets also provide a Lifetime Warranty on geared hinges. Electrify them as listed in sets and provide proper mortar boxes. Subject to compliance to this specification provide continuous geared hinges from one of the following manufacturers:

1. Roton/Hager, 780-112HD or as listed in sets.
2. Bommer, FM 83 HD series.
3. Pemko, CFM 83 HD series.

### B. Hinges
Unless otherwise noted, hinges when listed in sets shall be the five knuckles type and they shall meet or exceed ANSI/BHMA 156.1. Hinges shall have a lifetime warranty and all must be from the same manufacturer. Electrify hinges as listed in and provide proper mortar boxes.

1. Hager, BB1279, series or as listed in sets.
2. Bommer, BB5000, series.

### C. Electric strike
Provide electric strikes that conform with ASNI/BHMA A156.31 for Grade 1 Strikes. Where electric strikes are listed in sets also provide the proper power supply.

1. Trine, model 3234 24VDC as listed in sets or approved equal.

### D. Flush Bolts, Coordinators
Unless otherwise noted provide flush bolts, dust proof strikes, from the listed manufacturer that conform to ANSI/BHMA A115.4 Unless otherwise listed noted in schedule, provide the following;

1. Hager, 282D, with 280X dust proof strike and 297D.
2. Ives, 458B, with 487/489 dst prf strk.
3. DCI, 780 F, with 80 dst prf strk.

### E. Locks/Latches
Provide locks/latches from the manufacturer that conform to ANSI/BHMA standard A156.2 series 4000 Operational Grade 1. Provide KNURLING on levers when required by code. Provide curved lip strikes. Cylinders and keying is described in 2.04 of this Specification.

1. Sargent, 10 Line series with GL trim.
2. Hager, 3400 series with WTN trim.
3. Schlage, ND series with RHO trim.
F. Exit devices: Subject to compliance with this article, provide heavy duty, security, fire rated and non-fire rated exit devices from the same manufacturer as listed below that conforms to ANSI/BHMA A156.3 Standard Grade 1 and shall have the proper UL listings and labels. Provide keyed cylinder dogging at non-fire rated devices as listed in sets. Electrify devices as listed in sets include switches and power supplies/controllers these shall be from same manufacturer to keep the proper warrantee and labeling. Device bodies shall be smooth steel extruded aluminum bodies are not acceptable. Provide KNURLING as required by code. Types and functions as listed in sets.
   1. Egress and Fire Safety Exit Devices:
      a. Hager, 4500, series as listed in sets.
      b. Sargent, 80 series.
      c. Von Duprin, 33/35 or 98 series.
   2. Unless otherwise noted, when trims are listed they shall be Heavy Duty. Provide KNURLING as required by code.
      a. Hager HD 45 series trim with WTN lever or as listed in sets.
      c. Sargent, ETL with Freewheeling lever.
      e. Von Duprin, HD 994L x 06 trim.
   3. Keyed removable mullions and the proper stabilizers shall be from the same manufacturer as the exit devices.

G. Door Closer: Provide surface mounted door closers from the same manufacturers as listed below that comply with ANSI/BHMA A156.4 grade 1 standard C02011 or C02021, and will have a minimum ten (10) year written warranty. Provide mounting brackets as required for proper installation. Provide options as listed in sets. Install closing devices away from public view when possible. Provide heavy-duty arms when listed as in sets.
   1. Hager 5100, 5200 series as listed in sets.
   3. LCN, 4000, 1400 series.

H. Door Operators: Provide low energy closer/opener device that conforms to ANSI A156.19 standards and UL requirements. Provide a ten-year warranty on the closer body and a two-year warranty on the complete system. Provide HD arms that contain a spring action stop to prevent damage. Provide any mounting plates needed for the proper installation and use of these units.
   1. Hager 8400 series as listed in sets.
   2. Besam, 350/450 series.
   3. Horton, 7000 series.

I. Push/Pulls: Provide solid stainless-steel pulls that comply with ANSI/BHMA A156.6 standard J401, and will be 1” inch in diameter with 12” inches on-center. Push/pull bars will be 1” Inch in diameter and solid stainless steel.
   1. Hager, 12 L, 160V as listed in sets.
   2. Rockwood, 158, or series equal to above.
   3. Don Jo, 1158, or series equal to above.

J. Protection plates: Provide kick, armor and mop plates from one of the listed manufacturer that conforms to ANSI 156.6 standard J102 or J103. Thickness shall be .050 and have beveled edges. Height of protection plates shall be as listed in sets. The width of the kick plates shall be less -2” inches for single doors and less - 1” inch for pairs of doors. Mop plates shall be less -1” inch for singles and less - 1/2” inch for pairs. Fasteners shall be countersunk, regardless of how they are listed in sets.

DOOR HARDWARE

087100-5
1. Hager, 190 S series or as listed in sets.
2. Rockwood, .050 thick materials.
3. Ives, 8400 series.

K. Door Stops: Provide doorstops from one of the listed manufacturer that conforms to ANSI 156.16 grade 1. Furnish floor stops, with risers if needed, only when wall stops are not practical. Provide adequate internal wall blocking for wall stops. When listed in sets or when a wall or floor stop will not work provide heavy duty surface overhead holder or stops equal to Hager 7000 series regardless of how stops are listed in sets.
1. Hager, 236 W, 243 F stops, or as listed.
2. Rockwood, 400, 443 series
3. Ives, 402, 438 series

L. Thresholds, weather-stripping, gasketing and miscellaneous items; Provide perimeter gasketing, door bottoms, thresholds, astragals, etc, from one on the listed manufacturers that conforms with ANSI/BHMA A156.22 standard and to the Energy Code requirements for air infiltration per ASTM E283-91.
1. Thresholds: (Where shown on drawings provide expansion or other needed cover plates equal to Hager 626S x proper width and fasteners, see details on drawings).
   a. Hager, 626S or as listed in sets.
   b. National Guard, equal to above
   c. Pemko, equal to above
2. Meeting stile smoke gasketing:
   a. Hager, 737 as listed in sets.
   b. National Guard, equal to above.
   c. Pemko, equal to above.
3. Smoke/fire gasketing:
   a. Hager, 720 as listed in sets.
   b. National Guard, equal to above series
   c. Pemko, equal to above series
4. Door sweeps:
   a. Hager, 756S V as listed in sets.
   b. National Guard, 110 series
   c. Pemko, 307 V series
5. Sound gasketing:
   a. Hager, 864S N as listed in sets.
   b. National Guard, 107 series
   c. Pemko, 379 series
6. Meeting stile astragals:
   a. Hager, 872S N as listed in sets.
   b. National Guard, 125 series
   c. Pemko, equal to above series
7. Rain drip guard:
   a. Hager, 810S as listed in sets.
   b. National Guard, 16A series
   c. Pemko, 346 series
M. Silencers: At openings that do not have weather stripping/gasketing, provide rubber silencers. Comply with ASNI/BHMA A156.16 standard L03011. Supply 3 silencers for a single opening and 2 for pairs.
1. Hager, 307 D
2. Glynn Johnson, GJ64 series
3. Ives, 20 series

2.3 FINISHES

A. Conform to ANSI/BHMA A156.18 Standard for architectural finishes, use brushed chrome 626 or 652 (US26D), brush stainless steel 630 (US32D) or 689 (AL/CLR), as listed in sets.

2.4 KEYING

A. Provide construction keying for the project, construction cores and keying shall be returned to supplier.
1. Cylinders and Keying: Sargent (contact project manager for details)
2. Keying System, shall be a continuum of the existing keying system for this school.
   a. Keys:
      1) CMK - Masters: 12
      2) GMK - 6
      3) MK - 6 per section or department
      4) Change keys: 3 per keyed cylinder

B. Card Key Access Equipment: Software system for access control and their keys are by Div.26.

C. Provide keyed cylinders, compatible with locks furnished by other specialty door/gate/grille/access door type manufacturers listed in other Sections of this project, see plans for locations and quantities.

2.5 KEY CONTROL

A. Provide a complete lockable "Key Control System" cabinet as manufactured by one of the listed manufacturers. Include all components for expansion of 50% of building capacity. Provide lock manufacturer’s standard software program for key control.
1. MMF Industries
2. Telkee
3. Lund

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine doors, frames and existing finish hardware conditions under which the work is to be performed and notify the Architect in writing of any detrimental conditions to the proper completion of the installation. Do not proceed until unsatisfactory conditions have been corrected. Starting the Work means the installer has accepted substrates and existing conditions and the responsibility.
3.2 INSTALLATION

A. Comply with manufacturer’s installation instructions. Install door-closing devices away from public view when possible.

B. Mount the finish hardware at the recommended location listed in DHI’s document on installation, except where required by law.

C. Installer of the mechanical hardware shall be present at start-up of the electrified hardware to provide adjustments.

D. Install closers away from public view and tampering.

3.3 ADJUSTING AND CLEANING

A. At completion of installation, hardware shall be left clean and free from disfigurement. Make final adjustments to closing devices after HVAC system has been activated and balanced. Where hardware is found defective or not in conformance with the specifications, repair or replace as instructed by the Designer.

B. The mechanical hardware installer shall be present when the electronic systems are connected to provide the mechanical adjustments needed for the opening to operate properly.

3.4 PROTECTION

A. Provide proper protection of hardware items until the Architect accepts the project as complete and the building is being turned over to the owner.

3.5 FIELD QUALITY CONTROL

A. After final installation and adjustments are made, provide for the manufacturer’s representative of each major group of hardware to determine if their products were installed according to their recommended guidelines and the approved hardware schedules. This task shall be supervised by a certified AHC chosen by the Designer. This Individual shall provide a written report confirming that the hardware has been installed properly and that it is operating as intended.

3.6 HARDWARE SETS

A. Text in brackets prompts for information which is to be determined by the hardware supplier and shown on the hardware schedule.

B. Hardware sets:

   HW # 1 Pair, main entry doors with card reader
   Doors # X01

   2 Elec/geared hinge 780-112HD x [full height of door] x RETW-10 x CLR
   1 Elec/rim/device ELRX4501 x 3901 Cylinder only x US32D (night latch)
   1 Elec/rim/device ELRX4501 x EO x US32D (exit only)
   1 Keyed removable mullion 4900TKR (proper cylinder) x USP
   2 Offset pulls 12L x US32D
Operations Descriptive: Both openings are secured. One leaf of the pair can be opened using the access control reader. These doors will be dogged/latch retracted during student usage using the ELR option. Entry by someone pushing a button located at reception desk (provided by Div.26) would be used to provide entry unless you are a key or card access key bearer. One leaf would then be temporarily unlocked by this remote means permitting entry. For special occasions or during morning arrivals both pairs can be dogged electronically.

HW # 2 Pair, main vestibule doors with card reader
Doors # 100B

1. Access control system and its power source by Division 26.
1. Remote release switch if required is provided by Division 26.
2. Surface closers 5100 1-6 HDCS (5955) x ALM
1. Power/supply control 2902 (provided by hardware supplier interface w/Division 26)
2. Protection plates 190 S x [proper height] x [proper width] x US32D
1. Threshold 626S x 6” x [proper length] x C
1. Set of weather-stripping 896S V x [perimeter of opening] x MIL
1. Set (2) of split astragals 756S V x [full height of doors] x MIL
2. Door sweep 756S V x [width of door leaf] x MIL
1. Overhead rain drip 810S x [full width of frame header] x MIL
1. Riser and point-to-point wiring diagram

Operations Descriptive: Both openings are secured. One leaf of the pair can be opened using the access control reader. These doors will be dogged/latch retracted during student usage using the ELR option. Entry by someone pushing a button located at reception desk (provided by Div.26) would be used to provide entry unless you are a key or card access key bearer. One leaf would then be temporarily unlocked by this remote means permitting entry. For special occasions or during morning arrivals both pairs can be dogged electronically.

HW # 3 Pair, exterior egress/entry doors with concealed security monitoring
Doors # X04, X07, X09, X13

1. Geared hinge 780-112HD x [full height of door] x RETW-10 x CLR
1. Rim exit dev RX4501CD x 3901 Cylinder only x US32D (night latch)
1. Rim exit dev RX4501CD x EO x US32D (exit only)
1. Keyed removable mullion 4900TKR (proper cylinder) x USP
2. Offset pulls 12L x US32D
1. Access control system and its power source by Division 26.
1. Remote release switch if required is provided by Division 26.
2. Surface closers 5100 1-6 HDCS (5955) x ALM
1. Power/supply control 2902 (provided by hardware supplier interface w/Division 26)
2. Protection plates 190 S x [proper height] x [proper width] x US32D
1. Set of weather-stripping 896S V x [perimeter of opening] x MIL
1. Riser and point-to-point wiring diagram

Operations Descriptive: Both openings are secured. One leaf of the pair can be opened using the access control reader. These doors will be dogged/latch retracted during student usage using the ELR option. Entry by someone pushing a button located at reception desk (provided by Div.26) would be used to provide entry unless you are a key or card access key bearer. One leaf would then be temporarily unlocked by this remote means permitting entry. For special occasions or during morning arrivals both pairs can be dogged electronically.
Elizabeth Brooks Elementary School  
Renovations  
New Bedford, MA  

1. Set of weather-stripping 896S V x [perimeter of opening] x MIL  
2. Set (2) of astragals 756S V x [full height of doors] x MIL  
2. Door sweep 756S V x [width of door leaf] x MIL  
1. Overhead rain drip 810S x [full width of frame header] x MIL  
1. Riser and point-to-point wiring diagram  

Operations Descriptive: Doors are closed and secured, these doors have concealed electric wires to permit concealed monitoring of these doors by security (Request to exit) REK switches are inside the exit device or lock.

HW # 4 Single, egress door with security monitoring  
Door # X02, X03, X05, X06, X08, X10, X12, X15  
1. Elec/geared hinge 780-112HD x [full height of door] x RETW-10 x CLR  
1. Elec/rim/device RX4501CD x 3901 x US32D  
1. Offset pull 12L x US32D  
1. Door closer 5100 1-6 HDCS (5955) x AL  
1. Protection plate 190 S x 10” inches high x [proper width] x US32D  
1. Set of weather-stripping 896S V x [perimeter of opening] x MIL  
1. Door sweep 756S V x [width of door leaf] x MIL  
1. Overhead rain drip 810S x [full width of frame header] x MIL  
1. Riser and point-to-point wiring diagram  

Operations Descriptive: Door is closed and secured, entry by mechanical key override, door has concealed electric wires and monitoring switches to permit concealed monitoring of these doors by security.

HW # 5 Pair, exterior back of house service doors  
Doors # X11, X14  
2. Geared hinge 780-112HD x [full height of door] x CLR  
2. Manual flush bolts 282D x US26D  
1. Cylindrical lock 41-10G04 GL x US26D (storeroom function)  
1. Door latch guard 341D x US32D  
1. Surface closer 5100 HDHOS (5955) x ALM (active leaf)  
1. Surface overhead holder stop 7017 x US32D  
2. Protection plate 190S x 18” high x [proper width] x US32D  
1. Threshold 626S x 6” x [proper length] x C  
1. Set of weather-stripping 896S V x [perimeter of opening] x MIL  
1. Set of astragals 756S V x [full height of doors] x MIL  
2. Door sweep 756S V x [width of door leaf] x MIL  
1. Overhead rain drip 810S x [full width of frame header] x MIL  
1. Riser and point-to-point wiring diagram  

Operations Descriptive: Doors are closed and secured, these doors have concealed electric wires to permit concealed monitoring of these doors by security (request to exit) switch is inside the mortise lock.

HW # 6 Single door, single user washroom room with door closer  
Doors # 101A, 128A, 130A, 133A, 134A  
3. Standard weight hinges BB1279 4.5 x 4.5 x US26D  
1. Cylindrical lock 10G65 GL x US26D (privacy)  
1. Surface closer 5200 1-6 x AL
DOOR HARDWARE

HW # 7 Single door multi user washroom doors with door closer
Doors # 116, 121

3 Heavy weight hinges BB1168 4.5 x 4.5 x NRP x US26D
1 Push pulls 33G 4" x 16" x 30S 4" x 16" x US32D
1 Surface closer 5200 1-6 x AL
1 Protection plate 193S x 8" high x [proper width] x US32D
1 Wall or floor stop 236W or 243F x US32D/26D
3 Silencers 307 D
1 Coat hook 9124 x US26D

HW # 8 Single staff keyed washroom doors with door closer
Doors # 122, 123

3 Heavy weight hinges BB1168 4.5 x 4.5 x NRP x US26D
1 Cylindrical keyed privacy lock ND85PD x US26D (Schlage)
1 Surface closer 5200 1-6 x AL
1 Protection plate 193S x 8" high x [proper width] x US32D
1 Wall or floor stop 236W or 243F x US32D/26D
3 Silencers 307 D
1 Coat hook 9124 x US26D

HW # 9 Single, vestibule classroom entry door

3 Standard weight hinges BB1279 4.5 x 4.5 (NRP @ RB) x US26D
1 Cylindrical lock 10G38 GL x US26D (secure classroom function)
1 Surface closer 5200TRK 1-6 x AL (install pull side)
1 Protection plate 193S x 10" high x [proper width] x US32D
1 Wall stop 236W x US32D (use a floor stop only when wall stop cannot be used)
1 Threshold 626S x [proper width] x C
1 Set of smoke/fire/sound gasketing 864S N x [perimeter of opening] x CLR
1 Door bottom sweep 756S V x [proper width] x CLR

HW # 10 Single, secure library door
Doors # 124

3 Standard weight hinges BB1279 4.5 x 4.5 (NRP @ RB) x US26D
1 Cylindrical lock 10G38 GL x US26D (secure classroom function)
1 Surface closer 5200TRK 1-6 x AL (install pull side)
1 Protection plate 193S x 10" high x [proper width] x US32D
1 Wall stop 236W x US32D (use a floor stop only when wall stop cannot be used)
1 Set of smoke gasketing 720 x [perimeter of opening]
3 Silencers 307 D
HW # 11  Single, secure classroom/office door with ADA operator  
Doors # 103A, 125, 128, 130  
Existing hardware to remain add the following:  
1 Electric strike 3234 24VDC x US26D (for 2-3/4" high strike cut out)  
1 Power supply 2904  
1 Cylindrical lock 10G38 GL x US26D (secure classroom function)  
1 Door Operator 8418 x ALM  
2 Door actuators 2-659-0175  
1 Keyed on-off switch 29KSASD red/green LED x US32D  

Operations Narrative: Door normally unlocked, using wall mounted ADA switches starts the cycle of releasing the door from the strike and opening the door. Same process to exit. After hours when door is locked, power to corridor side wall switch is turned off thus operator will not open door. Entry by key only, from room side operator is always functioning permitting usage of the wall switch as well as constant egress.

HW # 12  Single, secure classroom/office function doors with new hardware  
Doors # 126, 136, 137, 139  
3 Standard weight hinges BB1279 4.5 x 4.5 (NRP @ RB) x US26D  
1 Cylindrical lock 10G38 GL x US26D (secure classroom function)  
1 Protection plate 1935 x 10" high x [proper width] x US32D  
1 Wall stop 236W x US32D (use a floor stop only when wall stop cannot be used)  
1 Set of smoke gasketing 720 x [perimeter of opening]  
3 Silencers 307D  

HW # 13  Single, secure classroom/office function doors with new lever lock  
Doors # 101, 102, 103, 105A, 105B, 109, 125A, 125B, 126A, 126B, 126C, 140, 140A  
Existing hardware to remain except replace lockset with following:  
1 Cylindrical lock 10G38 GL x US26D (secure classroom function)  

HW # 14  Single, office function doors with new lever lock  
Doors # 106, 106A  
Existing hardware to remain except replace lockset with following:  
1 Cylindrical lock 10G24 GL x US26D (office function)  

HW # 15  Pair, multi-purpose room, corridor doors on hold open  
Door # 105A, 105B, 105C, C01, C02, C03, C04, C05, C06  
2 Geared hinges 780-112HD x [full height of door] UL x CLR  
2 SVR Exit. Dev.4501F x LBR x 45CE WTN x US32D (classroom function)  
2 Surface door closer 5200 1-6 x ALM  
2 Protection plates 190S x 10" high x [proper width] x US32D  
2 Wall stops 236W x US32D (use a floor stop only when wall stop cannot be used)  
2 Wall magnets 380S x 24VDC x ALM (connect to smoke/fire alarm)  
1 Set of smoke gasketing 720 x [perimeter of opening, omit at hinge side]  
1 Meeting stile gasket 737 x [full height of meeting stile, one leaf only]  

DOOR HARDWARE  
087100-12
Elizabeth Brooks Elementary School
Renovations
New Bedford, MA

HW # 16 Pair, storage/mechanical/electrical/and other service type doors
Doors # 108, 111
6 Standard weight hinges BB1279 4.5” x 4.5” x NRP at RB doors x US26D
1 Set of constant latching flush bolts 293 D x US26D
1 Dust proof strike 280X x US26D
1 Door coordinator 297D x [proper width]
1 Cylindrical lockset 41-10G04 GL x US26D (storeroom function)
2 Surface door closers 5200 1-6 x AL
2 Protection plates 193S x 16” high x [proper width] x US32D
2 Wall or floor stops 236W x US32D or 243F x US26D
1 Set of smoke/fire gasketing 720 x [perimeter of opening]
1 Meeting stile astragal 737 x [full height of one leaf]

HW # 17 Single, mech/electrical/storage/room doors with closers
Doors # 123A
3 Standard weight hinges BB1179 4.5” x 4.5” x NRP at RB doors x US26D
1 Cylindrical lockset 10G04 GL x US26D (storeroom function)
1 Surface door closer 5200TRK 1-6 x AL
1 Protection plates 193S x 16” high x [proper width] x US32D
1 Wall or floor stop 236W x US32D or 243F x US26D
1 Set of smoke/fire gasketing 720 x [perimeter of opening]

END OF SECTION 08 71 00
SECTION 088000  
GLASS AND GLAZING  

PART 1 - GENERAL  

1.01 GENERAL PROVISIONS  

A. PART A and DIVISION 1 of PART B, as listed in the TABLE OF CONTENTS, are hereby made part of this SECTION by reference thereto.  

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.  

1.02 WORK TO BE PERFORMED  

A. Furnish and install the following:  

1. Glass for pressed steel frames, wooden doors, fiberglass doors, and for other conditions indicated on the Drawings, except as otherwise specified.  

2. All materials required to properly install glass furnished hereunder, including sealants, tapes, setting blocks, and spacers.  

B. Install the following as furnished under the designated SECTIONS:  

1. Metal glazing beads for pressed steel frames: SECTION 081113, HOLLOW METAL DOORS AND FRAMES.  

2. Wooden glazing beads for wooden doors: SECTION 081400, WOOD DOORS.  

3. Glazing sticking for fiberglass doors: SECTION 081613, FIBERGLASS DOORS.  

C. Perform initial cleaning of all glass furnished hereunder.  

1.03 RELATED WORK  

A. The following related work will be performed under the designated SECTIONS:  

1. Final cleaning of glass: SECTION 015000, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.  

2. Building systems commissioning: SECTION 019113, COMMISSIONING REQUIREMENTS.  

1.04 SUBMITTALS  

A. Submit the following in accordance with the provisions of SECTION 013300, SUBMITTAL PROCEDURES:  

1. Samples:  

a. Glass: 12 by 12 inches, in each specified type and thickness.  

b. Glazing tape: 12-inch length of specified type and size.
2. Literature: Manufacturer's product data, including specifications, for glass, glazing tape, and all other pertinent data for items to be furnished hereunder.

3. Certification: Certified written affidavit stating that all glass, to be furnished, meets or exceeds the requirements specified herein.

1.05 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:


5. ASTM Standard C-1036, for non-tempered glass; and ASTM Standard C-1048 Kind FT, for tempered glass.


PART 2 - PRODUCTS

2.01 GLASS AND GLAZING MATERIALS

A. Glass types:

1. Tempered glass for all interior doors, sidelights and borrowed lights: Clear, heat-tempered float glass, conforming to ASTM Standard C-1048, Kind FT, 1/4-inch thick, permanently labeled as tempered glass, except as otherwise indicated.

2. Insulated glass for exterior doors, transoms and other locations indicated on the Drawings: Factory-fabricated insulating glass units comprised of Green Tinted, 0.45 shading coefficient, select quality tempered safety glass, complying with ASTM C 1048, low E-coated, double-light sealed insulating glass, 5/8-inch thick, as manufactured by Pittsburgh Plate Glass, Guardian Industries, LOF, or equal, bearing the standard SIGMA 10 year warranty for all insulating glass, SIFMA.IGCC certifies to performance level CBA when tested in accordance with ASTM E 774. Provide standard SIGMA 10-year warranty for all insulating glass. Permanently-impair manufacturer's stamp showing date of manufacture on corner of each unit.

B. Glazing materials:

1. Setting blocks: Neoprene, 70-90 durometer hardness, 4 inches long, minimum.

2. Glazing tape: Closed cell vinyl foam tape, pressure-sensitive one face, 2 inches wide by 3/16-inch thick, Norseal V-780, as manufactured by Norton Company, Hi-Lo Closed Cell Vinyl Foam Tape, or equal. Provide solvent recommended by tape manufacturer for sealing exposed edges of tape on exterior applications.
3. Glazing bolts, nuts and neoprene washers for attaching laminated safety glass to metal guardrail assemblies: Chrome plated steel or brass decorative glazing fasteners

**PART 3 - EXECUTION**

3.01 DELIVERY AND STORAGE

A. Deliver materials when and as required and store in a safe location as directed. Do not unpack material until it is to be set, unless packing is required for inspection by the Architect.

3.02 ACCEPTANCE OF INSTALLATION CONDITIONS

A. Be fully responsible for the proper execution and performance of the work described herein. Inspect all installation conditions and request the Contractor to correct any conditions which may affect work adversely.

3.03 PREPARATION FOR GLAZING

A. Ensure that receiving surfaces are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.

B. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained. Inspect all butt and miter joints and remove all projections from fixed rabbets.

C. Ensure that all glass has been cleanly and accurately cut to properly fit the openings, allowing the necessary clearances for glazing materials. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance. Provide proper glass edge protection to prevent abrasion from contact with concrete and masonry surfaces.

D. Sizes of glass indicated on the Drawings are approximate only. Determine the actual sizes required by measuring the receiving openings. Size glass to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards.

3.04 GLAZING

A. Installation of glass in doors and frames: Place setting blocks at quarter points. Apply continuous strip of specified foam tape around perimeter of glass with adhesive side of tape toward glass. Turn tape onto each surface of the glass to form a channel around the entire perimeter. Set glass in place, and attach the glazing beads with sufficient pressure against the tape to compress the tape to approximately seventy (70) percent of its original thickness. After applying glazing beads, trim off excess tape with razor blade, or other sharp tool, level with sight line. Wherever glazing tape is exposed to the exterior, apply manufacturer's recommended solvent to edge of the tape to provide a weather seal.

3.05 GLASS BREAKAGE

A. Replace with new materials of similar types and thicknesses all glass which is broken, cracked, or otherwise damaged in executing the glass and glazing work, or caused by the installation of faulty work hereunder, at no additional cost to the Contract. Replace all glass breakage and glass damage caused by other trades, due to

GLASS AND GLAZING
088000 - 3
negligence or any other reason, and the costs for such replacements will be borne by the trade responsible for the damage, or by the Contractor, if responsibility cannot be determined.

B. Identify all glazed openings with markers such as tapes or flags that are not in contact with the glass, but which are held in position away from the glass and attached to the framing members. Do not apply markers to surface of glass.

3.06 CLEAN UP AND CLEANING OF GLASS

A. Remove all labels, excess glazing tape, stains, and spots from glass upon completion of glazing work.

B. Remove all rubbish and debris from the site at the end of each day's work. Clean sealant smears and stains from adjacent surfaces as the work progresses.

C. At the completion of the entire project, all glass surfaces will be professionally cleaned and polished, at the Contractor's expense, under SECTION 015000, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 WORK TO BE PERFORMED

A. Furnish and install the following:

1. Aluminum louvers including but not limited to mechanical intake and exhaust vents, complete with bird screens and other related items, for indicated locations in exterior walls.

1.03 RELATED WORK:

A. The following related work will be performed under the designated SECTIONS

1. Perimeter sealant and backer rod and connections to continuous air and vapor barrier: SECTION 071000, WATERPROOFING, DAMPPROOFING & CAULKING.

2. Motorized dampers, ductwork and other mechanical equipment connected to louvers and vents, including insulated blank-off panels: SECTION 230000, HVAC.

3. Power, wiring and connections to alarm systems for motorized dampers: SECTION 260000, ELECTRICAL.

1.04 SUBMITTALS

A. Submit the following in accordance with the provisions of SECTION 013300, Submittal Procedures:

1. Shop drawings: Schedule of all louvers to be furnished hereunder, indicating locations for each size and type of louver, and locations and sizes of blank off panels within louver units; large scale details of louver and blank off panel construction; indicating all sizes, gauges, and thicknesses; large scale details of bird screens and accessory items; and complete installation details, coordinated to the specific receiving conditions.

2. Literature: Manufacturer's complete product data and specifications for type of louvers and elevator vent unit proposed.

3. Warranty: Louver manufacturer's standard written warranty for the louvers.
PART 2 - PRODUCTS

2.01 EXTERIOR METAL LOUVERS

A. General: Refer to the Drawings for locations and sizes of louvers in exterior walls.

B. Description: Extruded 6063-T5 alloy aluminum assembly, comprised of 0.081-inch minimum thickness fixed stormproof J-blades set on a 45-degree slope, in a 4-inch deep aluminum frame of C-channel design; with all joints and connections welded, providing approximately 44 percent free air opening; equipped with removable 1/2-inch square 14 gauge aluminum wire bird screens in folded frames. Where required to accommodate reduced duct size, equip louvers with prefinished metal blank off panels, secured to the interior of the louver frames.

C. Pre-finishing system for aluminum:
   1. Thoroughly clean and degrease all surfaces.
   2. Apply one coat of epoxy primer, and oven-bake at at least 375 degrees F for 12 to 15 minutes, providing a dry film thickness of not less than one (1) mil.
   3. Apply one coat of acrylic or polyester finish, in selected colors, to all exposed to view surfaces, and oven-bake at at least 400 degrees F for 12 to 15 minutes, providing a dry film thickness of not less than one (1) mil. Provide sufficient quantity of factory-finish materials for field touch-up work, of same colors and production runs as those used in the process.

D. Manufacture and type: Construction Specialties model No. 4115, storm proof louver, or equal.

PART 3 - EXECUTION

3.01 PRE-INSTALLATION CONDITIONS

A. Examine receiving conditions in locations where louvers are to be installed, and ensure that conditions are satisfactory for the installation of the items to be furnished hereunder.

B. Do not deliver metal louvers until the receiving conditions are proper and ready for louver and vent installation. Protect louver and accessories from damage during delivery, handling, storage, and installation.

3.02 INSTALLATION

A. Perform the installation work in strict accordance with the approved shop drawings, the manufacturer's installation instructions, and additional requirements specified herein.

B. Install louvers absolutely plumb and in true line, securely anchored to the surrounding construction. Conceal screw and bolt heads to the fullest extent possible.
C. Furnish and install insulated metal blank off panels wherever required for connection of smaller-sized ductwork to louvers.

D. Upon completion of the installation, touch-up all scratches, abrasions, and other defects in the finished surfaces, using the same material and color as that used in the finishing system; and thoroughly clean all surfaces free from dirt, handling marks, and foreign matter.

END OF SECTION
SECTION 092100

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Furnish and install the following:

1. Drywall construction systems for interior partitions, chases, framed ceilings, and other conditions indicated, gypsum wallboards, metal drywall accessories, and other related drywall items.

2. Drywall construction systems for interior soffits, including wire hangers, hanger attachments, screwable metal tee suspension system, gypsum wallboards, metal drywall accessories, and other related drywall items.

3. Drywall construction enclosures for ductwork, and for various furring conditions, to the extent indicated on the Drawings, including, as applicable, metal drywall furring channels, gypsum wallboards, metal drywall accessories, and other related drywall items, as required for providing fire-resistive ratings indicated on the Drawings.

4. All additional supplementary framing and bracing required for the support of concentrated loads imposed by items indicated to be attached to, or hung from, gypsum board surfaces.

5. Tape-joint finishing system for all gypsum wallboard surfaces, including surfaces to which ceramic tile will be applied; mesh joint reinforcement system for joints and internal corners of gypsum board, plastering base and cement board; and compound, only, for filling all fastener head depressions, scratches, and other surface defects in exposed to view gypsum wallboard surfaces.

6. Sealant for the following locations:

a. Joints between casing beads, furnished hereunder, and dissimilar materials.

b. Joints around all items which penetrate gypsum wallboard.

c. Joints between edges of gypsum wallboard, and dissimilar materials.

d. Joints between stud runners and adjacent dissimilar construction, on one side only.
B. Perform sanding of all rough spots in taped gypsum finish, and leave ready to receive applied coatings; and sand all joint compound surfaces in gypsum wallboard which are exposed to view and leave ready to receive applied coatings.

C. Install the following items as furnished under the designated SECTIONS:

1. Access panels, occurring in gypsum wallboard surfaces: By trade requiring same.

2. Anchor clips for pressed steel frames occurring in drywall partitions, welded to frames, for attachment to studs hereunder: SECTION 081100, STEEL DOORS AND FRAMES.

3. Designated items of specialties: SECTION 108000, Miscellaneous Specialties.

D. Level of Finish:

1. Tape-joint finishing for exposed to view walls, ceilings and soffits shall be Level 4 finish with the exception of storage and mechanical rooms which shall be Level 3.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

1. Independent hangers for suspended lighting fixtures: SECTION 260000, ELECTRICAL.

2. Vinyl bases, where indicated, to be applied to gypsum wallboard surfaces: SECTION 096500, RESILIENT FLOORING.

3. Applied coatings for gypsum wallboard and veneer plaster surfaces: SECTION 099100, PAINTING.

4. Wood framing, wood blocking, nailers, and other rough lumber in conjunction with gypsum drywall work: SECTION 061100, ROUGH CARPENTRY.

5. Wood stud framing, and related items in conjunction therewith, for exterior and interior wall framing, not otherwise specified herein: SECTION 061100, ROUGH CARPENTRY.

6. Furnishing of access panels, for installation into the various drywall construction systems hereunder: By the respective mechanical and electrical trades requiring same.

7. Furnishing and installing fire-safering batt insulation, around all pipes, ducts, conduits, and similar items, which penetrate fire-rated partitions, for the full partition thickness at such penetration locations; furnish glass fiber batt insulation for installation hereunder; and furnishing vapor retarder sheeting for interior surfaces of the wood studs in exterior wall construction for installation hereunder: SECTION 078500 FIRESTOPPING.

1.04 SUBMITTALS

A. Submit the following, in accordance with the provisions of SECTION 013300, Submittal Procedures:
1. Shop drawings: Include a typical layout for drywall partitions, drywall furred areas and surfaces, and all suspended ceilings and soffits, showing openings therein by dimension; details of proposed methods of supplementary framing as required for assembly rigidity and for items which are hung from drywall assemblies. Include a complete material list, including type, grade, thickness, gauge, and manufacturer's specific product name for each item.

   a. 1/4" = 1'-0" scale plans and interior elevations showing proposed control joint locations in accordance with manufacturer's recommendations.

2. Samples:

   a. Metal suspension and tee grid system: 12 inch length of each component.

   b. Cold rolled channel: 12 inch length.

   c. Sealant materials: Strips of each type and available colors, for selection by the Architect, with proposed locations for each type sealant.

   d. Metal accessories: 12 inch length of each type specified.

   e. Gypsum wallboards: 12 by 12 inches, in each specified type and thickness.

3. Literature: Manufacturer's product data sheets, specifications, and cuts for each item to be used hereunder.

4. Guarantee: Manufacturer's and installer's joint written guarantee, covering defects in materials and workmanship for a period of at least two (2) years from date of Substantial Completion of the project as defined in the GENERAL CONDITIONS.

1.05 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:

   1. Gypsum Products Accessories & Systems (Folder SA-919), Plaster Products Accessories & Systems (Folder SA-920), Drywall/Steel-Framed Systems (Folder SA-923), and Gypsum Panels and Accessories (Folder SA-927), all as published by United States Gypsum, or similar standards of other manufacturers whose products are used.


PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Metal components, except as otherwise specified: As manufactured by U.S. Gypsum, National Gypsum, Georgia Pacific Gypsum Division, MM Systems Corporation, Inland Steel, Penn Metal, or equal.

B. Gypsum boards, cement board, and related items therefor: U.S. Gypsum, National Gypsum, Georgia Pacific Gypsum Division, or equal.

C. Metal suspension and tee grid system for ceilings and soffits: Chicago Metallic, National Rolling Mills, Eastern, or equal.

D. Sealants: U.S. Gypsum, Pecora, Tremco, or equal.


2.02 MATERIALS

A. Hanger attachments for suspended drywall ceilings and soffits: Galvanized steel hanger attachments, expansion-type for concrete receiving surfaces; stud-weld type for steel receiving surfaces to which hangers cannot be tied; of sizes and gauges to safely sustain a live load of at least 150 pounds per hanger attachment.

B. Hangers: 8-gauge galvanized steel wire.

C. Grid system for attachment of suspended gypsum wallboard ceilings and soffits: Chicago Metallic 640 Furring System, or equal, comprised of double web main furring tees, 1 1/2 inches high by 1-3/8 inches flange face by 0.020 inch thick; double web cross tees, 1 1/2 inches high by 15/16 inch flange face by 0.020 inch thick; 0.020 inch thick wall channels, with 1 1/2 inches interior web height; and all splices, clips, and related items, completely prefinished in baked white enamel where exposed.

D. Carrying Channels: Cold rolled steel channels, 1-1/2 inch size, weighing not more than 475 pounds per 1,000 linear feet, shop-primed with rust resistant black enamel. Use carrying channels for diagonal bracing within gypsum wallboard ceilings and soffits, except as otherwise indicated on the Drawings.

E. Drywall furring channels: USG Drywall Furring Channels, or equal. Provide proper expansion-type fasteners for securing furring channels to masonry or concrete.

F. Runners for studs in shaft wall assemblies: USG steel J-Runner, 24 gauge, galvanized, 2-1/2 inch size.

G. Struts for jamb framing of door openings in shaft wall assemblies: USG steel J-Strut, 20 gauge, galvanized, 2-1/2 inch size.

H. Internal reinforcement for various stud conditions, and bracing as required: 20 gauge, minimum, galvanized steel.

I. Wire, for tying drywall furring to cold rolled steel carrying channels: 16 gauge, galvanized annealed wire.
J. Wallboards:

1. Moisture-resistant wallboard: USG Sheetrock Brand Firecode W/R Gypsum Panels, or equal, 5/8 inch thick, except as otherwise indicated.

2. Fire-resistive-rated wallboard: USG Sheetrock Brand Firecode, or equal, 5/8 inch thick, except as otherwise indicated on the Drawings.


K. Fasteners for applying wallboards to metal studs, wood studs, screwable metal tee grid system, and drywall furring channels: USG Brand Type S bugle head screws, one inch size for single layer; 1-5/8 inches long for double layer.

1. Fasteners for cement boards: Durock coated steel screws; 1-5/8 inches long.

L. Laminating adhesive: Durabond Joint Compound, Taping or 90, or equal.

M. Sealant material: USG Acoustical Sealant, or equal, for all locations.

N. Metal accessories:

1. For gypsum wallboards:
   a. Corner beads:
      (1) For general locations: USG Dur-A-Bead, No. 104, or equal, galvanized, for finishing with joint compound.
   b. Casing beads:
      (1) For general locations: USG No. 200-A, or equal, galvanized, for finishing with joint compound.
      (2) For locations indicated on the Drawings to receive reveal-type casing beads: MM Systems Corporation Ceiling/Wall reveal Molding RMF58-34, or equal, 3/4-inch wide reveal, extruded aluminum with factory-applied chromate conversion coating.
   c. Control Joints: USG Control Joint 093, or equal, galvanized.

O. Joint, internal corner, and depression treatment for gypsum wallboards: USG Joint Sheetrock Joint Tape and USG Ready-Mixed Plus 3 Total Joint Compound, or equal. Use compound, only, for treatment of screw heads and other surface depressions.

PART 3 - EXECUTION

3.01 PREPARATION AND PRE-INSTALLATION REQUIREMENTS

A. Keep fully informed at all times as to work of appurtenant trades and obtain all necessary information for the proper relation of this work to that of other trades.

B. Store all materials in completely dry and covered areas and obtain all necessary information for the proper relation of this work to that of other trades.
C. Protect, during progress of the work of this SECTION 09250, all wood, metal, glass, flooring, and other finished work, be fully responsible for correction of any damage done to same, and bear all costs therefor.

D. Do not install gypsum wallboards, gypsum board plaster bases, or gypsum shaft wall liner panels, until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

3.02 INSTALLATION STANDARDS

A. General: Except as otherwise specified herein, perform erection procedures for the various drywall construction and veneer plaster conditions, as set forth in the referenced published specifications and folders of United States Gypsum Company, latest editions or comparable specifications of other accepted materials manufacturers, together with additional requirements specified hereunder and as indicated on the Drawings.

B. Metal grid system for interior ceiling and soffit conditions: Install grid system in strict accordance with the recommendations of the system manufacturer, and additional requirements as specified herein.

C. Refer to the Drawings for UL test design numbers for the various fire resistive-rated drywall assemblies, and perform the erection work in strict accordance with the materials and procedures used in each test.

3.03 INSTALLATION OF PARTITIONS AND FURRED SYSTEMS

A. Except as otherwise indicated on the Drawings, extend all components of partitions, and furred areas, to the underside of overhead structural components or decking, as applicable.

B. Install specified control joints wherever partition or furred surfaces run exceeds 30 feet, in accordance with approved shop drawings. Locate control joints at corners of head frames of doors, as far as practicable, and show locations of all control joints on shop drawings. Run control joints continuously to top of partition, soffit or furred area, as applicable.

C. Furnish and install additional cross bracing, knee bracing, and gypsum wallboard gussets, as required to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing and gussets have been indicated on the Drawings. Furnish and install all additional bracing as required for proper receipt of items which will be attached to the surfaces of the various drywall construction assemblies.

D. Install access panels, occurring in drywall surfaces, which are furnished by trades requiring same, securing the flanges of the panels as recommended by the manufacturer.

E. Secure all pressed steel frames, occurring in stud partitions, to the steel studs with not less than 2 self-tapping machine screws per anchor clip.

F. Provide spot grout at door jamb anchor clips for all doors 2 feet 8 inches in width or wider installed in metal stud partitions. Apply grout just prior to in-setting gypsum wallboard into metal door frame.
G. Install specified batt insulation between metal screw studs of interior partitions and furred areas, where so indicated on the Drawings, in a continuous manner with tightly butted joints, and in other locations indicated on the Drawings in conjunction with drywall systems.

H. Install specified drywall furring channels on surfaces of masonry partitions and walls, with expansion-type fastenings, spacing the channels 16 inches on centers.

I. Erect the various systems to conform to the manufacturer's listed test constructions for the required fire ratings for each assembly, said assemblies being as noted on the Drawings.

J. Install specified sealant between stud runners and dissimilar materials, in a continuous manner, on one side of the runners.

K. Install the various wallboards in accordance with the herein-referenced standards.

L. Install specified joint treatments for all internal corner joints of gypsum wallboard and for all joints between abutting sheets of the boards, whether or not such joints will be concealed from view. Apply compound to all fastener head depressions and abrasions in the surfaces. Sand all compound surfaces, which will be exposed to view, completely smooth and leave to receive applied coatings. Final layer of joint compound and sanding of same will not be required for joints in gypsum wallboard which are located above finish ceiling lines.

M. Install specified sealants in the following joints:

1. Between gypsum wallboard, and gypsum board plastering base, and floors, wherever bottom of board will be concealed by a base.

2. Between interior casings and dissimilar surfaces.

3. Around all items which penetrate the gypsum wallboard and gypsum board plastering base surfaces, including electrical receptacle boxes, piping, and the like.

4. Between cement board ceilings and soffits and adjacent surfaces.

5. Other joints in conjunction with the drywall and veneer plaster surfaces indicated on the Drawings to receive sealant.

3.04 INSTALLATION OF SCREWABLE TEE SUSPENDED CEILINGS AND SOFFITS

A. Install all components of concealed screwable metal tee system in accordance with the manufacturer's instructions, with current AMA and ASTM-C636 requirements, with design and installation of suspended grid system safely sustaining a membrane loading of at least 7.9 pounds per square foot.

B. Install specified hanger attachments to overhead structure in accordance with the approved shop drawings, using specified type fasteners, spacing the attachments not more than 24 inches on centers over locations of main tee members. Install hanger wires to hanger attachment with triple twists. Install additional wires as required to provide support for main tees, at intervals not exceeding four feet, wherever main tees must be interrupted in order to install other work and at all other locations as may be directed by the Architect. Use extra hanging wires at each location where a recessed lighting fixture occurs.
C. Install gypsum wallboards directly to suspended screwable tee system using specified fasteners spaced uniformly; and install specified metal accessories, tape/compound joint treatment, compound fill for fastener head depressions and surface imperfections; all as specified herein and in accordance with the referenced standards. Install specified batt insulation directly on suspended gypsum wallboard ceilings and soffits, in locations where so indicated on the Drawings.

D. Coordinate suspended drywall ceilings work with that of other trades. Re-adjust ceiling suspension system, prior to the installation of the gypsum wallboard and after installation of mechanical and electrical equipment and fixtures by the respective trades.

3.05 INSTALLATION OF SUSPENDED CEILINGS AND SOFFITS

A. Install all components of the suspension system in accordance with the current AMA and ASTM-C636 requirements, with design and installation of suspended grid system safely sustaining a membrane loading of at least 7.9 pounds per square foot.

B. Install specified hanger attachments to overhead structure in accordance with the approved shop drawings, using specified type fasteners, spacing the attachments not more than 24 inches on centers over locations of carrying channels. Install hanger wires to hanger attachment with triple twists. Install additional wires as required to provide support for carrying channels, at intervals not exceeding four feet, wherever carrying channels must be interrupted in order to install other work and at all other locations as may be directed by the Architect. Use extra hanging wires at each location where a recessed lighting fixture occurs.

C. Install specified carrying channels, in a direction perpendicular to the short dimension of the room or area, spacing the channels 24 inches on centers. Set channels absolutely level, in uniform true alignment, and secure the bottom end of each hanger wire to the channel with a double wrap and triple twist of the wire.

D. Install specified drywall channels in a direction perpendicular to the carrying channels, spacing the furring channels not more than 16 inches on centers, (not more than 12 inches on centers for cement boards), and secure to carrying channels with specified wire in a double looped saddle tie. Shop roll furring channels to the radii shown on the Drawings for curved ceilings.

E. Install gypsum wallboards directly to the metal drywall channels using specified fasteners spaced uniformly; and install specified metal accessories, tape/compound joint treatment, compound fill for fastener head depressions and surface imperfections; all as specified herein and in accordance with the referenced standards. Install specified batt insulation directly on suspended gypsum wallboard ceilings and soffits, in locations where so indicated on the Drawings.

F. Coordinate suspended drywall ceilings work with that of other trades. Re-adjust ceiling suspension system, prior to the installation of the gypsum wallboard and after installation of mechanical and electrical equipment and fixtures by the respective trades.
3.06 PROTECTION AND CLEANING

A. During the operation of gypsum drywall and veneer plastering work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair and/or replace any work so damaged and soiled.

B. After completion of the work of this SECTION, remove equipment, and clean all wall, partition, and floor areas free from deposits of compound, gypsum fill, veneer plaster, and other materials installed under this SECTION.

END OF SECTION
SECTION 092300

PLASTER PATCHING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 WORK TO BE PERFORMED

A. Furnish and install the following:

1. Metal lath, base coats and finish coats of plaster, metal reglets, and metal plaster accessories, for patching the following existing plaster conditions:

   a. Plaster surfaces which will remain exposed to view, from which existing items have been removed therefrom.

   b. Plaster surfaces which will remain exposed to view, which have been cut or otherwise altered under the work of this Contract.

   c. Cracks and spalled areas in existing plaster surfaces which will remain exposed to view.

   1.) Refer to the Drawings and Specifications for limits of work elsewhere in the building.

   B. Perform key-cutting of cracks in existing plaster surfaces, as required to provide proper mechanical bonding for plaster patching to be performed hereunder.

   C. Perform sanding of plaster patched areas, and leave ready to receive applied finishes.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

   1. Wood nailers, blocking, and furring, in conjunction with the lathing and plastering work: SECTION 061100, ROUGH CARPENTRY.

   2. Applied finishes for plaster surfaces: SECTION 099000, PAINTING.

   3. Gypsum drywall work with tape and compound joint treatment in conjunction therewith, and related items: SECTION 092100, GYPSUM BOARD ASSEMBLIES.

   4. Removals and general demolition of existing materials, except key-cutting of existing plaster edges as specified hereunder: SECTION 022820, ASBESTOS REMEDIATION.
1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Literature: Manufacturer's complete product data and specifications for metal lath, metal accessories, and plasters proposed.

1.05 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:


3. Plasters, Bases, and Accessories (Folder SA-917), as published by U.S. Gypsum, or similar standards of other manufacturers whose products are used.

PART 2 - PRODUCTS

2.01 MANUFACTURE

A. To establish a standard of quality, type, design, and function, specifications have been based on plasters, metal lath, and metal plaster accessories, as manufactured by U.S. Gypsum. Similar products as manufactured by National Gypsum Company; Silibond Products Co.; Inryco Co., Keene Corporation, and other manufacturers, will be considered for approval as an equal by the Architect, upon receipt of adequate supporting data.

2.02 LATHING AND ACCESSORIES MATERIALS

A. Metal lath for patching existing interior plaster surfaces: 3/8-inch rib lath, factory-painted black, and weighing 3.4 pounds per square yard.

B. Metal casings: No. 66, square edged, with expanded metal flanges, of 3/4-inch ground height, 24-gauge galvanized steel.

C. Metal corner beads: Small nosed, with 2 7/8-inch expanded wings, USG No. 1-A, 26-gauge galvanized steel, or equal.

D. Reglets: Number PCS-75-75, 3/4 by 3/4-inch aluminum channel screed, as manufactured by Frye Reglet Company, or equal.

E. Wire: for tying metal lath to itself, and for tying metal accessories to lath: 18-gauge galvanized annealed steel wire.

2.03 PLASTER MATERIALS

A. Gypsum plaster for basecoats: High strength gypsum plaster, conforming to ASTM C-28, USG Structo-Base Gypsum Plaster, or equal.

B. Gypsum gauging plaster for finish coat: High strength gypsum gauging plaster, conforming to ASTM C-28, USG Structo-Gauge Gauging Plaster, or equal.
C. Lime: Pressure-hydrated finishing lime, ASTM C-206, Type S.

D. Sand: Clean, sharp, free from alkali, salt, and quicksand, containing not more than 5 percent loam or clay, graded from coarse to fine, and conforming to ASTM C-35.

E. Water: Clean, potable, and free from deleterious amounts of oils, salts, alkali, organic matter, and other foreign matter.

**PART 3 - EXECUTION**

**3.01 PRE-INSTALLATION REQUIREMENTS**

A. Keep fully informed at all times as to work of appurtenant trades, and obtain all necessary information for the proper relationship of the lathing and plastering work to that of other trades.

B. Store all materials in completely dry and covered locations, at all times.

C. Furnish, install, and maintain during the progress of the plastering work, substantial coverings and other protective measures for all finished surfaces, be fully responsible for correcting any damage thereto caused by the plastering work, and bear all costs therefor.

D. Ensure that a temperature of at least 55 degrees F. can be maintained from the commencement of the plastering work through the completion of the curing process for the plaster. Ensure that regulated ventilation will be provided during the application and curing period. Immediately report any unacceptable conditions to the Architect, requesting disposition therefor, and do not mix or apply plaster materials until all conditions are satisfactory and acceptable to the lathing and plastering applicator.

E. Do not install lath and plaster until all pipes, conduits, ducts, and other such items which are to be concealed thereby, have been permanently installed, inspected, and approved.

**3.02 PREPARATION FOR PLASTER PATCHING**

A. Cracks in existing plaster surfaces: Carefully key-cut cracks to a vee configuration, to permit a proper mechanical bond for the new patching plaster, and thoroughly dry-brush the cuts to remove all loose plaster particles.

B. Interfacing between new patching plaster and existing plaster surfaces: Carefully key-cut the existing plaster edge to a uniform 45-degree angle, and thoroughly dry-brush the cuts to remove all loose plaster particles.

**3.03 INSTALLATION OF METAL LATH AND ACCESSORIES FOR PATCHING AND FACING**

A. Lath: Secure the lath to the receiving surfaces with specified fasteners, spaced not more than 6 inches on centers. Lap adjacent edges of lath with at least one-inch laps, tied with specified wire, spacing ties not more than 6 inches on centers.

B. Casings: Install specified casings wherever new patching plaster abuts a dissimilar material, and in other locations so indicated on the Drawings. Secure casings to metal lath with specified tie wires spaced not more than 6 inches on centers. Ensure that casings are set absolutely level, and at the proper height to receive the required thickness of plaster.
C. Corner beads: Install specified corner beads at all external corners of new patching plaster, securing the corner beads to the metal lath with specified tie wires spaced not more than 6 inches on centers. Ensure that corner beads are installed absolutely plumb, in uniform line, and at the proper height to receive the required thickness of plaster.

3.04 PROPORTIONING AND MIXING

A. Gypsum plaster system:

1. Scratch coat: Two (2) cubic feet of sand per 100 pounds of specified basecoat plaster.

2. Brown coat: Three (3) cubic feet of sand per 100 pounds of specified basecoat plaster.

3. Finish coat: One (1) part lime or lime putty and one (1) part of specified finish gauging plaster, with sufficient amount of water added to make the mix workable, in accordance with the manufacturer's recommendations.

B. Mixing for base coats and finish coat: Use containers of known capacity, or by information contained on the specific packages, and accurately mix the materials. Do not use any lumpy or frozen materials in the mixes. Ensure that all mixing equipment, tubs, and tools are absolutely clean, before commencing the mixing operations. Use specified mix proportions, except where variations thereto would be more suitable due to prevailing conditions, and only when such variations are submitted to, and approved by, the Architect. Continue mixing process until all materials are evenly distributed and blended. Mix only the amount of material which may be applied within 2 hours.

3.05 APPLICATION OF GYPSUM PLASTER SYSTEM

A. Scratch coat: Apply with sufficient material and pressure to cover well and key into the lath, then scratch to a rough surface to provide proper bond for the brown coat.

B. Brown coat: Apply brown coat to the firm and hard scratch coat, spreading the brown coat over an entire elevation, without laps or joinings, in a thickness of not less than 1/4-inch over the scratch coat, and bring to a straight and true plane by rodding in every direction. Leave the surface of the brown coat rough for proper bonding of the finish coat.

C. Finish coat: Apply the finish coat to an entire elevation, without laps or joinings, in a thickness of 1/8 to 1/4-inch over the brown coat, doubling back as necessary to provide a uniformly smooth dense finish, free from blemishes and irregularities.

D. Total thickness of base coats and finish coats: As required to match the overall thickness of the existing plaster.

E. After plaster patching has fully cured, thoroughly sand the surface with fine grit sandpaper, leaving the surfaces at the same plane as the surrounding existing plaster, completely smooth and ready to receive the applied finishes.
3.06 CLEAN-UP

A. After completion of plastering work, remove equipment and tools, and clean all walls, floors, and other surfaces, free from deposits of plaster and lathing materials.

END OF SECTION
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON-TEXT PAGE
PART 1 - GENERAL

1.00 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER'S CHECK or CASHIER'S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P1.2, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 123000, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 WORK TO BE PERFORMED

A. Furnish and install the following:

1. Glazed ceramic wall tile, including matching bullnosed caps and internal and external corners; installed in organic adhesive on gypsum wallboard substrates.

2. Unglazed ceramic mosaic floor tile, including matching built-up coved bases installed in thin set Portland cement mortar setting bed.

3. Marble saddles, between ceramic mosaic floor tile and dissimilar flooring materials, installed in thin set Portland cement mortar setting bed.

4. Sealant material, around all items which penetrate tile surfaces; in joints between tile and abutting dissimilar materials; and in perimeter joints of marble saddles.

B. Perform cleaning and polishing of all tile and marble surfaces.
C. Prepare all substrates, as required to properly receive materials to be furnished and installed hereunder, except as otherwise specified herein.

D. Perform cutting in tile surfaces, as required to accommodate recessed and penetrating items, in accordance with dimensioned drawings and templates provided by the trades responsible for furnishing and installing such items.

E. Install the following items as furnished under the designated SECTIONS:
   1. Access panels, occurring in tile surfaces: By the respective trades requiring same.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:
   1. Floor drain assemblies, and other plumbing work: SECTION 220000, PLUMBING.
   2. Gypsum wallboard substrates, with all joints tape/compound-treated: SECTION 092100, GYPSUM BOARD ASSEMBLIES.

1.04 SUBMITTALS

A. Submit the following in accordance with the provisions of SECTION 013300, SUBMITTAL PROCEDURES:
   1. Samples:
      a. Manufacturer's standard color samples for each type and color group of tile specified, grout colors, and sealant colors, for initial selections by the Architect.
      b. After receipt of initial color selections, submit one 12 by 12-inch panel of each type and size of tile, with grouted joints, in selected colors.
   2. Literature: Manufacturer's product data and specifications for each type tile, marble, sealant material, installation recommendations, and cleaning and maintenance procedures.

1.05 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:
   1. American National Standards Institute (ANSI) specifications for:
      b. Ceramic Tile Installed with Organic Adhesive, A108.4.
      c. Installation of Grout in Tile work, A108.10.
      d. Ceramic Tile Grouts, A118.6.
      e. Organic Adhesives for Installation of Ceramic Tile, A136.1.
      f. Ceramic Tile, A137.1.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.01 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

2.02 TILE, MARBLE, AND RELATED INSTALLATION MATERIALS

A. Glazed ceramic wall tile: Complying with Section 6.1, ANSI A 137.1; Standard Grade, 3 by 6 by 1/4-inch thick, with gloss-glazed Group 1 and 2 colors with up to twenty percent (20%) in Group 3 and 4 accent colors, patterns and colors as selected by the Architect, cushion-edged, laid up in a running bond pattern. Provide matching bullnosed caps, internal and external corner units, and other shapes, as required.

B. Unglazed ceramic mosaic tile: Standard Grade unglazed ceramic mosaic tile, conforming to ANSI A137.1, nominal 2 by 2 by 1/4-inch thick, porcelain body, cushion-edges, in standard Group 2 colors with up to ten percent (10%) in Group 3 accent colors, patterns and colors as selected by the Architect. Provide matching built-up coved base units in conjunction with ceramic mosaic floor tile.

C. Marble, for saddles between ceramic tile floors and dissimilar flooring materials: Domestically-quarried marble, ASTM C 503, with a minimum abrasion resistance of
12 per ASTM C 1353 or ASTM C 241 and with honed finish, with all exposed surfaces having a smooth sand finish, of color as selected by the Architect from veined white or light buff color price range. Refer to the Drawings for sizes and profiles. Marble saddles shall be set flush with adjacent finish floor surfaces.


E. Grout for floor, wall and base tile: Polymer-Modified Tile Grout, ANSI A118.7, with waterproofing admixture and added colors as selected by the Architect.

F. Waterproofing admixture for conventional Portland cement setting bed mix: Toch Brothers Toxement powder, Medusa Waterproofing Admixture, Master Builders Omicron, or equal, in quantity of to be incorporated in the various mixes as recommended by the manufacturer.

G. Sealants:

1. For surfaces directly exposed to water: Mildew-resistant, ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures: DAP Inc.; 100 percent Silicone Kitchen and Bath Sealant, GE Silicones; a division of GE Specialty Materials; Sanitary 1700, Dow Corning Corporation; Dow Corning 786. or equal.

2. For joints between tile and abutting frames, joints around penetrations in ceramic tile, and joints between tile and dissimilar materials not otherwise specified herein: Pecora Acrylic Latex Caulk AS-20, DAP Acrylic Latex Caulk, Gibson Holman Acrylic Latex Caulk, or equal, in colors as selected by the Architect.

3. VOC limit for sealants shall be 65 g/L.

PART 3 - EXECUTION

3.01 PRE-INSTALLATION REQUIREMENTS

A. Inspect all surfaces and notify the Contractor of any conditions which may affect this work adversely, requesting correction thereof. Do not commence installation of materials hereunder until all substrates are in acceptable condition and proper to receive the work.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.

   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
B. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed; and that all surfaces are dry and clean before setting bed is applied.

C. Do not install any tile materials until all required submittals have been approved by the Architect, and colors selected.

3.02 INSTALLATION

A. Comply with the installation procedures and requirements of the herein-referenced ANSI and TCA standards and specifications, with the following additional requirements:

1. Glazed ceramic wall tile, and ceramic mosaic tile bases, on gypsum wallboard substrate: Install organic adhesive setting bed to a nominal thickness of 1/8-inch, and apply tile thereon, in accordance with ANSI 108.4 and TCA Procedure W242. Use specified latex/Portland cement grout, and grout all joints in accordance with ANSI A108.10.

2. Ceramic mosaic floor tile for thin set on concrete floor slab substrate: Install in accordance with manufacturer's instructions and with ANSI A 118.1.

3. Marble saddles: Ensure that saddles have been accurately cut to fit profiles of door jambs, where such condition exists, with uniform 1/8-inch wide joints at the interfaces. Install Portland cement setting bed and set one piece saddles thereon, in accordance with ANSI A108.5. Ensure that the saddles are absolutely level. Leave perimeter joints of saddles free from mortar to a depth of between 1/4 and 3/8-inch to receive sealant material.

4. Install all tile with a unit-to-unit level tolerance not exceeding 1/16-inch, and an overall level tolerance not exceeding 1/8-inch in 10 feet, with uniform-width joints throughout, in strict accordance with the specified standards.

5. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.

3.03 INSTALLATION OF SEALANTS

A. Apply specified sealant materials, in accordance with the respective manufacturers' recommendations, into joints specified herein. Clean off excess sealant immediately, and tool all sealant to a smooth and uniformly dense surface.

3.04 ADDITIONAL MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.
3.05 CLEANING AND PROTECTION

A. Clean all tile in accordance with the herein-referenced ANSI and TCA standards and specifications. Upon completion of setting and grouting, sponge and wash tile surfaces thoroughly, using a diagonal traverse across the joints. Polish all surfaces with clean, dry cloths. Do not use acid or acid-containing cleaners on tile work.

B. Upon completion of the tile work, apply heavyweight non-staining Kraft paper, or other approved protective coverings, over all tile surfaces. The Contractor will replace torn or worn papers thereafter, and maintain same until final acceptance of the Contract. Make all arrangements with the Contractor to close off all traffic and other work in tiled areas, until the tile work has cured.

END OF SECTION
SECTION 095100
ACOUSTICAL CEILINGS
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.00 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER’S CHECK or CASHIER’S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 WORK TO BE PERFORMED

A. Furnish and install the following:

1. Acoustical panel ceilings, consisting of suspended exposed and concealed prefinished metal grid system, prefinished metal edge moldings and trim, mineral fiber acoustical panels of the sizes, styles and finishes noted herein, and all splices and other accessories necessary to complete the installation.

2. Acoustical panel ceilings, adhered directly to the ceiling substrate and to match the existing acoustical panel ceilings, as required to patch existing ceiling assemblies which have been affected by the new Work.

3. Color-coded identification markers at access locations of suspended acoustical ceilings, at locations of valves, controls, and other similar mechanical and electrical items concealed by the ceilings.

4. Suspended exposed and concealed prefinished metal grid system for installation of acoustical panel ceilings as noted above, and in some cases, for the direct
screw attachment of gypsum drywall panels where shown on the drawings, designed to allow screw attachment of drywall.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

1. Electrical fixtures, including supports therefor, wiring, and correlated electrical work: SECTION 270000, ELECTRICAL.

2. Staging and planking, over eight (8) feet in height, furnished, installed, and maintained, at no cost to the Acoustical Tile Subcontractor: SECTION 015000, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

3. Suspended gypsum wallboard ceilings and soffits: SECTION 092100, GYPSUM BOARD ASSEMBLIES.

1.04 SUBMITTALS

A. Submit the following, in accordance with the provisions of SECTION 013300, SUBMITTAL PROCEDURES:

1. Shop drawings:
   a. A complete reflected ceiling plan for each area receiving acoustical panels, indicating, by dimension, locations of access assemblies, lighting fixtures and other items penetrating the acoustical ceilings, and showing extent of each type of acoustical ceiling system specified herein.
   b. Large scale details of metal components for each type suspended grid system, completely dimensioned, with proposed spacings and methods of installation.

2. Samples:
   a. Two full-sized units each of the acoustical panels proposed to be used.
   b. Four-inch long pieces of all metal components for each type of installation, edge moldings, hanger wire, and one piece of each type hanger attachment and clip.

3. Literature: Manufacturers' complete product data and specifications for proposed types of acoustical panels, and grid systems.

4. Test results: Fire-resistive test data for acoustical panels, and metal grid systems; and acoustical performance data for each of the acoustical panels.

5. Guarantees and warranties: Manufacturers' standard written guarantees and warranties for each type acoustical material and metal grid systems to be furnished hereunder.

1.05 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:

1. ASTM C423 for NRC test; and AMA 1-II, for STC test.
2. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.


PART 2 - PRODUCTS

2.01 ACOUSTICAL PANEL CEILING MATERIALS

A. Hanger attachments: Galvanized steel acoustical hanger attachments, expansion-type for concrete and precast concrete receiving surfaces; stud-weld type for steel receiving surfaces to which hangers cannot be tied; of sizes and gauges to safely sustain a live load of at least 150 pounds per hanger attachment.

B. Hangers: 12-gauge, minimum, galvanized steel wire.

C. Exposed metal grid system:

1. Description: Directly-suspended 15/16-inch wide metal tee system, comprised of double-web main tees, double-web cross tees, splices, and connectors, all fabricated from steel, and completely prefinished in baked white enamel. Provide folded flange metal angle reveal-edge moldings, prefinished in baked white enamel, for attachment to intersecting wall and partition surfaces, and to surfaces of all major items which penetrate the acoustical ceilings.

2. Panel hold-down clips: Compatible spring or compression type metal hold-down clips, provided at a rate of not less than four per acoustical panel, for all locations where acoustical panel ceiling systems are installed either sloped or below 8 feet clear from finished floors.


D. Acoustical panels as indicated on the Drawings: Composed of non-combustible mineral fibers, 24 by 24 by 3/4-inch, lay-in, and tegular lay-in edge, rated Class A and Class 25 under Federal Specification SS-S-118B, having a NRC range of .60-.70, a STC range of 35-39, a light reflectance of more than 75 percent, a non-directional fine textured face pattern, with standard factory-applied washable white finish; Armstrong Cirrus, product number 589, or similar products by Celotex, USG, or equal.

1. Accent Tiles, same as field tiles above, with the following exception: Second Look III style, scored to simulate 12 x 12 tiles.

E. Acoustical panels to match existing adjacent panels, as indicated on the Drawings or as required to patch existing ceilings which have been affected by the Work (Field Tiles): Composed of non-combustible wood fibers, 12 by 12 by 3/4-inch, direct adhered, and square edge, splined (to match existing), rated Class A and Class 25 under Federal Specification SS-S-118B, having a NRC range of .60-.70, a STC range of 35-39, a light reflectance of more than 75 percent, drill fiber tile (with 23 rows both directions) with standard factory-applied washable white finish; Silent Source 12 x 12, or similar products by Armstrong, Celotex, USG, or equal.

1. Border Tiles, same as field tiles above, with the following exception: Smooth, no drill pattern, to match existing.

ACOUSTICAL CEILINGS
095100 - 3
F. Prefinished metal edge trim system:

1. Description: Prefinished, extruded aluminum alloy trim channel, for edges of suspended ceiling systems specified elsewhere herein factory finished in baked polyester paint, aluminum unfinished T-bar connection clips for screw attachment to the bulb section of the T-beam system; galvanized steel splice plates, in sizes and radii as shown on the Drawings. Provide all necessary splice plates, inside and outside corners, and accessories, complete. Color to be selected by the Architect.

2. Manufacture and type: Axiom Building Perimeter System as manufactured Armstrong World Industries, Inc., Compåsso system as manufactured by USG Interiors Inc., or equal.

G. Color coded indicators: Provide no. 8 x 3/8-inch round head sheet metal screws, with factory applied color coatings.

**PART 3 - EXECUTION**

3.01 PRE-INSTALLATION CONDITIONS

A. Ensure that all masonry, gypsum drywall, concrete, and other wetwork, to which the work of this SECTION will interface, is completed and fully dry, prior to commencing the work hereunder.

B. Start no work until a uniform temperature of at least 65 degrees F. can be maintained 24 hours before, during, and after the installation of the acoustical work.

C. Carefully examine all receiving surfaces, to which attachments will be made hereunder, and determine the most practical way of making such attachments. Request Architect's approval of any attachment method which differs from that indicated on the approved shop drawings before proceeding therewith.

D. Do not commence installation work until all submittals, required hereunder, have been received and approved by the Architect.

E. Coordinate the installation schedule with the work of related trades, to allow work which will be concealed by the ceilings to be completed prior to commencing installing the ceilings in such locations.

3.02 INSTALLATION OF ACOUSTICAL PANEL CEILING SYSTEM

A. Install all components of the suspended exposed grid system in accordance with the manufacturer's instructions, the approved shop drawings, and current ASTM C636 requirements, to ensure a deflection not exceeding 1/360 span of 48-inch simple span.

B. Install specified edge moldings wherever ceilings intersect a wall or partition surface, and around all items having any dimension of 4 inches or more which penetrate the ceilings. Set moldings absolutely level, using as long lengths as practicable, and secure with stub nails, masonry nails, expansion screws, or sheet metal screws, as most appropriate for the type of receiving surface.

1. Install specified edge trim at open edges of suspended ceilings where shown on the drawings. Set edge trim absolutely level, using as long lengths as practicable, and secure to ends of bulb tees using screws and the specified hardware. Install
splice plates and corner reinforcements in strict accordance with manufacturer's recommendations, so that straight runs are flush, plumb, square and true.

C. Install hanger attachments to overhead construction in accordance with the approved shop drawings, spacing the attachments not more than 48 inches on centers over location of each main tee member. Install hanger wire to attachments with triple twists. Install additional attachments and hanger wires as needed to provide support for the main tees, at intervals not exceeding 48 inches, wherever main tees must be interrupted to accommodate other work, and at other locations as may be directed by the Architect. Use extra attachments and hangers at each grid section where a recessed lighting fixture occurs. Ensure that the allowable uniform load, in pounds per lineal foot of main tee, does not exceed the amount of that section in a simple supported span is capable of supporting without mid-span deflection greater than 0.133 inches in 48 inches.

D. Install main tees parallel to the long dimension of each area, spacing the tees 24 inches on centers. Secure the bottom of hanger wires through slots in the main tee members and tie with triple twists. Level the main tees as the work progresses. Install cross tee members at 24 or 48-inch spacing as required, locking into the main tees.

E. Install panels from the center of each area, working toward the area perimeters. Space panels in a manner which will ensure that edge panels abutting parallel walls are of uniform width, and not less than 6 inches in any case.

F. Field cut regular edges on panels according to manufacturer's instructions and touch up with paint provided by the manufacturer for same, at all edge conditions.

G. Coordinate with the General Contractor and other trades and provide color coded indicators attached to the center point of exposed grid crossing adjacent to tile at access locations of suspended acoustical ceilings, at locations of valves, controls, and other similar mechanical and electrical items concealed by the ceilings.

3.03 CLEANING AND REPLACEMENT

A. Properly clean surfaces of panels free from dirt and handling marks. Wherever surfaces cannot be cleaned by normal methods, and where surfaces have defects, remove the units and replace with new materials, and bear all costs therefor.

B. Remove peel coatings from edge trim materials and touch up any chipped or marred surfaces in accordance with manufacturer's recommendations.

3.04 ADDITIONAL MATERIALS

A. Provide at no extra cost, one full un-opened bundle (containing at least 12 panels) of each type ceiling panel specified hereunder for the Owner's use. Place in a dry, protected interior area on site as directed by the Architect.
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON-TEXT PAGE

ACOUSTICAL CEILINGS
095100 - 6
SECTION 096500
RESILIENT FLOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Furnish and install the following:
   1. Vinyl composition floor tile.
   2. Vinyl bases, straight uncoved when used in conjunction with carpeting, coved for all remaining locations, with matching end stops, and matching job-formed internal and external corner segments.
   3. Vinyl transition strips wherever edges of resilient flooring materials abut dissimilar flooring.
   4. Adhesives, and mastic leveling material to the extent specified herein.
   5. Cleaning and finishing materials for application to all materials installed hereunder.

B. Inspect all receiving surfaces, and ensure that they are in proper condition to receive the work to be performed hereunder. Commencement of work on any floor or other receiving surface will be construed as acceptance of such surface as being satisfactory, and any defects thereon being correctable under this SECTION 096500, at no additional cost to the Contract.

C. Properly prepare receiving surfaces, as required for the proper installation of materials to be furnished hereunder, including application of mastic leveling material as required to provide the specified tolerance in level of finish flooring.

D. Perform specified stripping, cleaning and finishing of materials furnished and installed hereunder.

1.03 RELATED WORK

A. The following related work is not included in this SECTION and will be performed under the designated SECTIONS:
   1. Concrete floor slabs, leveled to a tolerance not exceeding 1/4-inch in 10 feet, in any direction: SECTION 033000 CAST IN PLACE CONCRETE.
2. Carpentry, and leveling materials in conjunction therewith: SECTION 096800, CARPET TILE.

1.04 SUBMITTALS

A. Submit the following in accordance with the provisions of SECTION 013300, SUBMITTAL PROCEDURES:

1. Samples:
   a. Manufacturers' standard samples of vinyl composition tile, vinyl bases, and vinyl transition strips, in all available colors and patterns, for selections by the Architect.
   b. One full 12 by 12 by 1/10-inch quartz vinyl composition tile containing at least 70% quartz crystals, of the specified type, ground down with three different-sized sanding discs, indicating uniform pattern and color concentration at 25 percent, 50 percent, and 75 percent, of the total thickness of the tile.

2. Literature: Manufacturer's complete product data and specifications for each type of resilient material proposed, leveling material, adhesives, cleaning materials, and finishing materials.

3. Results of calcium chloride moisture and alkalinity tests for concrete slabs receiving finishes under this SECTION 096500.

PART 2 - PRODUCTS

2.01 RESILIENT FLOORING AND RELATED MATERIALS

A. Vinyl composition tile (Vinyl quartz tile): 12 by 12 by 1/10-inch, with pattern and color extending through the entire thickness of the tile in equal concentration; composed of vinyl resins, at least 70 percent quartz crystals, in colors (including Custom Colors) and unit patterns as selected by the Architect; with a compressive strength of 2000 psi in accordance with ASTM F 970; Rikett Quartz Color Tile as manufactured by Rikett Quartz, Knight-Rikett, LLC, Marrero, LA, or equal.

B. Vinyl bases: Homogeneous vinyl, 4-inches high, .080-inch wall thickness, straight uncoved when used in conjunction with carpet, coved for remaining locations, in colors as selected by the Architect, and furnished with matching end stops wherever ends of bases are exposed to view. Job-form all external and internal corners from lengths of the base, as specified herein. Pre-moulded corner pieces will not be acceptable. Bases shall be as manufactured by Armstrong, Mercer, Johnson Rubber, Kentile, or equal.

C. Transition strips: Homogeneous vinyl, one by 1/8-inch tapering to feather-edge, in colors as selected by the Architect, as manufactured by Armstrong, Mercer, Johnson Rubber, or equal.

D. Leveling material for substrates, including depressions left by removal of existing items from floors, as required to provide specified finish flooring level tolerance: Premixed, trowel-consistency, latex-based underlayment material, Selby Levelite-Latex, Levelastic, or equal.
E. Adhesives and primers: As recommended by the manufacturers of the specific resilient materials to be used.

F. Cleaning material: Domestic floor detergent, as approved by the flooring manufacturer.

G. Finish material: Clear acrylic floor finish, as required and as recommended by the manufacturers of the specific resilient materials to be used.

PART 3 - EXECUTION

3.01 PRE-INSTALLATION CONDITIONS AND PREPARATION

A. Inspect all surfaces and ensure that they are in proper condition to receive the work of this SECTION.

B. Ensure that a temperature of at least 65 degrees F. will be maintained for not less than 48 hours before commencing installation of resilient materials, and continued for 48 hours after completion of the installation.

C. Start no work until all required submittals have been received, approved, and colors and patterns selected by, the Architect. Label all material packaging, stating colors, locations, and areas in which the materials are to be installed.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound. Remove, by light sanding, all protruding edges, high spots, and foreign matter from receiving surfaces. Thoroughly wash and rinse receiving surfaces, and permit to completely dry before commencing the installation work.

E. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

   a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

3.02 INSTALLATION

A. Install all products, furnished hereunder, with qualified personnel, in strict accordance with each manufacturer's written installation recommendations and additional provisions specified herein.
B. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections. Ensure that concentration of surface patterns is uniform throughout, and that all materials used for each area are taken from the same production run, to prevent variations in color and surface patterns. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.

C. Pre-form all external and internal corners of vinyl bases by applying heat to a 24-inch length of base, bending the base at midpoint to a sharp 90-degree angle, and immersing the base into cold water to set the heated material. Clip cove lip at bend points. Standard pre-molded corner pieces will not be acceptable. Continuously cement all bases to the vertical surfaces, including cabinet and casework bases. Where base is to be installed on masonry surfaces, apply a sufficient amount of specified mastic leveling material to the receiving surfaces to provide a smooth surface to which the base will be cemented.

D. Extend resilient flooring under movable equipment and movable casework into wall lines. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.

E. Except as otherwise directed by the Architect, install resilient floor tile with face pattern running in one direction per area, parallel to the long dimension of the area.

F. Ensure that all finish surfaces of resilient flooring are within a tolerance of 1/8-inch from true level for 10 feet in any direction.

3.03 CLEANING AND FINISHING

A. Protect flooring from foot traffic for a minimum of five (5) days, after which, clean and finish as specified herein and cover with a non-staining kraft paper or exclude from foot traffic completely.

B. Not sooner than five (5) days after installation, clean all materials installed hereunder with a non-abrasive detergent approved by the material manufacturers, and thoroughly rinse with clear water. Strip any factory applied coatings or waxes. After surfaces have fully dried, apply one coat of specified clear acrylic floor finish to all surfaces. Actual time for cleaning and finishing shall be as directed by the Architect.

END OF SECTION
PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 WORK TO BE PERFORMED

A. Furnish and install the following:
   1. Modular Carpet Tile and all related accessories required to complete the installation.
   2. Broadloom walk-off mat for entry vestibules at town hall, installed by direct-adhesion method, and all related accessories required to complete the installation.
   3. Mastic type leveling materials for receiving surfaces, as required to ensure conformance with the specified finish floor level tolerance.

B. Vacuum-clean all carpeting upon completion of the installation.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:
   1. Straight un-coved vinyl bases in conjunction with carpeting: SECTION 096500, RESILIENT FLOORING.

1.04 SUBMITTALS

A. Submit the following in accordance with the provisions of SECTION 013300, SUBMITTALS:
   1. Shop drawings: Include complete layout for each area receiving carpet of each type specified hereunder, indicating extent of carpet, sizes of segments, seam locations, direction of carpet in all areas, (direction of carpet pile being uniform throughout). Include edge details on shop drawings. Provide accessory manufacturers' standard cuts showing these details.

   2. Literature: Manufacturers' specifications for proposed types of carpet, accessories, adhesives, leveling materials, and installation materials, including methods of application and installation instructions of the manufacturers whose materials are used.

   3. Samples: Samples for Initial Selection for each type of carpet tile. After initial selection of carpet types and color blends has been made by the Architect, submit one 24 by 24 inches sample of each selected type, in each selected color blend of the actual carpet material, for final approval of the Architect. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.
4. Warranties and guarantees:

a. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1) Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2) Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
3) Warranty Period: 10 years from date of Substantial Completion.

b. Carpeting installer's written guarantee covering prompt and proper replacement of any and all carpeting that indicates improper installation workmanship and/or defective material within twelve months from completion of the installation and acceptance thereof by the Architect, said corrective work being performed by the Carpeting installer at no cost to the Owner.

1.05 SCHEDULE AND DELIVERY OF MATERIAL

A. Place order for all carpeting for this project to the mill in sufficient time before the required delivery date to allow ample time for mill vacations, production, and delivery requirements. Be responsible for the scheduling, receiving, and placement of materials required under this SECTION to meet the requirements of this project on time.

B. Deliver all carpeting to the job site in original mill wrappings with each roll having register number tags attached or register number stenciled on bale and intact. Submit a written record of receipt of the goods with verification of the approved color combinations.

1.06 QUALIFICATION OF INSTALLER

A. The Carpeting installer shall be regularly engaged in the installation of the type of carpeting specified herein.

1.07 STANDARDS AND CERTIFICATION

A. Applicable requirements as set forth in accordance with ASTM standards on Textile Materials prepared by ASTM Committee D-13 shall apply to the standards established herein. All testing for shrinkage, moth-repellency, seam strength, and flame resistance shall meet or exceed testing procedures and end limits as described in ASTM DDD-C-95. In addition to the above-specified requirements, all materials, including adhesives and tapes shall meet or exceed the flame-resistance and smoke contribution requirements of the Commonwealth of Massachusetts state Building Code.

B. Samples for testing may be taken from the job, as determined by the Architect.

C. The carpet manufacturer will be required to certify on the invoice, or on a separate certificate, that the carpet and other related materials to be supplied hereunder meet all requirements specified herein.
PART 2 - PRODUCTS

2.01 CARPET TILE AND RELATED MATERIALS

A. Carpet Tile:

1. Manufacture and type: To establish a standard of quality, type, function, and color blends, specifications have been based on Weave Accent Tile, Style Number 59442, SILK Collection, as manufactured by Shaw Contract Group. All carpets shall be treated with the standard antimicrobial product of the manufacturer.

Product: Weave Accent Tile, #59442, as manufactured by Shaw Contract Group

| Construction | multi-level pattern cut/loop |
| Gauge | 1/12-inch (47.24 / 10 cm) |
| Stitches Per Inch | 9.0 per inch (35.43/10 cm) |
| Finished Pile Thickness | 0.146-inch avg (3.71 mm) |
| Thickness | 0.306-inch (7.77 mm) |
| Dye Method | yarn dyed |
| Backing Material | synthetic |
| Protective Treatments | Soil protection |
| Radiant panel | Class I |

Secondary Backing: Manufacturer’s standard material.

Size: 24 by 24 inches.

Color: Three (3) colors from this line, as shown on the Drawings.

B. Broadloom walk-off mat:

Product: Lineage DS946 as manufactured by Lees Commercial Carpet

| Construction | tufted |
| Surface Texture | performance loop pile |
| Gauge | 5/32" (25.2/10 cm) |
| Stitches Per Inch | 8.5 per inch (33.46/10 cm) |
| Finished Pile | .249" avg (6.3 mm) |
| Dye Method | yarn dyed |
| Backing Material | Integrated Cushion Thermobond™ Tile |
| Face Yarn | Invista nylon 6,6 with nylon 6,6 scraper yarn |
| Fiber Technology | Leesguard soil Release Technology |
| Face Weight | 38 oz/yd2 (1288.59 gm/m2) |
| Primary Backing | reinforced synthetic |
| Bonding Agent | premium vinyl |
| Secondary Backing | fiberglass reinforced thermoplastic composite |
| Total Weight | 215.45 oz/yd2 (7305.91 gm/m2) |
| Size/Width | 12 feet |
| Pattern Repeat | n/a |

C. Installation accessories: All adhesives shall be NFPA Class A and UBC Class 1 types, as determined by ASTM E-84 Tunnel Test.

1. Installation adhesives: Manufacturer’s recommended adhesives, low odor, low VOC.
2. Transition strips where carpeting abuts dissimilar flooring material: Homogeneous vinyl, Afco Rubber Corporation No. 223 Carpet and Tile Joiner, Flexco Stock No. 64 Tile & Carpet Joiner, Johnson Rubber Company Type CTA-XX, or equal, in colors as selected by the Architect.

3. Leveling material, as required for substrates to ensure specified finish flooring level tolerance: Premixed trowel-consistency, latex-based underlayment material, Selby Levelite-Latex, Levelastic, or equal.

PART 3 - EXECUTION

3.01 PREPARATION AND MEASUREMENTS

A. Ensure that all receiving surfaces are dry, clean, smooth and level before any carpet is installed. Thoroughly sweep and vacuum all surfaces and remove all foreign matter. Apply specified mastic underlayment material into all depressions in the receiving surfaces, as required to ensure that carpet surface will be level to within 1/4 inch tolerance in ten (10) feet in any direction. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected. Start of work shall constitute acceptance of subfloors by the carpeting installer.

B. Measure all areas to receive materials to be furnished and installed hereunder, and verify in the field their actual dimensions, including wall-to-wall dimensions, offsets, door locations, and details, fixed equipment, and all other installed items. Cut to fit irregular edges of existing flooring. Extra charges will not be allowed because of lack of familiarity with actual project conditions. Use largest carpet widths to produce minimum number of seams. Small pieces will not be acceptable.

3.02 STORAGE AND PROTECTION

A. Ensure that a temperature of at least 60 degrees F, with a relative humidity of between 15 and 60 percent, will be maintained for a period of 48 hours before, during, and after installation. Unroll carpet for adjustment to environmental conditions at least 24 hours prior to installation.

B. Store all carpeting material under cover in dry, well-ventilated spaces as soon as delivered. Protect carpeting from damage, dirt, stain, moisture, and mildew.

3.03 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Partial glue down; install perimeter tiles with releasable, pressure-sensitive adhesive.

C. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer. Install specified edging wherever carpeting intersects a dissimilar flooring material, except where marble saddles occur. Carefully measure all cut-outs at the project. If the manufacturer of the carpet has specific installation instructions, they shall be strictly adhered to.

D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
E. Ensure that all traffic and movement of furniture and materials is restricted for twenty-four (24) hours after carpet has been installed.

F. Protect all carpet tile, after installation thereof, with heavy duty non-staining drop cloths or reinforced non-staining Kraft paper.

3.04 REPAIR OR REPLACEMENT OF DAMAGED CARPET TILE

A. Repair or replace, as directed by the Architect, any installed carpet that is damaged due to work performed under the Contract, at no additional cost to the Contract.

3.05 INSPECTION AND CLEAN-UP

A. Make written request to the Architect for inspection at least ten (10) days before completion of carpet installation work.

B. Correct all defects in materials and workmanship listed by the Architect during inspection.

C. Upon completion of the installation, remove all waste and excess materials, and all tools and equipment. Clean up all dirt. Clean carpet of all spots with spot remover. Remove all loose threads with sharp scissors.

D. Except for maintenance stock, as specified herein, completely remove all excess carpet pieces from the project.

E. Be fully responsible for the correction of any damage done to paint, walls, woodwork, doors, and other surfaces, caused by the work of this SECTION, and bear all costs therefor.

F. After all equipment and partitions are installed and just prior to occupancy by the Owner, remove all protective covering. Thoroughly vacuum-clean the entire installation, clean and remove all spots with proper cleaning agents, and leave entire installation clean and in approved condition.

3.06 MAINTENANCE RECOMMENDATIONS

A. Upon completion of the work, submit to the Architect, for transmission to the Owner, four (4) copies of a complete manual of the manufacturer's maintenance recommendations for the specified type of carpet installed hereunder.

END OF SECTION
PART 1 - GENERAL

1.00 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER’S CHECK or CASHIER’S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

1.01 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. After inspecting existing conditions at the site, examine the various trade SECTIONS of the Specifications and be thoroughly familiar with all provisions regarding painting and finishing work included herein.

C. Refer to the Room Finish Schedules and other Drawings for various surfaces to receive applied coatings hereunder, together with other surfaces and items specified herein.

D. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 WORK TO BE PERFORMED

A. Furnish and install the following:

1. Specified first coat material, for back-priming all surfaces of new exterior and interior finish carpentry woodwork and plywood which will be concealed from view after installation thereof.
2. Complete specified finish systems, for exterior and interior surfaces and materials of all trades, as indicated on the Drawings, except as otherwise specified hereunder.

B. Touch-up all scratches and other blemishes on surfaces of pre-primed items and surfaces, prior to applying finish systems hereunder. Touch-up all surface defects in finishes applied hereunder, prior to final acceptance of the General Contract.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

1. Shop priming and touch-up of non-galvanized structural steel and miscellaneous metals: SECTION 055000, METAL FABRICATIONS, respectively.

2. Gypsum drywall work, including sanding of all joint and fastener head compound: SECTION 092100, GYPSUM BOARD ASSEMBLIES.

3. Shop priming of flush steel doors, pressed steel frames, and related items in conjunction therewith: SECTION 081100, METAL DOORS AND FRAMES.

4. Shop priming and touch-up of interior new operable and fixed windows and related items in conjunction therewith: SECTIONS 084523, TRANSLUCENT FIBERGLASS WALL PANEL ASSEMBLIES and 085113 ALUMINUM WINDOWS.

5. Prefabricated signs, name plates, and other prefabricated graphics: SECTION 101400, IDENTIFYING DEVICES.

6. Stenciling of piping: 210000, Fire Protection, Section 220000, Plumbing and SECTIONS 230000, HEATING, VENTILATING AND AIR CONDITIONING, respectively.

7. Factory-finishing of new mechanical and electrical equipment: SECTIONS 210000, 220000, 230000, 260000, and, 270000, respectively.

8. Staging and planking over eight (8) feet in height, furnished, installed, and maintained, at no cost to the PAINTING Sub-Contractor: SECTION 015000, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

9. Factory finishing of interior wood doors: SECTION 081400, WOOD DOORS.

B. The following items of work do not require painting or finishing under this SECTION 099100:

1. New prefinished items.

2. Copper, brass, unprimed aluminum, stainless steel, and bright metalwork.

3. Concealed-from-view items and surfaces, except as specified hereunder.


5. Ceramic tile.

6. Interior floor surfaces, except concrete slabs designated to receive paint / sealer.
7. New metal toilet partitions and accessories.

8. New finish hardware, except primed hinges and closers.

1.04 SUBMITTALS

A. Submit the following in accordance with the provisions of SECTION 01300, SUBMITTALS:

1. Colors and samples:

   a. The Architect will furnish a schedule of colors for each area and surface. Mix all colors in accordance with the manufacturer's instructions. The Architect reserves the right to select, at no additional cost to the Contract, up to four (4) bright accent colors, in quantity amounting to no more than five (5) percent of the total of the interior wall surface area to be painted, and up to two (2) accent colors, in quantity amounting to no more than ten (10) percent of the total of the exterior wall surface area to be painted. More than one color may be used on any interior wall surface with straight line separation between colors, at no additional cost to the Owner.

   b. Colors of priming coats (and body coats where specified) shall be lighter than those of finish coat.

   c. Ensure that all colorants are pure, non-fading pigments, mildew-proof, sunproof, finely ground in approved medium; and limeproof, when used in coatings to be applied on masonry, concrete, plaster, and gypsum board surfaces.

   d. Prepare, and submit to the Architect for approval, samples of all colors, stains, and finishes. Make the submissions sufficiently in advance of the schedule application commencement to permit a proper review by the Architect, adjustments in colors to be made, re-submissions to be reviewed, and approvals given, so as not to delay work. Re-do any coatings, applied without such approval, to the Architect's satisfaction, and bear all costs therefor.

   e. Prepare and submit samples of opaque coatings on separate 12 by 16 inch tempered hardboard panels, or same sized dense-surfaced cardboard. Prepare and submit samples of stain and clear finish on the actual species of new woods or wood veneer plywood specified under SECTION 062000, FINISH CARPENTRY, in at least 8 by 8 inch size.

   f. After final approval of all colors by the Architect, submit to the authorized representative of the Owner, color chips of all coatings used, with manufacturer's name and his designation of the coating and color for the purpose of future re-ordering of coatings. Color chips for color shall total at least six (6) square inches for each color.

2. Literature: Manufacturer's complete product data and specifications for each type of coating to be applied hereunder, including material compositions, recommended application procedures, and product limitations.

B. Do not commit to ordering materials until all required submittals have been made, and approval of the Architect has been received.
1.05 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:

1. Painting and Decorating Contractors of America (PDCA) quality standards and trade practices.
2. SSPC SP #6/NACE No. 3, Commercial Blast Cleaning Standard for cleaning ungalvanized steel prior to coating.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sealant: For painter’s work, provide One Part Polyurethane: Tremco Dymonic or equal. For window perimeters and all other applications.

B. Paint: To establish a standard of Quality and performance, the painting schedule herein is based on the products of the manufacturers listed within. Comparable products as manufactured by Benjamin Moore, Glidden, Pittsburgh, and other manufacturers may be submitted, provided adequate supporting data and samples are approved by the Architect.

2.02 EXTERIOR COATING SCHEDULE

A. New and existing galvanized and non-galvanized ferrous metal surfaces, including steel doors; pressed steel frames; and other new and existing galvanized and non-galvanized ferrous metal surfaces:

1. First coat, for galvanized metal items only: Omnithane Series 1, Modified Aromatic Polyurethane Primer, by Tnemec, or equal.
2. First coat, for non-galvanized bare metal surfaces only:
   a. Prepare steel surfaces by abrasive blast cleaning per SSPC SP #6 Standard.
   b. 90G-1K97 Tneme-Zinc, zinc-rich primer by Tnemec, or equal.
3. Two coats: Series 73 Endurashield, by Tnemec, or equal.

B. Wood trim, exterior faces of exterior wood doors, and frames, for Semi-gloss paint finish, Alkyd Primer, Alkyd finish:

1. First coat: Devoe No. 1102 All Weather House Primer or equal primer/sealer product of the finish coat manufacturer.
2. Two coats: Devoe all Weather Semi-Gloss 1XX or equal by Moore or Olympic.

2.03 INTERIOR COATING SCHEDULE

A. Concealed from view wood trim, plywood shelving, and other exposed to view items of, solid birch and poplar, and fir plywood:

1. First coat: Moore Alkyd Enamel Underbody, Pittsburgh Quick Dry Enamel Undercoater, Glidden Spred Undercoater, or equal.
2. Two coats: Moore Regal Aquaglo, Pittsburgh Manor Hall Latex Lo-Lustre Enamel, Glidden Spred Latex Semi-Gloss Enamel, or equal.
B. New and existing finish wood noted on Drawings to receive clear finish:
   1. First coat: Moore Benwood Architectural Stain, Glidden Spred wood Stain, PPG Rez Wood Stain, or equal.
   2. Three coats: Two coats gloss, third coat satin; Moore Benwood Finish Varnish, Glidden Interior Varnish, PPG Rez Varnish, or equal.

C. New and existing ferrous metal work, including unprimed galvanized steel surfaces; steel doors; pressed steel frames; shop-primed items of finish hardware; and all other exposed to view ferrous metal items, except as otherwise specified herein:
   1. First coat, for unprimed galvanized metal surfaces, only: Galvanized metal primer product of finish coating manufacturer.
   2. First coat for shop-primed new metal work, and second coat for field-primed new galvanized metal surfaces, only: Interior alkyd enamel undercoater product of finish coating manufacturer.
   3. Two coats: Moore Alkyd Dulamel, Glidden Spred Lustre Semi-Gloss Enamel, PPG Satinhide Alkyd Low Lustre Enamel, or equal.

D. Vertical surfaces of new and existing gypsum wallboard, plaster, veneer plaster, and concrete, concrete masonry units and brick:
   1. First coat for plaster, and for joint and depression compound surfaces of gypsum wallboard, only, prior to finish coats: Moore Q.D. Prime Seal, Glidden 3416 Vinyl Primer Tinted, PPG Speedhide Emulsion Sealer, or equal.
   2. First coat for concrete, concrete masonry units and brick, only: Latex-base block filler product of the finish coating manufacturer.
   3. Two coats: Moore Regal Aquavelvet, PPG Satinhide Latex Lo-Lustre, Glidden Spred Ultra Eggshell, or equal.

E. Overhead horizontal surfaces of new and existing plaster, concrete, and exposed to view gypsum wallboard:
   1. First coat for plaster, and for joint and depression compound surfaces of gypsum wallboard, only, prior to finish coats: Moore Q.D. Prime Seal, Glidden 3416 Vinyl Primer Tinted, PPG Speedhide Emulsion Sealer, or equal.
   2. Two coats: Moore Regal Wall Satin, Pittsburgh Wallhide Latex Flat, Glidden Spred Satin, or equal.

F. New exposed to view covered pipes within finished painted areas:
   1. First coat: Moore Latex Quick Dry Prime Seal, Glidden Insulcap, PPG Speedhide Emulsion Sealer, or equal.
   2. Two coats: Same finish specified herein for immediately adjacent surfaces.

G. New exposed to view uninsulated hot pipes within finished painted areas:
   1. Two coats heat-resistant enamel conforming to Federal Specification TT-E-496, Type II, applied when surfaces are less than 140 degrees F.
H. New exposed to view metal ductwork, metal conduit, and uncovered cold piping, and existing previously anodized aluminum, and all hangers and supports for such items within finished painted areas:

1. First coat for galvanized metal surfaces, only: Galvanized metal primer, product of the finish coating manufacturer.

2. Two coats: Same finish specified herein for adjacent surfaces.

J. New electrical equipment (not prefinished) within finished painted areas, including cabinets, mounting boards, and supports:

1. Two coats: Same finish specified herein for ferrous metal items.

K. New and existing concrete floors where no other floor finish is called for on the finish schedule:

1. Two Coats, Moisture Cured Urethane, Clear Gloss, Benjamin Moore, Coronado or Rust-oleum, to meet the following requirements:
   a. Solids by Volume: 34.0 percent.
   b. Wet Film Thickness: 5.6 mils.
   c. Dry Film Thickness: 2.0 mils.
   d. Weight per Gallon: 7.9 lbs.

2.04 COMPATIBILITY OF COATINGS

A. Ensure that all paints, enamels, and coatings, proposed to be applied hereunder, are compatible with coatings used for shop-primed items and items which have been prime-coated under the work of other trades. Approved shop drawings and manufacturer's data sheets generally indicate types of priming materials used on the various items. Such information may be obtained from the Architect upon request.

B. Bring to the Architect's attention any condition which may require a change in the specifications before proceeding with the work. Failure to do so shall be construed as acceptance of the coatings specified. Perform all corrective measures, at no cost to the Owner, for any defects in the work, resulting from the use of such materials.

PART 3 - EXECUTION

3.01 PROTECTION

A. Furnish and lay suitable drop cloths in all areas where coating work is being done to protect floors and all other surfaces from damage during the work.

B. The Contractor will remove and replace all finish hardware applied to doors except hinges and locks on exterior doors. Do not paint around hardware except on exterior doors where hardware will remain in place.

C. At the completion of work in each area, remove all coating spots from all surfaces, including finish hardware. Do not use abrasive paper or abrasive cleaner on hardware.
3.02 STORAGE AND USE OF MATERIALS

A. Store all materials in designated spaces, in a manner which meets the requirements of applicable codes and fire regulations. When not in use, ensure that such spaces are kept locked and inaccessible to those not performing work under this SECTION 099100. Provide a carbon dioxide or dry chemical-type fire extinguisher, bearing the label of the National Board of Fire Underwriters and tag of recent inspection, for each space where coating materials are stored.

B. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle. Remove oily rags and waste each day.

C. Deliver all materials in manufacturer's original sealed containers, bearing the manufacturer's standard label, indicating type and color. Deliver sufficient quantities of materials in advance of the time needed, in order that work will not be delayed.

D. Before application, thoroughly stir all canned materials, unless otherwise directed by the manufacturer of the specific coating used, to ensure uniformity of color and mass, and remove all skins, coating lumps, and other foreign matter, by straining. Apply materials without reducing or thinning, except as otherwise recommended by the specific material manufacturer, and then only with the approval of the Architect.

3.03 ACCEPTANCE OF SURFACES

A. Inspect all new surfaces and assure that they are in proper condition to receive work to be performed under this SECTION 099100. Submit to the Architect any questions as to the proper performance of the various paint systems specified herein, no later than 15 calendar days prior to the date of commencing work, requesting disposition on the systems in question; otherwise, assume the responsibility for providing the desired results.

B. If the new surfaces are not thoroughly dry or if they cannot be put in proper condition to receive paint by customary cleaning methods, or sanding, notify the Contractor in writing requesting necessary correction.

C. The commencement of applied coatings work in any space will be construed as acceptance of the surface as being satisfactory. Correct any defects in the coatings work resulting from such accepted surfaces, and bear all costs therefor.

3.04 WORKMANSHIP

A. Perform all work with skilled mechanics under adequate supervision.

B. Apply all materials under adequate illumination, spreading and smoothly following the materials on, without runs, sags, or holidays.

C. Perform no work in the rain, dew, or fog, when the temperature is below 50 degrees F., or before the other finish materials have been thoroughly dried out.

3.05 PREPARATION WORK

A. General: Perform all preparation work on the various surfaces, as required to properly receive paint and finish materials. Remove all foreign matter which would otherwise prevent proper adhesion of the applied finishes.

B. New wood and plywood surfaces:
1. Smooth minor defects by sanding and/or by the use of steel wool. Remove all foreign matter with commercial paint remover and fine sandpaper.

2. Wash sap spots and knots with mineral spirits. When dry, touch up spots and knots with commercial stain kill formulation.

3. Fill up nail holes and cracks with wood putty or plastic wood after primer of first coat of finish is dry.

C. New metal work:

1. Remove rust, blistered and defective existing and shop prime paint, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, and/or commercial paint remover. Spot prime bare metal with exterior or interior alkyd base metal primer, as applicable. Use only rust-inhibiting type primer for exterior metal priming.

2. Remove all grease or dirt with mineral spirits before applying paint.

D. New gypsum wallboard and plaster: Spot-seal all compound surfaces in gypsum wallboard, and hot spots in plaster, with specified first coat material before application of the first coat.

3.06 APPLICATION

A. Apply all materials in strict accordance with the approved manufacturer's printed instruction, and in accordance with the best trade practices, and each coat shall be inspected and approved by the Architect before succeeding coat is applied.

B. Do not apply successive coating until the preceding coat is thoroughly dry, and in no case in less than 24 hours after the preceding coat.

C. Make each coat slightly lighter in color tone than the final coat to be applied thereon.

D. The number of coats of the specified coatings listed in the coating schedules are minimums. If the specified minimum number of coatings does not completely cover or hide the base materials, provide additional coats as required to provide a uniform finish appearance, without additional cost to the contract.

3.07 CLEAN-UP

A. Upon completion of the work of this SECTION 099100, remove all coating splatters from glass, prefinished surfaces, bright metals, and from other surfaces that have not been painted or finished hereunder. Remove all materials and debris and leave the site of the work in a clean condition so far as this work is concerned.

B. Final inspection: Protect all painted and finished surfaces against damage until the date of final acceptance of the work. The Architect will conduct a final inspection of all work performed hereunder. Re-coat or touch-up, as directed by the Architect, any areas found which do not comply with the requirements of this SECTION 099100, and bear all costs therefor.

C. Any re-coating or touch-up work, required after the work of this SECTION 099100 has been accepted by the Architect, will be paid for by the Contractor.

END OF SECTION
SECTION 101400
IDENTIFYING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Furnish the following for installation under SECTION 062000, FINISH CARPENTRY:

1. Raised-character two-color acrylic plates, with concealed tamper-proof fastenings, for interior locations indicated, and as detailed, on the Drawings.

2. Vinyl-Character Numbers, applied to the exterior surface of all new exterior doors (or door glazing), as indicated on the Drawings.

3. Prefinished cast aluminum letters for application to the exterior wall surfaces of the building, as indicated on the Drawings.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

1. Stenciling and coding for various mechanical and electrical lines and equipment: Under respective mechanical and electrical trade SECTIONS.

2. Temporary project identification sign: SECTION 015000, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

1.04 SUBMITTALS

A. Submit the following in accordance with the provisions of SECTION 013300, SUBMITTAL PROCEDURES:

1. Shop drawings:

   a. Schedule, indicating location of each interior sign to be furnished hereunder, and 1/2 scale details of each sign, indicating type and size for all characters, sign material and colors.

2. Samples: Manufacturer's standard samples of all available colors for each type sign and letters. Colors for the directory shall be selected from the full range of the Pantone color system. All color selections by the Architect.
3. Literature: Manufacture's complete product data and specifications for each type sign to be furnished hereunder.

1.05 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:

3. Applicable OSHA specifications.
4. Americans with Disabilities Act (ADA & ADAAG), applicable segments.

PART 2 - PRODUCTS

2.01 INTERIOR SIGNAGE

A. General: Actual copy for each sign will be issued by the Architect, after award of the General Contract. Refer to the Drawings for types, details, and locations of interior signs. To establish a standard, for bidding purposes only, the room name, as noted on the Drawings, shall be used for each of the signs not specifically noted to contain pictographs or otherwise.

B. Manufacture and type: To establish a standard of quality and design desired, specifications are based on signs as manufactured by Mohawk Sign Systems. Similar type signs as manufactured by Best Manufacturing Company, ASI Sign Systems, and other manufacturers will be considered for approval as an equal by the Architect upon receipt of adequate supporting data and samples.

C. Material and description: High pressure laminate ES plastic, 1/8-inch thick, thermoset type, self-extinguishing, suede finish, having raised lettering and numerals, as well as Grade 2 Braille, within a recessed field, to comply with requirements of ADA, with the raised and recessed portions of the sign having two different colors, with a changeable window plaque, as selected by the Architect. Letters and numbers shall be upper case, and be 1-1/2 inches high, and all characters, pictographs, Braille figures, and borders shall be raised from the recessed field 1/32-inch. All signs with the exception of pictographs, shall be 6 inches high, unless otherwise noted on the Drawings, with lengths to accommodate the room number and name as noted on the room finish schedule on the Drawings.

D. Pictographs for the toilet rooms shall be of the same manufacture, with the pictographs, lettering, Braille, raised accordingly. The pictograph field for each of the toilet room doors shall be as noted on the Drawings and wide enough to accommodate all pictographs and lettering. All handicapped accessible toilet room signs shall display the international symbol for men/women and the handicapped accessible symbol for all such toilet rooms. Each toilet room sign shall be one piece and have the following as required: men and women symbol and handicapped symbol (where applicable) in an bordered upper field, room name (TOILET) and the Braille equivalent to the same in a bordered lower field to match typical room sign. In addition; all signs carrying the handicapped symbol shall have the following statement, in Braille, immediately...
following the room name: "HANDICAPPED ACCESSIBLE". Provide 1/32 inch thick vinyl tape and silastic adhesive for concealed mounting of signs.

E. Quantity and type: Refer to Drawings for quantities and type. Unless otherwise noted herein or on the Drawings, provide one sign at all doors and openings, including but not necessarily limited to, all new and existing doors, the elevator entry doors, corridor branches, offices, and toilet rooms.

2.02 FIELD-APPLIED, VINYL-CHARACTER NUMBERS

A. Field-Applied, Vinyl-Character Sign: Pre-spaced characters and numbers die cut from 3- to 3.5-mil thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ASI Sign Systems, Inc.
   b. Best Sign Systems Inc.
   c. Mohawk Sign Systems.

2. Size: 12 inches high, minimum.

3. Text and Font: As shown on the Drawings. Use Helvetica, or other sans serif font as approved by the Architect.

B. Quantity and type: Refer to Drawings for quantities and type. Unless otherwise noted herein or on the Drawings, provide two signs ((1) on the interior, (1) on the exterior) at all exterior doors.

2.03 PREFINISHED CAST ALUMINUM LETTERS

A. General: Refer to the Drawings for locations and details of cast letters to be installed on the exterior wall surface of the building, and shall read: ELIZABETH CARTER BROOKS SCHOOL.

B. Materials: Cast aluminum letters, with stainless steel tube spacers, and stainless steel threaded studs.

C. Prefinishing system for aluminum:

1. Thoroughly clean and degrease all surfaces.

2. Apply one coat of epoxy primer, oven-bake at 375 degrees Fahrenheit, minimum for 12 to 15 minutes, providing a dry film thickness of not less than one (1) mil.

3. Apply one coat of acrylic or polyester finish, in selected colors, to all exposed to view surfaces, and oven-bake at 400 degrees Fahrenheit, minimum, for 12 to 15 minutes, providing a dry film thickness of not less than one (1) mil. Provide sufficient quantity of factory-finish materials for field touch-up work, of same colors and production runs as those used in the process.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of interior and exterior signage will be performed under SECTION 062000, FINISH CARPENTRY. Provide all installation accessories and instructions with each type sign and item furnished hereunder.

END OF SECTION
SECTION 102113
TOILET PARTITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this SECTION.

B. Refer to SECTION 012300, ALTERNATE, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:

1. Steel toilet compartment partitions for installation under Section 062000, Finish Carpentry:

   a. Toilet enclosures.

B. Related Requirements:

1. Section "Cast in Place Concrete" for compartment anchorage to concrete substrates.
2. Section "Rough Carpentry" for compartment anchorage to frame walls.

1.03 REFERENCES

A. ASTM International (ASTM):

1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. International Code Council (ICC)/American National Standards Institute (ANSI):
ELIZABETH CARTER BROOKS SCHOOL  
WINDOW, DOOR & BOILER REPLACEMENT  
New Bedford, Massachusetts

1. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities, as applicable to toilet compartments designated as accessible.

C. United States Department of Justice:

1. ADA - Americans with Disabilities Act

1.04 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets for each type of product indicated. Include fabrication details, description of materials and finishes.

1. Product Test Reports: When requested by Architect, submit documentation by qualified independent testing agency indicating compliance of products with requirements.

B. Shop Drawings: Include overall product dimensions, floor plan, elevations, sections, details, and attachments to other work. Include choice of options with details.

C. Samples for Selection: Furnish samples of manufacturer's full range of colors for initial selection.

D. Samples for Verification: Furnish physical sample of material in selected color.

   1. Size: 2 by 2 inch (52 by 52 mm) minimum, in type of finish specified.

1.05 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance and cleaning instructions.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in the manufacture of toilet compartments.

B. Source Limitations: Obtain toilet compartment components and accessories from single manufacturer.

C. Accessibility Requirements: Comply with requirements of the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities", 523 CMR, and ICC/ANSI 117.1, and with requirements of authorities having jurisdiction.

TOILET PARTITIONS
102113 - 2
D. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 0.
2. Smoke-Developed Index: 0.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver toilet compartments to site until building is enclosed and HVAC systems are in operation.

1. Deliver toilet compartments in manufacturer's original packaging.
2. Store in an upright condition.

1.09 WARRANTY

A. Special Manufacturer’s Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship during the following period after substantial completion:


PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of Bradley Corporation, Mills Metals Division, Menomonee Falls, WI, or similar product as manufactured by the following, or equal.

1. Flush Metal Partition Corp.
2. Metpar Corp.

2.02 MATERIALS

A. Metallic Coated Steel Sheet: ASTM A 653/A 653M, galvannealed commercial steel sheet suitable for exposed applications. Provide with mill phosphatized surface. Provide smooth material, without creases or ripples.

B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.

C. Stainless Steel Sheet: ASTM A 240 or A 666, 300 series.

D. Stainless Steel Castings: ASTM A 743/A 743M.
E. Aluminum: ASTM B 221.

2.03 STEEL TOILET COMPARTMENTS

A. Toilet Compartment Type:

1. Floor-to-ceiling type.

B. Door, Panel, and Pilaster Construction, General: Form edges with interlock to provide watertight fit without crown molding. Braze corners and finish smooth.

1. Provide exposed surfaces free of pitting, visible seams and fabrication marks, stains, telegraphing of core material, or other imperfections.
2. Core Material: Manufacturer's standard sound-deadening, water resistant honeycomb in thickness required to provide finished thickness for doors, panels and pilasters.

C. Door Construction: 1 inch (25 mm) thick, constructed from 0.0313 inch/22 ga (0.794 mm) galvannealed steel.

1. Provide each door with internal 0.0625 inch/16 ga (1.59 mm) and 0.0781 inch/14 ga (1.98 mm) welded reinforcements at top and bottom hinge locations, with factory installed concealed true gravity cam hinges.

D. Panel Construction: 1 inch (25 mm) thick, constructed from 0.0313 inch/22 ga (0.794 mm) galvannealed steel.

1. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
2. Tapping Reinforcement: Provide concealed reinforcement for drilling and tapping holes at locations where machine screws are used for attaching items to units.

E. Pilaster Construction: 1 1/4 inch (32 mm) thick, constructed from 0.0375 inch/20 gauge (0.953 mm) galvannealed steel.

1. Provide pilaster with internally welded reinforcement suitable to accept minimum 8 inch (203 mm) long, 3/8 inch (9.5 mm) zinc-plated jack bolt for leveling. Connect bracket to two L-brackets secured to floor to allow for full range of adjustment.

F. Shoes: 3 inches (76 mm) high minimum, Type 304 stainless steel with No. 4 satin brushed finish. Provide concealed retainer clips to attach to pilaster.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; stainless steel.
H. Steel Sheet Finish: Manufacturer's standard baked-on finish, with one color in each room.
   1. Color: As selected by Architect from manufacturer's full range.

2.04 HARDWARE

A. Hardware, Heavy Duty: Manufacturer's heavy-duty stainless steel castings, including stainless steel tamper-resistant fasteners:
   1. Hinges: Self-closing wrap-around gravity-type, adjustable to hold doors open at any angle up to 90 degrees, with emergency access by lifting door. Mount with stainless steel through-bolts.
   2. Latch and Keeper: Surface-mounted slide latch with wrap-around rubber-faced combination door strike and keeper, with provision for emergency access, meeting requirements for accessibility at accessible compartments.
   4. Door Pull: Standard unit on outside of inswing doors. Provide pulls on both sides of outswing doors.

2.05 FABRICATION

A. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

B. Door Size and Swings: Unless otherwise indicated, provide 26-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, in-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at bottoms of posts. Provide caps, shoes, and covers at posts to conceal anchorage.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine work area to verify that measurements, substrates, supports, and environmental conditions are in accordance with manufacturer's requirements to allow installation.
   1. Proceed with installation once conditions meet manufacturer's requirements.
3.02 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

B. Install toilet partitions and screens in spaces with operating, temperature controlled HVAC systems. Shield partitions and screens from direct sunlight.

C. Clearances: Install with clearances indicated on Drawings. Where clearances are not indicated, allow maximum 1/2 inch (13 mm) between pilasters and panels, and 1 inch (25 mm) between panels and walls.

D. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

3.03 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 15 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

3.04 FINAL CLEANING

A. Remove packaging and construction debris and legally dispose of off-site.

B. Clean partition and screen surfaces with materials and cleansers in accordance with manufacturer's recommendations.

END OF SECTION
SECTION 102813

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Furnish the following for installation under Section 061100, Finish Carpentry:

1. Metal toilet accessories, complete with all related items.

1.03 RELATED WORK

A. Wood Blocking: SECTION 061100, ROUGH CARPENTRY.

1.04 SUBMITTALS

A. Submit the following for approval of the Architect, in accordance with the provisions of SECTION 013300, SUBMITTAL PROCEDURES:

1. Literature: Cuts of all items required hereunder with all descriptive data accompanying.

2. Schedule: Complete schedule, indicating types, quantity, and model numbers of accessories for each location in which the accessories will be installed.

3. Warranties: Manufacturer's standard warranties on all items. Electric hand dryer warranty shall be a 10-year warranty on all parts except brushes. Motor brushes shall be warranted for a period of three years.
PART 2 - PRODUCTS

2.01 MANUFACTURE

A. Accessory items listed herein have been selected from the catalog of Bradley Corporation. Similar items as manufactured by Bobrick Washroom Equipment, Inc., Charles Parker Co., Tubular Specialties, D.J. Alexander Co., and other manufacturers will be considered for approval as an equal upon receipt of adequate supporting data, and samples, if requested. As far as possible, all accessories to be provided hereunder shall be the products of one manufacturer.

2.02 ACCESSORIES SCHEDULE

A. General: Locations of Type Numbers for toilet accessories within each area shall be as indicated on the Drawings. Furnish and install the following:

<table>
<thead>
<tr>
<th>Description</th>
<th>Bradley Model</th>
<th>Bobrick Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface mounted satin finish stainless steel grab bars with peened gripping surface, 1 1/4-inch diameter by 42-inches with mounting flanges.</td>
<td>#8322-001420</td>
<td>B-5806.99x42</td>
</tr>
<tr>
<td>Stainless steel, channel-framed glass mirror.</td>
<td>#781</td>
<td>B-165 Series</td>
</tr>
<tr>
<td>Coat hook.</td>
<td>#9115</td>
<td>B-671</td>
</tr>
<tr>
<td>Recessed combination napkin/tampon vendor</td>
<td></td>
<td>B-3500</td>
</tr>
<tr>
<td>Sanitary Napkin disposal, one per stall in toilet rooms with napkin/tampon vendor</td>
<td></td>
<td>B-353</td>
</tr>
</tbody>
</table>

B. General: Locations for toilet accessories within each area shall be as indicated on the Drawings. Install the following accessories, provided by the Owner.

- Surface-mounted toilet tissue dispenser. By Owner
- Wall-mounted soap dispenser. By Owner
- Wall-mounted paper towel dispenser. By Owner
PART 3 - EXECUTION

3.01 INSTALLATION

A. Ensure that templates for holes to be factory-cut in toilet partitions, to accommodate partition-mounted accessories, are furnished to the toilet partition manufacturer at the appropriate time, so as not to delay the partition fabrication schedule.

B. Coordinate with the Owner to have the Owner furnished toilet room accessories delivered to the site in a timely manner. Insure that installation instructions for same are delivered in advance to insure that internal reinforcing and blocking is installed with the walls and partitions as required.

C. Include complete installation instructions for each item, in the shipping containers for same, and deliver all accessories to the Plumbing Contractor for installation.

D. Include all concealed design, theft-proof fasteners, of the size and type most appropriate for the specific receiving surface, in the shipping containers for each item.

E. Deliver at least four (4) master keys, for lockable accessories, to the authorized representative of the Owner, upon completion of the installation.

END OF SECTION
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

NON TEXT PAGE
SECTION 108000
MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Furnish the following for installation under SECTION 062000, FINISH CARPENTRY:

1. Fire extinguisher cabinets.

2. Fire extinguishers.

1.03 RELATED WORK

A. The following related work will be performed under the designated SECTIONS:

1. Sealants in conjunction with expansion joints: SECTION 071000, WATERPROOFING, DAMPPROOFING AND CAULKING.

2. Louvers and vents: SECTION 089000, LOUVERS AND VENTS.

1.03 SUBMITTALS

A. Submit the following in accordance with the provisions of SECTION 01300, SUBMITTALS:

1. Shop drawings: Large scale details of all items to be furnished hereunder, completely dimensioned, and indicating anchorage and interfacing to adjacent surrounding conditions.

2. Samples: Manufacturer's samples of all available standard and custom colors for each prefinished item to be furnished hereunder, for selections by the Architect.

3. Literature: Manufacturer's complete product data, including cuts, specifications, installation instructions, and other pertinent data, for each item to be furnished hereunder.

4. Guarantees and warranties: Manufacturer's standard written guarantees and warranties for each item to be furnished hereunder.
PART 2 - PRODUCTS

2.01 INTENT

A. It is the intent of this SECTION 108000 to include only items which require no special manufacture, and all items indicated hereunder are standard products of the specified manufacturers.

B. Names and model numbers of manufacturers set forth hereunder are specified to indicate the minimum standard of quality which will be acceptable and for sizes used in the design. To be considered for approval as an equal by the Architect, substitute items must be reasonably similar to specified items in all respects.

2.02 FIRE EXTINGUISHERS

A. General: Refer to the Drawings for locations of each type fire extinguisher.

B. Manufacture and type:

1. Extinguishers, where shown on the Drawings shall be Dry chemical type for Class ABC fires: 10 pound capacity, rated 4A-60B-C, JL Industries Cosmic 10E, Larsen MP-10, Potter-Roemer 3010, or equal.

C. Brackets: For non-public areas, such as the boiler room, provide manufacturer's standard, heavy-duty, galvanized steel J-bracket for wall mounting: JL Industries J-Hook, or equal.

2.03 FIRE EXTINGUISHER CABINETS

A. General: Refer to the Drawings for locations of fire extinguisher cabinets. Provide compatible wall hangers, only, for extinguishers in Mechanical and Electrical spaces. Coordinate fire extinguisher cabinets with depth of walls and provide matching semi-recessed fire extinguisher cabinets where required. Semi-recessed fire extinguisher cabinets shall not protrude from walls more that 4-inches.

B. Description:

1. For Pressurized Water Type: Steel cabinet and door, prefinished in red baked enamel, having clear tempered glass in door, 1 1/2-inch, square framed, semi-recessed extinguisher cabinet: JL Industries Ambassador 8116F17, or equal products of Larsen, Potter-Roemer, or equal.

2. For Dry Chemical Type: Same as for pressurized water.

PART 3 - EXECUTION

3.01 INSTALLATION OF SPECIALTIES

A. Provide complete installation instructions and copies of the approved shop drawings of all specialty items to be furnished under this SECTION 108000, to the specified trades for installation of the various accessories thereunder.
SECTION 144200

WHEELCHAIR LIFTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. Section Includes:

1. Unenclosed, self-contained vertical platform wheelchair lift.

B. Related Requirements:

1. Section 061100, Rough Carpentry for blocking within wall framing for lift component attachment.
2. Section 062000, Finish Carpentry for wood paneling and trim around installed wheelchair lift.
3. Section 260000, Electrical for electrical power service, wiring connections.

1.03 REFERENCES

B. ASME A17.5 - Elevator and Escalator Electrical Equipment.
F. Code of Massachusetts Regulations, 524 CMR: Board of Elevator Regulations.
1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Submit manufacturer’s installation instructions, including preparation, storage and handling requirements.
   2. Include complete description of performance and operating characteristics.

B. Shop Drawings:
   1. Show typical details of assembly, erection and anchorage.
   2. Include wiring diagrams for power, control, and signal systems.
   3. Show complete layout and location of equipment, including required clearances and coordination with shaftway.

C. Selection Samples: For each finished product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finished product specified, two samples, minimum size 2-inches square, representing actual product, color, and patterns.

E. Manufacturer Qualifications: Minimum 10-years of experience manufacturing vertical platform lifts, with evidence of experience with similar installations of type specified.

F. Installer Qualifications: Licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts, and have qualified personnel for installation and maintenance services.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wheelchair lifts to include in maintenance manuals.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, and other manufactured items so as not to be damaged or deformed. Package for protection during transportation and handling.

B. Store components off the ground in a dry covered area, protected from adverse weather conditions.
C. Unload, store, and erect lift components in a manner to prevent bending, warping, twisting, and surface damage.

D. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 FIELD CONDITIONS

A. A pit depth of 3-inches is available at the site, which is the distance between the existing raised gymnasium floor and the existing concrete slab-on-grade below. Products with pit depth requirements greater than 3-inches are not acceptable.

1. Sloped thresholds or ramps between the existing floors and the wheelchair lift platform are not allowed.

B. It is the sole responsibility of the Contractor to review the documents, the field conditions, and to fully understand the construction of the pit and the supporting structure, AC power requirements, and to provide equipment to suit said conditions. Bear all costs incurred for changes in the work from that shown on the Contract Documents, due to the requirements of the particular equipment furnished which may not comply to the dimensional or other requirements of the Contract Documents.

C. Do not use wheelchair lift for hoisting materials or personnel during construction period.

1.09 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace wheelchair lift work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

2. Warranty Period: Two (2) years from date of Substantial Completion.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. To establish a standard of quality, design, and function desired, specifications have been based on Genesis Opal vertical lift, as manufactured by Garaventa Lift, Blaine, WA, or equal products as manufactured by the following:
   1. Model V1504-STD, as manufactured by Savaria, Brampton, ON, Canada.
   2. Model VPL-3353B with 3-Gate, as manufactured by Bruno Independent Living Aids, Inc., Oconomowoc, WI.

B. Source Limitations: Obtain vertical wheelchair lift system components, from single source from single manufacturer.

2.02 UNENCLOSED VERTICAL WHEELCHAIR LIFT

A. Capacity: 750 lbs (340 kg) rated capacity.

B. Mast Height:
   1. Model GVL-OP-42; 45 inches maximum lifting height.

C. Platform Size and Nominal Clear Platform Dimensions:

D. Platform Configuration:
   1. Straight Through: Front and rear openings.

E. Landing Openings: Gates shall be self-closing type.
   1. Gate Height: 42-inches.
   2. Platform Gate: Travels with platform and opens at lower landing.
   4. Lower Landing Gate: Installed at lower landing.

F. Lift Components:
   3. Platform Side Wall Panels: 16 gauge (1.5 mm) galvanized steel sheet.
   5. Side Guard Panels: 42-inches high mounted on platform.

G. Base Mounting at Lower Landing:
1. Pit Mount: Lift to be mounted in pit with dimensions to meet manufacturers requirements for the platform size specified.

H. Hydraulic Drive:

1. Drive Type: Chain hydraulic.
2. Emergency Operation: Manual device to lower platform and battery auxiliary power to raise or lower platform.
3. Safety Devices:
   a. Slack chain safety device.
   b. Shoring device.
4. Travel Speed: 17 fpm (5.2 m/minute).
5. Motor: 3.0 hp (2.2 kW); 24 volts DC.
6. Power Supply:
   a. 120 VAC single phase; 60 Hz on a dedicated 20 amp circuit.

I. Platform Controls: 24 VDC control circuit with the following features.

1. Direction Control: Illuminated tactile and constant pressure elevator-style buttons with dual platform courtesy lights and safety light.
2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm with battery backup.

J. Call Station Controls: 24 VDC control circuit with the following features.

1. Direction Control:
   a. Constant pressure rocker switch.
   b. Illuminated tactile and constant pressure elevator-style buttons with dual platform courtesy lights and safety light.
2. Keyed operation.
3. Call Station Mounting: Wall mounted surface at upper and lower landings.

K. Safety Devices and Features:

1. Grounded electrical system with upper, lower, and final limit switches.
2. Tamper resistant interlock to electrically monitor that the gate is in the closed position and the lock is engaged before lift can move from landing.
3. Pit stop switch mounted on mast wall.
4. Electrical disconnect shall shut off power to the lift.
5. Under platform safety pan with five waterproof safety switches to detect obstruction under platform.
6. Lower Landing Gate: Includes mechanical interlock which releases door, only when platform is at lower landing; electronic sensors stop platform from operating unless door is closed; includes call/send rocker switch or paddle controls and keyed on/off switch mounted into gate frame.

L. Finishes

1. Aluminum Extrusions: Champagne anodized finish, or manufacturer's standard.
2. Ferrous Components: Electrostatically applied baked powder finish, fine textured.
   a. Color: Grey, or manufacturer's standard.
3. Lift Finish: Custom baked powder coat finish as selected by the Architect from RAL color chart.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Verify shaft and machine space are of correct size and within tolerances.
C. Verify required landings and openings are of correct size and within tolerances.
D. Verify electrical rough-in is at correct location.
E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install platform lifts in accordance with applicable regulatory requirements including ASME A 17.1, ASME A 18.1 and the manufacturer's instructions.
B. Install system components and connect to building utilities.
C. Accommodate equipment in space indicated.
D. Startup equipment in accordance with manufacturer’s instructions.

E. Adjust for smooth operation and clean unit thoroughly.

F. Instruct users in operation procedures and Owner's maintenance person in trouble-shooting and maintenance procedures.

3.04 FIELD QUALITY CONTROL

A. Perform tests in compliance with ASME A18.1 and as required by authorities having jurisdiction.

3.05 CLEANING AND PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products.

END OF SECTION 144200
SECTION 220000

PLUMBING
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS.................................1
1.02 RELATED DOCUMENTS..........................................................................................1
1.03 DESCRIPTION OF WORK....................................................................................1
1.04 RELATED WORK....................................................................................................3
1.05 CODES, ORDINANCES, AND PERMITS.................................................................3
1.06 DISCREPANCIES IN DOCUMENTS.........................................................................4
1.07 MODIFICATIONS IN LAYOUT..................................................................................4
1.08 SHOP DRAWING AND MATERIAL SCHEDULES.....................................................5
1.09 COORDINATION DRAWINGS...............................................................................5
1.10 RECORD DRAWINGS.............................................................................................6
1.11 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS..............................6
1.12 GUARANTEE.........................................................................................................7
1.13 DRAWINGS...........................................................................................................7
1.14 VALVE TAGS, NAMEPLATES, AND CHARTS............................................................7
1.15 PIPE MARKER IDENTIFICATION SYSTEM.............................................................8
1.16 SANITARY, WASTE, AND VENT SYSTEMS.............................................................8
1.17 DOMESTIC WATER SYSTEMS (POTABLE & NON-POTABLE).................................9
1.18 FUEL GAS SYSTEM................................................................................................9
1.19 EQUIPMENT FURNISHED BY OTHERS................................................................10
1.20 DEMOLITION.........................................................................................................10
1.21 PAINTING...............................................................................................................10
1.22 HOISTING EQUIPMENT AND MACHINERY............................................................11
1.23 STAGING AND SCAFFOLDING..............................................................................11
1.24 COMMISSIONING...................................................................................................11
1.25 BREAKDOWN.........................................................................................................11
1.26 VISIT TO SITE.......................................................................................................11
1.27 ENERGY REBATE PROGRAM................................................................................12
1.28 TRADE RESPONSIBILITY FOR INTERCONNECTIONS MATRIX..............................12

PART 2 - PRODUCTS

2.01 GENERAL ..............................................................................................................14
2.02 PIPE AND FITTINGS............................................................................................14
2.03 JOINTS..................................................................................................................15
2.04 VALVES..................................................................................................................15
2.05 INSULATION..........................................................................................................16
2.06 TRAPS....................................................................................................................17
2.07 DRAIN VALVES.....................................................................................................17
2.08 SHOCK ABSORBERS.........................................................................................17
2.09 PIPING ACCESSORIES.......................................................................................17
2.10 HOSE BIBB..........................................................................................................18
2.11 CLEANOUTS.........................................................................................................18
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

2.12 ACCESS DOORS .................................................................................................................. 18
2.13 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS .................................................. 19
2.14 HANGERS, ANCHORS, GUIDES, AND PIERS .................................................................... 19
2.15 DRAINS .................................................................................................................................. 20
2.16 PLUMBING FIXTURES ........................................................................................................ 20
2.17 BACKFLOW PREVENTERS .................................................................................................. 23
2.18 UNION AND NIPPLES ........................................................................................................... 23
2.19 TEMPERING VALVES ............................................................................................................ 24
2.20 RECIRCULATING HOT WATER PUMPS (RP-1) .................................................................. 24
2.21 EXHAUST BREECHING, CHIMNEYS AND STACKS ................................................................. 24
2.22 NATURAL GAS SUB-METER .................................................................................................. 25
2.23 EMERGENCY GAS SOLENOID VALVE .................................................................................. 25
2.24 DOMESTIC WATER SUB-METER .......................................................................................... 25
2.25 SUMP PUMP SYSTEM: .......................................................................................................... 26
2.26 FIRESTOP SYSTEMS ............................................................................................................ 27
2.27 SCAFFOLDS AND STAGING .................................................................................................. 27
2.28 HOISTING MACHINERY AND EQUIPMENT .......................................................................... 27

PART 3 - EXECUTION .................................................................................................................... 28

3.01 WORKMANSHIP AND INSTALLATION METHODS ................................................................. 28
3.02 WORK COORDINATION AND JOB OPERATIONS ................................................................. 28
3.03 CUTTING AND CORE DRILLING ............................................................................................ 29
3.04 CLEANING AND PROTECTION ............................................................................................. 29
3.05 SLEEVES, INSERTS, AND ESCUTCHEONS ......................................................................... 29
3.06 TESTING ................................................................................................................................. 30
3.07 CHLORINATION ..................................................................................................................... 30
3.08 INSTALLATION OF FIRESTOP SYSTEMS ........................................................................... 31
3.09 INSTALLATION OF EXHAUST BREECHING, CHIMNEYS AND STACKS .............................. 31
3.10 SYSTEM SHUTDOWNS .......................................................................................................... 32

END OF INDEX
SECTION 220000

PLUMBING
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER'S CHECK or CASHIER'S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

E. The Filed Sub-Bidder for the work of this SECTION 220000 shall list, in Paragraph E, of the FORM FOR SUB-BID, the name of each person, firm, or corporation, whom he proposes to use to perform the following classes of work or part thereof, at the bid price therefore:

<table>
<thead>
<tr>
<th>CLASS OF WORK</th>
<th>PARAGRAPH NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td>2.05</td>
</tr>
</tbody>
</table>

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.03 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.
B. The work covered by this Section of the Specifications includes the furnishing of all labor and materials and in performing all operations in connection with the installation of the Plumbing Work.

C. Without limiting the generality thereof, the work to be performed under this Section includes:

1. Complete Sanitary, Waste & Vent System as shown on the drawings.
2. Potable Cold, Hot, and Hot Water Re-circulation System.
4. Natural Gas System.
5. Furnish and install boiler exhaust breeching.
6. Insulation.
7. Kitchen Emergency Gas Solenoid Valve
8. Fixtures and Equipment
9. Connection to Equipment Furnished by Others
10. Flushing, Sterilization, and Tests
11. Furnishing of Access Panels
12. The work is to be phased. The Plumbing Subcontractor shall construct the project in phases as directed by the General Contractor to suit the Project progress schedule, as well as the completion dates of the various phases and the overall project. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural drawings. As each phase is occupied the entire space shall be fully functional with Code required facilities for occupancy. (Proper number of toilet facilities with hot & cold water as a minimum)
13. Drilling, Coring and Cutting & Patching of holes and openings where the largest dimension thereof does not exceed 12 inches for Plumbing Piping and Equipment.
14. Demolition of existing Plumbing Equipment and Disconnecting, Capping, and otherwise making inactive, all existing Plumbing Services in the various areas where Demolition and Removal Work is required; and removing, relocating, and reinstalling existing Plumbing items to the extent specifically noted in the documents. Remove all piping hangers and equipment in accordance with the description in paragraph 1.20.
15. Provide and maintain temporary water service as directed by General Contractor. General Contractor to pay for all water use.
16. Scaffolding, Rigging, and Staging required for all Plumbing Work. Comply with Division 1 requirements.
17. Provide Seismic Restraints for all Plumbing Systems conforming to the requirements of Section 230548 which Section is herein incorporated by reference. Seismic restraints are required on all new systems whether in new or existing building.
18. Preparation of Co-ordination Drawings.
19. Smoke and Firestopping Seals and sealing of all wall penetrations as detailed on the drawings. Refer to Section 078400 which defines the firestopping materials and methods.
20. Prior to start of the work, the Plumbing Sub-Contractor shall identify and locate all of the existing sanitary drains located below slab in each work area and provide the services of an outside firm who shall run an underground video camera, locating all lines including depth, preparing a video and identifying any problem areas. The Plumbing Sub-Contractor shall rod-out and power wash all existing sanitary drains prior to making any tie-ins. Turn over a copy of the video and report to the Architect. At completion of each phase of work and before turning over the particular phase for occupancy, prepare a similar video of all the new main lines that are installed including the existing ones. The video and report shall document all below slab piping in each work area, identifying in a report form the start of the pipe and video and stating the length to each branch along the video. At the end of the project the video shall document all of the buried systems. The video requirement is for all underground sanitary drainage pipe in the work areas.

21. When open-flame or spark producing tools such as blowers, welding equipment, and the like are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant non-working fire watch, paying all fees, where work is being performed and until it is completed. Fee for fire watch shall be included in the bid.

22. It shall be the responsibility of this division 220000 to provide all personnel as required to fully coordinate with the commissioning agent. The hours of training and instruction outlined in this division 220000 and the Testing requirements shall be in addition to those tests and requirements outlined in section 019113 and required to fulfill section 019113 commissioning obligations.

1.04 RELATED WORK

A. The following Related Work will be performed under the designated Sections:

1. Cutting and Patching beyond 1.03C.13 above: SECTION 024119 – SELECTIVE DEMOLITION
2. Flashing for vents through roof: SECTION 075419 - ROOFING & FLASHING
3. Electric Power Wiring: SECTION 260000 - ELECTRICAL
4. HVAC Equipment: SECTION 230000 - HVAC
5. Excavation and Backfill: DIVISION 31 - EARTHWORK
6. Finish Painting: SECTION 099100 - PAINTING
7. Installation of Access Panels: SECTION describing material in which panel is installed.
8. Toilet Room Accessories: SECTION 102813 - TOILET ACCESSORIES

1.05 CODES, ORDINANCES, AND PERMITS

A. Perform all work in accordance with the requirements of the City of New Bedford Building Department, Massachusetts State Plumbing and Fuel Gas Codes, D.E.P., A.D.A., NFPA, The Architectural Barrier Code, and applicable State and Federal Laws. Give all requisite notices, file all requisite plans, and obtain all permits required to perform all Plumbing Work. Where the Contract Documents indicate more stringent requirements than the above Codes and Ordinances, the Contract Documents shall take precedence.
B. Obtain all permits, inspections, and approvals, from the governing authorities and pay all fees and include cost in the bid, including approvals for the cross connection control device. Provide the Owner with the cross connection permit for the device in the Owner's name.

C. Owner will pay all related Gas Utility Company back charges.

1.06 DISCREPANCIES IN DOCUMENTS

A. Where Drawings or Specifications conflict or are unclear, advise Designer in writing before Award of Contract. Otherwise, Designer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or unclarities thus resolved.

B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Designer in writing before installation. Otherwise, make changes in installed work as Designer requires within Contract Price.

C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specs, this contractor shall provide that material, installation, or work which is of the higher standard.

D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the contractor has failed to notify the Designer of the situation in accordance with the paragraph above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.

E. In cases covered by the paragraph above, where the contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Designer shall review, note if necessary, and approve the sketch.

1.07 MODIFICATIONS IN LAYOUT

A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet architectural requirements.

B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Designer.

C. Check Contract Drawings as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this Section will be installed.
D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.

E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, D above. Systems shall be run in a rectilinear fashion.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Designer for review and approval.

1.08 SHOP DRAWING AND MATERIAL SCHEDULES

A. Refer to SECTION 013300 – SUBMITTAL PROCEDURES for submittal of Shop Drawings. If apparatus or materials are substituted for those specified, and such substitution necessitates changes in or additional connections, piping, supports or construction, same shall be provided as the responsibility, and at the expense, of the Plumbing Subcontractor.

B. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Subcontractor. The Subcontractor is responsible for furnishing and installing materials called for in the Contract Documents, even though these materials may have been omitted from approved Submittals.

C. Submit Shop Drawings for the following materials and equipment.

1. Valves, Piping, Couplings and Fittings
2. Fixtures, Drains and Equipment including Supports
3. Backflow Preventers
4. Access Panels and Covers
5. Insulation
6. Drains, and Hydro Mechanical Specialties
7. Hose Bibs
8. Hangers, Anchors, Guides, and Supports including Seismic Restraints
9. Cleanouts
10. Piping Identification System
11. Boiler exhaust breeching including coordinated working drawings of installation.

1.09 COORDINATION DRAWINGS

A. Before materials are purchased or Work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces (match lines).

B. Coordination Drawings are for the Contractor's and the Architect's use during Construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.
C. Detailed procedures for Coordination Drawings are contained in DIVISION 01 - GENERAL REQUIREMENTS of these Contract Documents.

1.10 RECORD DRAWINGS

A. General: Refer to DIVISION 01 - GENERAL REQUIREMENTS for general requirements for maintaining as-built drawings and submitting final reproducible record documents.

B. The General Contractor will provide two sets of Drawings to the Plumbing Subcontractor, one set of which shall be maintained at the site and which shall, at all times, be accurate, clear, and complete, showing the actual locations of all equipment and piping as it is being installed. The Record Drawings shall be available to the Architect/Engineer's field representative at all times.

C. Provide electronic AutoCAD drawings to indicate revisions to piping size and location both exterior and interior; including locations of valves and other equipment requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.

D. Include in the Record Drawings any addenda, sketches, and supplementary Drawings issued during the course of construction.

E. Non-availability of Record Drawings or inaccuracies therein will postpone the final inspection until they are available.

F. All valves shown on these Drawings shall be numbered with numbers corresponding to those on the valve charts.

G. All costs related to the foregoing requirements shall be paid by the Plumbing Subcontractor.

1.11 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Provide operating instructions to the Owner's designated representative with respect to operation functions and maintenance procedures for all equipment and systems installed. At the completion of the project, turn over to the Architect four (4) complete manuals, in three-ring, loose-leaf binders, containing the following:

1. Complete Shop Drawings of all equipment.
2. Operation description for all systems.
3. Names, addresses, and telephone numbers of all suppliers of the system.
4. Preventative maintenance instructions for all systems.
5. Spare parts lists of all system components.
6. Four copies of video of below slab piping.
7. Valve tag chart.
B. Provide DVD recording of operation and maintenance training sessions and include as part of O & M Manual submittal. Training session video recording and DVDs shall be performed by a professional videographer. Provide indexed table of contents for DVD recording.

1.12 GUARANTEE

A. Refer to Division 1 of the Contract. Guarantee all work under this Section free from defects in workmanship and materials for a period of one (1) year from the date of final acceptance of the building, as set forth in the Contract. Replace any such defective work developing during this period, unless such defects are clearly the result of bad usage of equipment by others. Where such defective work results in damage to work of other Sections of the Specifications, restore such work to its original condition by mechanics skilled in the affected trade.

1.13 DRAWINGS

A. All work shown on the Drawings is intended to be approximately correct to scale, but shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make complete working systems ready for use. The Plumbing Drawings are intended to show the main stacks and risers and may or may not necessarily show all runout piping particularly in lavatories and gang toilet areas. Contractor shall include all runout piping to all referenced scheduled fixtures and equipment appearing on the Plumbing Drawings.

B. All floor drains installed on this project, including all kitchen floor drains and trough drains, shall be equipped with trap primers. The trap primer and piping is not shown on the drawings and shall be located in the field by the Contractor as dictated by field piping conditions.

C. The Plumbing Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.

D. Refer to the Architectural, Structural, and other Mechanical and Electrical Drawings, which indicate the construction in which this Work shall be installed. Locations shown on the plans shall be checked against the general and detailed Drawings of the construction proper. All measurements shall be taken at the Building.

1.14 VALVE TAGS, NAMEPLATES, AND CHARTS

A. All valves on pipes of every description shall have neat circular brass valve tags at least 1-1/2 in. in diameter attached with brass hook to each valve stem. Stamp on these valve tags, in letters as large as practical, the number of the valve and the service, such as "H.W., C.W., GAS", for hot water, cold water, and gas respectively. The numbers for each service shall be consecutive. Where valves are located above ACT ceilings, furnish and install valve finder ceiling tack, tack shall be minimum 7/8 in. diameter with 1/2 in. steel point, color as determined by Owner.
B. All valves on tanks and pumps shall be numbered by 3 in. red metal discs with white numbers 2 in. high, secured to stem of valves by means of small solid link brass chain, to correspond to numbers indicated for valves on the Record Drawings and on two (2) printed detailed lists. These printed lists shall state the numbers and locations of each valve and the fixture or group of fixtures which it controls, and other necessary information such as requiring the opening or closing of another valve or valves when any one valve is to be opened and closed, and shall be prepared in form to meet approval of the Architect, and shall be framed under glass.

C. Nameplates, catalog numbers, and rating identifications shall be securely attached to Electrical and Mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

1.15 PIPE MARKER IDENTIFICATION SYSTEM

A. Mark all piping installed under this Section and at all Access Panels with a marking system in basic colors conforming to those specified in ANSI/ASME A-13.1. Markings shall indicate pipe content and direction of flow. Markers shall be applied at all valves and tee joints, and on straight runs of pipe at every 20 ft.-0 in. on center.

B. Markers shall be vinyl snap-around pipe type system. Adhesive markings are not acceptable.

C. Clearly mark potable and non-potable water system with 4 inch wide colored bands, with arrow for direction of flow, every twenty-five (25) feet on center on all piping installed whether it is concealed or exposed and also on both sides of floor and/or wall penetrations. Mark potable water green and non-potable yellow. Within 6 in. of each band identify with letter "Potable C.W.", Non-Potable H.W." Color of letter shall match banding.

1.16 SANITARY, WASTE, AND VENT SYSTEMS

A. Furnish and install complete Sanitary, Waste, and Vent Systems (all hereinafter called Drainage Systems) to convey wastes from all Soil and Waste Stacks, Fixtures, and Equipment as indicated and/or described in these Plans and Specifications. Urinal waste shall be 2 in. cast iron or sizes indicated on the drawings. Waste piping smaller than 3 in. shall not be used underground. The use of double "Y's" in the horizontal shall not be permitted. All piping shall be installed straight and true and located concealed within building construction.

B. All horizontal Drainage Systems Piping within the building, 3 in. and smaller, shall be pitched at least 1/4 in. per ft. in the direction of flow. Drainage Piping 4 in. and larger shall be pitched at least 1/8 in. per ft. Make changes in direction of drainage lines with 45 wyes, long turn wyes, or sweep bends.

C. Furnish and install all cleanouts indicated on the Drawings and/or where required in Drainage Pipes regardless of size so that the distance between cleanouts does not exceed 45 ft. o.c. Cleanouts shall be installed at the base of all risers and at each change of direction.

D. Refer to drawings for termination points, which generally are connection to existing piping.
1.17 DOMESTIC WATER SYSTEMS (POTABLE & NON-POTABLE)

A. Furnish, install, sterilize, and test in accordance with the documents and the Plumbing Code, complete potable and non-potable Domestic Cold, Hot, and Hot Water Recirculating Systems including all piping, valves, low point drains, shock absorbers, hangers, insulation, backflow preventers and water heating equipment. Clearly mark the systems as provided above. This work shall start as indicated on the Drawings.

B. In general, piping shall pitch upward in the direction of flow with each branch and riser separately valved and with 1/2 in. hose end drain on the outlet side of the valve and at all low points in the system. Install shutoff valves for each battery of fixtures and other valves as necessary to isolate any part of each system.

C. Install shock absorbers on hot and cold water piping to each fixture. Provide shock absorbers at all quick closing valves and as shown on the Drawings and/or specified.

D. Install a 1/2 inch hose bibb in each toilet room provided with a floor drain. The hose bibb shall be installed under a lavatory.

E. Install a 1/2 inch hose bibb in each mechanical room.

F. Furnish and install a ball valve, balancing valve and check valve at each hot water recirculation line before it connects to another hot water recirculation line.

1.18 FUEL GAS SYSTEM

A. Furnish and install a complete Natural Gas Supply System including pipe, fittings, valves, connections to all gas fired equipment requiring gas, and all accessories and incidentals as indicated or specified. Installation shall be made in accordance with the State Gas Code requirements. Piping shall be installed with an 8 in. long sediment leg at the base of all risers. All changes in direction shall be made with plugged tees for cleaning piping out.

B. All horizontal Gas Piping shall be pitched not less than 1/4 in. in 15 ft. to prevent traps. Pitch piping to risers. Install an 8 in. long sediment leg at the base of all risers. All changes in direction shall be made with plugged tees for cleaning piping out. All horizontal branch outlet pipes shall be taken from the top or side of horizontal mains and not from the bottom. Install shutoff valves for each battery of equipment and other valves as necessary to isolate any part of each system.

C. Arrange with the Local Gas Company for the installation of the gas meters, services, and gas pressure regulators. Refer to DIVISION 01 - GENERAL REQUIREMENTS for information regarding Utility Company Charges.

D. Provide seismic restraints for all gas piping per requirements of the Mass. Building Code. Refer also to Section 230548.

E. Plumbing Sub-Contractor shall furnish and install all gas vents for all knockdown regulators whether furnished by this Section, HVAC, or any other Section.
1.19 EQUIPMENT FURNISHED BY OTHERS

A. Verify the extent of the connection requirements from the General, Architectural, and Mechanical Plans and Specifications.

B. The Plumbing Subcontractor shall be responsible in making final connections to all equipment furnished by others, to ascertain complete cross-connection prevention compliance, and to furnish and install vacuum breaker and backflow preventers which may be required to be Code compliant and are not so furnished with the equipment.

1.20 DEMOLITION

A. When and as directed by the General Contractor perform all demolition work.

B. All hangers, valves, piping, pumps, fixtures, controllers, and other miscellaneous equipment and materials in the existing building not specifically designated for reuse in the documents shall remain the property of the Owner.

C. Remove as indicated existing Plumbing piping, fixtures, and equipment including all hangers and supports and disconnect all Plumbing connections to equipment to be removed under other Sections of the Specifications. Clean, recondition, and relocate where indicated all items to be reused.

1. Carefully remove shower and toilet room fixtures and trim and deliver in good condition to an on-site location designated by the Architect. The Owner will review all the fixtures and trim and select the items to be kept and the items to be disposed. The disposal of all items not wanted by Owner is specified by the Demolition Section.

2. In cases where main piping is to remain, remove all existing piping to fixtures being removed and cap said piping back to riser or main. All caps or plugs to be installed shall be of like material as pipe being capped or plugged.

3. All piping, valves, hangers, and fittings shall be removed from ceiling and walls as indicated and placed on the floor by this Section. The General Contractor shall remove from the floor and dispose.

4. Any disputes between this Subcontractor and other Contractors or Subcontractors relative to the responsibility for removal of equipment shall be referred to the Architect for decision. The Architect's decision shall be firm and binding and to whomever he designates responsibility for removal of equipment shall do so without any additional cost to the Owner.

1.21 PAINTING

A. All interior exposed piping is to be painted and all painting, except as noted, will be done by the Painting Subcontractor. All uncovered piping and hangers shall be thoroughly cleaned of rust, oil, and other containments by the Plumbing Subcontractor and left ready to receive primer coat.

B. Painting for pipe markings shall be done under this Section.
C. Painting of exterior gas piping at gas meter, generator, on roof, and at rooftop equipment, shall be done under this Section.

1.22 HOISTING EQUIPMENT AND MACHINERY

A. Unless otherwise specified, all hoisting and rigging equipment and machinery required for the proper and expeditious prosecution and progress of the Work of this Section shall be furnished, installed, operated and maintained in safe condition by each sub-contractor, as specified under Section 015000, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

1.23 STAGING AND SCAFFOLDING

A. Unless otherwise specified, each sub-contractor shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding as specified under Section 015000 Construction Facilities and Temporary Controls, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.

1.24 COMMISSIONING

A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 – Commissioning Requirements.

B. Complete installation and startup checks and functional tests according to Section 019113 – Commissioning Requirements and manufacturers written instructions.

C. Operational Test: After plumbing systems have been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the startup procedure.

D. Verify that equipment is installed and commissioned as per requirements of Section 019113 and manufacturers written instructions/requirements.

1.25 BREAKDOWN

A. Submit a breakdown of the contract price to aid the Architect in determining the value of the work installed as the job progresses.

B. No requisition will be approved until the breakdown is delivered to the Architect.

1.26 VISIT TO SITE

A. Prior to submitting a Bid, visit the site of work and become familiar with existing conditions. Any assumptions made are at this Subcontractor's expense.
1.27 ENERGY REBATE PROGRAM

A. This project has been designed to incorporate equipment approved for energy rebate such as domestic water heaters. Provide unit prices for each equipment type scheduled to be part of Rebate Program. Assist the Owner in filling out forms for utility company rebates.

1.28 TRADE RESPONSIBILITY FOR INTERCONNECTIONS MATRIX

<table>
<thead>
<tr>
<th>Device</th>
<th>Furnished By</th>
<th>Installed By</th>
<th>Power Wiring</th>
<th>Control Wiring</th>
<th>Fire Alarm Wiring</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke Detectors (Area type)</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00</td>
<td></td>
</tr>
<tr>
<td>Smoke Detectors (Duct mounted)</td>
<td>26 00 00</td>
<td>23 00 00</td>
<td>26 00 00</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00</td>
<td></td>
</tr>
<tr>
<td>Smoke &amp; Fire/Smoke Dampers</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Smoke &amp; Fire/Smoke Damper Actuators</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00</td>
<td>2</td>
</tr>
<tr>
<td>Fire Dampers</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>VAV Boxes</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>26 00 00</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>VAV Box Damper Actuator</td>
<td>23 00 00 (ATC)</td>
<td>Box Mfr</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>VAV Box DDC Controller</td>
<td>23 00 00 (ATC)</td>
<td>Box Mfr</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>Hydronic Control Valves</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00</td>
<td>N/A</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Hydronic Control Valve Actuator</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Sheet Metal Damper</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Sheet Metal Damper Actuators</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>26 00 00</td>
<td>26 00 00</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>3</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------</td>
<td>----------</td>
<td>--------------------------</td>
<td>----------------</td>
<td>-----</td>
<td>---</td>
</tr>
<tr>
<td>Electrical Energy Meters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC Hydronic Energy Meters</td>
<td>23 00 00</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>3</td>
</tr>
<tr>
<td>Airflow Measuring Stations</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>DDC Panels</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td>VFDs at AHU, EFs</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Elevator Hoistway Vent Damper</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Elevator Hoistway Vent Damper Actuator</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00</td>
<td></td>
</tr>
<tr>
<td>Boiler Exhaust Breeching</td>
<td>22 00 00</td>
<td>22 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Kitchen Emergency Gas Valve</td>
<td>22 00 00</td>
<td>22 00 00</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Division 23 00 00 and Division 23 00 00 (ATC) Contractors shall fully coordinate all airflow damper and hydronic valves sizes and quantities.
2. Smoke Damper and VAV Box power wiring shall be provided by Division 26 00 00 to junction box locations shown on electrical drawings; Division 23 00 00 (ATC) Contractor shall provide final power wiring from junction box to end device location.
3. Division 26 00 00 Contractor shall provide all line-voltage power wiring required for meters; Division 23 00 00 (ATC) Contractor shall provide all low-voltage power wiring required for meters.
4. Division 26 00 00 shall provide power at main DDC Panel. Division 23 00 00 (ATC) shall provide power to all other DDC Panels.
PART 2 - PRODUCTS

2.01 GENERAL

A. All materials and equipment furnished under this SECTION shall be new, unused, first quality of a manufacturer of established reputation. Each valve, fitting, section of pipe, and piece of equipment supplied to project shall have cast or indelibly stamped thereon the manufacturer's name, pressure rating where applicable, type, and any other specific information provided by manufacturer. Materials shall conform to Massachusetts Code as a minimum requirement and shall appear on the Massachusetts Approved Plumbing Products list.

2.02 PIPE AND FITTINGS


B. All piping installed under this SECTION shall be in accordance with the following:

<table>
<thead>
<tr>
<th>Service</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underground Drainage and Vent piping</td>
<td>Service weight cast iron soil pipe-coated bearing collective trademark of the Cast Iron Soil Pipe Institute (CISPI)</td>
</tr>
<tr>
<td>Above ground Drainage and Vent, piping 2 in. and larger</td>
<td>No Hub cast iron soil pipe and fittings bearing collective trademark of the CISPI</td>
</tr>
<tr>
<td>Above ground drainage, and Vent piping 2 in. and smaller</td>
<td>Type ‘L’ hard tempered copper tubing</td>
</tr>
<tr>
<td>Trap primer piping from Primer to floor drain</td>
<td>Type ‘K’ soft rolled copper tubing with Swaged ends</td>
</tr>
<tr>
<td>Domestic water piping above ground (potable &amp; non-potable)</td>
<td>Type ‘L’ hard tempered copper tubing</td>
</tr>
<tr>
<td>Indirect waste piping</td>
<td>Type ‘L’ hard tempered copper tubing coated with two (2) coats of white epoxy paint</td>
</tr>
<tr>
<td>Gas piping above ground</td>
<td>ASTM A-53 Schedule 40 black steel pipe</td>
</tr>
<tr>
<td>Gas piping below ground</td>
<td>ASTM A-53 Schedule 40 black steel pipe with fusion bonded epoxy coating Scotchkote 6233 or equal.</td>
</tr>
</tbody>
</table>
C. Fittings for underground Drainage Piping shall be service weight bell and spigot pattern C.I. soil pipe fittings. Above ground shall be no hub C.I. soil pipe fittings, Massachusetts Standard.

D. Fittings for sweat drainage piping shall be cast bronze or wrought copper of recessed drainage pattern.

E. Fittings for Type 'L' hard tempered copper tubing shall be cast bronze or wrought copper sweat type, water pattern fittings.

F. Fittings for gas piping 2-inch and smaller shall be threaded malleable iron gas pattern fittings for screwed pipe. All gas piping 2 ½ in. in size and larger shall be welded and shall utilize butt welded steel pipe fittings.

2.03 JOINTS

A. Joints for underground cast iron bell and spigot soil pipe shall be made up with resilient gaskets. Above ground shall be made up of heavy duty – 4 band stainless steel clamps, and gaskets. Couplings shall be in compliance with CISPI 310 and shall bear the mark of NSF International. Couplings shall be Husky “SD 4000”, Clamp - All HI-TORQ 125, Mission “HW”, or equal.

B. Copper tubing and sweat fittings shall be assembled with lead free solder, Silverbrite, Oatey, Harris, or equal, and a non-corrosive flux recommended by the manufacturer (includes waste piping and water piping).

C. Joints between copper waste/vent tubing and cast iron shall be made with cast iron threaded fittings and copper thread by sweat fittings.

D. Joints between copper tubing and ductile iron water pipe or at flanged joints to tanks shall be made with a combination iron and brass flange with composition gasket and iron bolts.

E. Joints at water heaters or other tanks having threaded connections shall be made up with dielectric unions.

F. Joints between floor or wall flanges and fixtures shall be made with one-piece special molded neoprene gaskets which shall be furnished by the fixture manufacturer.

G. Threaded pipe joints including plastics shall be made up with teflon tape.

H. Joints on screwed gas piping shall be made up with thread compound on male threads only. Welded joints shall be made up by certified welders. All joints on piping 2-1/2 in. and larger shall be welded.

2.04 VALVES

A. Furnish and install valves where indicated on the Drawings or where specified and located so that they may be operated, repaired, or replaced with a minimum effort and repacked under pressure.
B. The following list of valves is intended only as a guide for type and quality. Valves shall be as manufactured by Apollo, Milwaukee, Nibco, Elkhart, Watts or approved equal.

- **Shutoff valves 2 in. and smaller**
  - Apollo #70LF-202 through #70LF-208 solder end lead-free ball valves
- **Shutoff valves, 2-1/2 in. and 3 in.**
  - Apollo #70LF-109 and #70LF-100 lead-free
- **Balancing valves**
  - Bell & Gossett Model CB lead free calibrated balance valve.
- **Gate valves 4 in. and larger**
  - Jenkins 651-A
- **Stop and waste valves**
  - Apollo #95LF-203 through #95LF-205, lead-free
- **Check valves**
  - Walworth #406 SJ
- **Gas service stops, 1 in. and smaller**
  - Apollo #70-102-07 through #70-108-07 with tee handle
- **Gas service stops, 2-1/2 in. and larger**
  - Rockwell #143 lubricated plug valve
- **Drain valves**
  - Apollo #78-103-01 or #78-203-01 ball valve with cap and chain 1/2 in. x 3/4 in. hose end
- **Backwater Valve (Drainage Systems)**
  - Zurn #Z1095. At below grade installations provide with extension to grade Zurn model Z1095-FC, height as required.

2.05 **INSULATION**

A. Insulation for all water piping whether concealed or exposed shall be 1 in. thick, heavy density, preformed snap-on insulation equal to Johns Manville Micro-Lok HP, 850 degrees snap-on system. Insulation for cold water piping shall have a factory applied vapor barrier with ends and butts sealed with overlapping 4 in. sealing strips.

B. Valves and fittings shall be insulated with pre-formed fiberglass fitting insulation cut from dense fiberglass blanket and covered with pre-molded P.V.C. fitting covers. P.V.C. covers shall overlap the adjoining insulation and shall be secured with pressure sensitive vinyl tape over a vapor barrier adhesive seal at the joints. (Note: Staples or tacks are not permitted on covers).

C. All insulation shall have self-sealing type, all service jacket (ASJ-SSL) factory applied. At all exposed piping, cover jacket with continuous P.V.C. jacket.
D. Sealers, solvents, tapes, and adhesives, and mastics used in conjunction with the installation of insulation under this Section shall possess the maximum possible fire safe qualities available and shall be NFPA approved.

E. Covering shall be applied over clean and dry surfaces. No covering shall be applied until after the approval of all pressure and leakage tests.

F. Insulation shall be as manufactured by Johns Manville, Inc., Owens-Corning Fiberglass Corporation SSL II-ASJ, or Knauf Insulation 1000. Insulation shall be applied by skilled insulation mechanics in a first class manner.

2.06 TRAPS

A. Furnish and install traps with cleanouts on all fixtures and equipment requiring connection to the sanitary system of the same size and material as the pipe on which they occur. Traps installed on threaded pipe shall be recessed drainage pattern.

2.07 DRAIN VALVES

A. It shall be possible to drain the water from all sections of the Potable and Non-Potable Hot and Cold Water Piping. Furnish and install 1/2 in. x 3/4 in. hose end ball valves with cap and chain. (see 2.04 for model no.)

2.08 SHOCK ABSORBERS

A. Furnish and install, where shown on Drawings and where required to prevent water hammer, Zurn Manufacturing Company model 1250-XL lead free shock absorbers, or equal, as manufactured by J.R. Smith Manufacturing Company, Josam Manufacturing Company, or equal.

B. Installation of absorbers shall be as per manufacturer's recommendations.

2.09 PIPING ACCESSORIES

A. Pressure and Temperature Relief Valves shall be A.S.M.E. rated temperature relief 210 deg. F. double BTU rated, self-closing, as manufactured by Watts Regulator Company or equal by Wilkins, McDonnell and Miller, or equal.

B. Vacuum reliefs shall be lead free Watts Regulator Company #LFN36 or equal by Wilkins or Lawler.

C. Temperature gauges shall be 4-1/2 in. diameter dial thermometers, any angle, and range of 30 degrees F. to 240 degrees F. as manufactured by Weiss Instruments, U.S. Gauge, Trerice or equal.

D. Potable and non-potable Water system pressure gauges shall be 4-1/2 in. diameter with a range of 0 to 160 psi as manufactured by Weiss Instruments, U.S. Gauge, Trerice or equal.
E. Natural gas system pressure gauges shall be 4 inch diameter with a range of 0 to 30 inches of water as manufactured by Weiss Instruments, U.S. Gauge, Trerice or equal.

F. Trap primer connections are required on all floor drains to maintain trap seal. The requirement for trap primer connections shall include all floor drains in the kitchen including trough drains furnished by others. Trap primers shall be Precision Plumbing Products, Inc., Model PRO1-500 flow activated prime-pro trap-primer valve or shall, where appropriate, be Zurn, Josam, Smith or equal in-line connections installed on flush valve supply. Electronic trap primer shall be Precision Plumbing Products, Inc. Model MPB-500 mini-prime electronic trap-primer manifold, 120 volt, single phase. Furnish distribution units as required.

2.10 HOSE BIBB
   A. Hose bibb shall be T & S Brass or equal model #B-720 modified, chrome plated, 3/4 in. hose end, integral stop, vacuum breaker, modified with lock shield and loose tee handle.
   B. Hose bibbs shall be manufactured by T&S Brass, Speakman, Chicago, or equal.

2.11 CLEANOUTS
   A. Cleanout plugs on the Sanitary System shall be of heavy cast brass of the screwed type. Plugs shall be full size up to and including 4 inch.
   B. For piping running under floor slab, cleanouts shall be brought up to just under the floor slab level. Furnish and install access cover for all floor-type cleanouts, Zurn ZN-1400 Series with scoriated nickel bronze or by Josam, J.R. Smith, or equal. In the garage area and at exterior locations use Zurn model #Z-1474 cleanout housing set over brass cleanout plug.

2.12 ACCESS DOORS
   A. Furnish Access Doors for access to all concealed control valves, cleanouts, valves, expansion joints, and to all other concealed parts of the Plumbing System that require accessibility for the proper operation and maintenance of the system. These doors shall be installed under the appropriate SECTION of the Specifications as determined by the surface upon which the panels are mounted.
   B. All Access Doors shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that the valve or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 in. x 16 in.). Furnish Access Doors for each pipe space to permit thorough inspection of same. When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.
   C. Access doors shall be prime painted and completed with cylinder lock and two (2) keys as manufactured by Acudor, Inland Steel Products Company "Milcor", or Walsh-Hannon-Gladwin, Inc., "Way Loctor". Type shall be as follows:
      1. Acoustical Tile Ceiling Acudor AT-5020
      2. G.W.B. Surfaces Acudor DW-5040
3. Masonry Construction  Acudor UF-5000
4. Fire Rated Construction  Acudor FB-5060

D. Access Door Shop Drawings shall be submitted to the Architect for approval.

2.13 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS

A. Furnish and install all supplementary steel, channels, and supports required for the proper installation, mounting, and support of all equipment.

B. Supplementary Steel and Channels shall be firmly connected to building construction in a manner approved by the Architect.

C. The type and size of the Supporting Channels and Supplementary Steel shall be determined by the Plumbing Subcontractor and shall be sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

D. All Supplementary Steel and Channel shall be installed in a neat and workmanlike manner parallel to the walls, floor, and ceiling construction. All turns shall be made with 90 deg. fittings, as necessary to suit the construction and installation conditions.

2.14 HANGERS, ANCHORS, GUIDES, AND PIERS

A. All piping shall be supported from the Building Structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration, and to secure piping in place, and shall be so arranged as to provide for expansion and contraction.

B. The spacing for hangers for horizontal piping shall be in accordance with the following:

1. Cast Iron Soil Pipe: 5 ft.-0 in. at the hubs for 5 ft. lengths. For 10 ft. lengths, use one (1) hanger at the hub and one (1) at midpoint of the length. Install cast iron pipe in accordance with CISPI Handbook - latest edition.

2. Copper Tubing: 6 ft.-0 in. o.c. for 1-1/4 in. and smaller, and 10 ft.-0 in. o.c. for 1-1/2 in. and larger.

3. Steel Pipe: 10 ft.-0 in. o.c. for 1-1/2 in. and over; 8 ft.-0 in. for 1-1/4 in.; 6 ft.-0 in. for 1 in. and smaller.

C. Hanger rod diameter shall be as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 in. thru 2 in.</td>
<td>3/8 in.</td>
</tr>
<tr>
<td>2-1/2 in. and 3 in.</td>
<td>1/2 in.</td>
</tr>
<tr>
<td>4 in. and 5 in.</td>
<td>5/8 in.</td>
</tr>
<tr>
<td>6 in.</td>
<td>3/4 in.</td>
</tr>
<tr>
<td>8 in. and over</td>
<td>7/8 in.</td>
</tr>
</tbody>
</table>
D. Vertical lines shall be adequately supported at their bases by a suitable hanger placed in the horizontal line near the riser and at every 10 ft. interval.

E. All Hangers shall be adjustable Clevis Hanger. Hanger rods shall have machine threads. Malleable iron brackets of approved type shall be used along the walls. All Hangers for copper tubing shall be copper plated except where pipe is insulated, in which case, Steel Clevis Hanger and pipe shield shall be used.

F. Piping shall not be hung from the hangers of other trades.

G. Provide seismic restraints for all piping per requirements of the MA Building Code and Section 230548. All gas piping shall be seismically restrained.

H. Hangers shall be manufactured by Grinnell, Carpenter and Paterson, Fee and Mason, or equal.

I. Wire and strap hangers will not be permitted in this installation.

J. Install a 14 gauge metal pipe shield between pipe insulation and all pipe hangers. Hangers shall be sized so that the pipe insulation passes through the hanger and is supported on the shield.

2.15 DRAINS

A. Furnish and install all floor drains where shown on the Drawings.

B. All floor drains in flooring systems without waterproofing membranes shall have galvanized iron clamping rings with 6-pound lead flashing to bond 9 in. in all directions. All drains shall be checked with Architect's Drawings to determine depth of the flashing collar. Brass extension pieces shall be provided if necessary.

C. All floor drains installed on this project shall be fitted with Automatic Trap Primer Connections. Field determine appropriate location for Trap Primer valve and drain piping.

D. Drain Schedule:

1. Type "A" – (General) Zurn #ZN-415-5BZ-P dura coated cast iron body with bottom outlet, combination invertible membrane clamp, adjustable collar, seepage slots, type BZ polished nickel bronze, light-duty, leveling strainer, trap primer connection.

2. Type "B" – (Mechanical Room) Zurn #Z-550-Y-P, 9 in. diameter top, dura coated cast iron body bottom outlet, seepage pan, combination membrane flashing clamp, frame for medium-duty, cast iron, heel-proof slotted grate, sediment bucket, cast iron grate, trap primer connection.

E. Drains shall be of one manufacturer, by Zurn, J.R. Smith, Josam, or equal.

2.16 PLUMBING FIXTURES

A. Furnish and install all fixtures and equipment, including supports, connections, fittings, and any incidentals, to make a complete installation in accordance with the Drawings and as specified.
The Architect shall be final judge as to whether fixtures and trim fulfill the requirements of the Specifications and as to whether they are of suitable quality.

All fixtures requiring hot and cold water shall have the cold water faucet on the right hand side of the fixture and the hot water faucet on the left hand side of the fixture.

Escutcheons shall be furnished and installed on all supplies and traps. Escutcheons shall be one (1) piece chrome plated brass with set screws.

All fixtures shall have the manufacturer's guaranteed label or trademark indicating first quality. All acid resisting enameled ware shall bear the manufacturer's symbol signifying acid resisting material.

Unless otherwise specified, faucets and all exposed fittings shall be chromium plated.

All supply pipes shall run in a reasonable straight vertical line from the stops to faucets. Traps shall be installed perpendicular to walls.

Vitreous china and acid resisting enameled fixtures shall be of one manufacturer by Sloan, American Standard, Toto, or equal. Trim shall be Symmons, Speakman, Chicago, T & S Brass, or equal. Flush valves shall be Sloan, Toto, Zurn, or equal. Water coolers and drinking fountains shall be manufactured by Elkay, Just, Filtrine, or equal. Stainless steel sinks shall be Elkay, Just, Kindred, or equal.

Note: All fixtures and fittings shall be vandal proof mounted, unless specifically noted otherwise.

Carefully coordinate roughing for flush valves so that the dimension from top of fixture to C-L of flush valve is a minimum of 6 in..

Special Note: There are several age groups accommodated in this building and therefore there are different mounting heights. Irrespective of the heights called for on the Documents, be responsible to re-verify in writing in field before installing any roughing for any fixture.

Fixture Schedule:

1. P-1 Water Closet:
   Sloan ST-2459, vitreous china, wall hung, elongated, siphon jet bowl, 1-1/2 in. top spud.
   Sloan “Royal” 111, exposed manually operated, water conserving flush valve with vacuum breaker, 1.6 gallons per flush.
   Olsonite 10CT solid plastic white open front seat with check hinge.
   Zurn 300# carrier coordinated with adjacent construction or existing conditions. Carefully coordinate with Architect's plans to fit in wall. Use Z-1209 where required by field conditions.
2. **P-1A Water Closet, Accessible:**
   Same as specified for P-1 except mounting height and location shall meet Accessibility Standards.

   The mounting heights are variable. Refer to Architect’s Drawing and request direction in field in writing before installing.

3. **P-1F Student Water Closet, Accessible:**
   American Standard Madera Youth 2599.001, white, elongated bowl, vitreous china, and floor mounted water closet, designed for 1.6 GPF.

   Sloan "Royal" 111-1.6, manually operated flush valve.

   Olsonite 10CT solid plastic white open front seat with check hinge.

   Cast iron floor flange secured to floor slab; Bolt Caps.

4. **P-1K Water Closet, Accessible (Pre-K):**
   American Standard "Baby Devoro" 10-1/4-inch height, 2282.001, floor mounted vitreous china elongated bowl, 1.6 gallon per flush, 1-1/2 inch inlet spud.

   Sloan "Royal" 111-1.6, manually operated flush valve.

   Olsonite 10CT solid plastic white open front seat with check hinge.

   Cast iron floor flange, bolt caps.

5. **P-2 Urinal:**
   Sloan Model WEUS 1000.1001-0.25, complete high efficiency urinal system with exposed, manually operated, 0.25 gallon per flush flush valve and vitreous china urinal.

   Zurn Z-1222 concealed support.

6. **P-2A Urinal, Accessible:**
   Same as specified for P-2 except Urinal shall conform to Accessibility Standards. Note that there are variable heights and locations on this project. Refer to Architect’s Drawing and request direction in field in writing before installing.
7. **P-3 Wall Hung Lavatory**:
   
   Kohler Soho K-2054, wall mounted 20 in. x 18 in. vitreous china lavatory, 4-inch centers, punched for concealed armchair carrier.

   Chicago EQ-A12C-13ABCP, self-generating with battery backup sensor faucet with 0.35gpm outlet, 4-inch centers, dual supply with integral concealed thermostatic mixing valve.

   McGuire Model 155-WC, 1-1/4 in. offset drain with open grid strainer.

   McGuire Model H-167 (pair) C.P., 3/8 IPS angle supply with loose key stop.

   McGuire Model B-8902 C.P., 1-1/4 in. x 1-1/2 in. cast brass adjustable ‘P’ trap with cleanout and #17 ga. tubing outlet to wall.

   Zurn #Z-1231 floor mounted concealed arm chair carrier.

   Conceal all exposed roughing and electrical wiring components under lavatory with Truebro Model #2018 rigid PVC enclosure.

8. **P-4 Drinking Fountain**:

   Elkay EDFP217FPK, Barrier Free Hi-Lo drinking fountain, tandem mounting, #4 satin finish stainless steel bowls, flexi-guard safety bubbler, push button actuator, ADA compliant, complete with 97258C cane apron.

   1-1/4 in. x 1-1/2 in. rough p-trap with cleanout; 1/2 in. ball valve stop.

2.17 **BACKFLOW PREVENTERS**

   **A.** Backflow preventers shall be reduced pressure type furnished complete with shutoff valves, Massachusetts Approved. Backflow preventers 2-1/2 inch and smaller shall be Watts #LF009-QT-S. Backflow preventers 3 inch and larger shall be Watts 957-QT. Backflow preventers shall be lead free, all bronze, complete with strainer and soft seated check valve. Size shall be as indicated on Drawings.

   **B.** Mount backflow preventer 3 ft.(+/-) above finished floor. Provide indirect waste funnel and run pipe to an air gapped discharge at sink or floor drain. Furnish a spare parts kit and parts list mounted in the vicinity of the device.

   **C.** Prior to the installation of devices in the name of the Owner file for, pay for, and obtain all required permits and approvals for cross connection control devices from the Authority having Jurisdiction.

   **D.** Backflow preventers shall be of one manufacturer, by Watts, Wilkins, Beeco, or equal.

2.18 **UNION AND NIPPLES**

   **A.** All connections between copper tubing and galvanized piping or between copper tubing and all tanks (such as water heaters, chillers, and similar equipment) shall be made with dielectric unions and nipples.
B. All connection to Water Heaters, Meters, Pumps, and other equipment requiring maintenance or alteration shall be made up with unions. Unions on brass piping, 2 in. and smaller, shall be brass composition "E" in strict accordance with Federal Specification WW-U-516. On plastic piping, use unions of the same material as the piping.

C. All close and shoulder nipples shall be corresponding materials as the pipe and shall be extra heavy.

2.19 TEMPERING VALVES

A. Furnish and install at the existing domestic water heater, Leonard Valve Company TM-520-RF-DT-TC High-Lo Thermostatic Water Mixing Valve, inlet check-stops, outlet volume/shutoff valve, dial thermometer, and test connection. Valves are to be furnished in rough bronze finish and are to be factory assembled and tested.

B. Furnish and install a 4 in. diameter thermometer on the outlet side of the tempering valve and where indicated on the Drawings as manufactured by U.S. Gauge Company, Powers Regulator Company, and/or Trerice Company.

2.20 RECIRCULATING HOT WATER PUMPS (RP-1)

A. Circulators shall be all-bronze booster type, Grundfos Magna3 40-80 or equal by Bell & Gossett, Taco or approved equal.

B. Furnish and install, where shown on the Drawings, an immersion aquastat, Honeywell #L-4006-A set to start and stop pump at a 10 degree differential temperature.

C. Programmable 7-day time clock set to run during school operating hours.

2.21 EXHAUST BREECHING, CHIMNEYS AND STACKS

A. The air intake and exhaust vents shall be double-wall stainless steel, factory-built type for use on condensing appliances.

B. Maximum temperature shall not exceed 550°F.

C. Vent shall be listed for an internal static pressure of 6 in. w.g. and tested to 15 in. w.g.

D. Vent shall be constructed with an inner and outer wall, with a 1 in. annular insulating air space.

1. The inner wall (vent) shall be constructed of AL29-4C superferritic stainless steel, .015 thickness for 4 in.-12 in. diameters and .024 thickness for 14 in.-24 in. diameters.

2. The outer wall (casing) shall be constructed of type 430 stainless steel, .018 thickness for 4 in.-12 in. diameters and .024 thickness for 14 in.-24 in. diameters.

3. Inner and outer walls shall be connected by means of spacer clips that maintain the concentricity of the annular space and allow unobstructed differential thermal expansion of the inner and outer walls.
E. All parts exposed to the weather shall be stainless steel.

F. All supports, roof or wall penetrations, terminations, appliance connectors and drain fittings, required to install the vent system shall be included.

G. Roof penetration pieces shall be UL listed and provided by the vent manufacturer.

H. All inner vent connections shall be secured by means of profiled connector bands with gear clamp tighteners. Joints shall be sealed with waterproof sealant. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.

I. Vent shall terminate in accordance with installation instructions and local codes.

J. Manufacturers: Subject to compliance with requirements, provide all steel, insulated, positive pressure double wall vents of one of the following:

1. Metal-Fab, Corr/Guard Model CG
2. Selkirk Heat-Fab Saf-T Vent CI
3. Schebler eVENTplus
4. or equal

2.22 NATURAL GAS SUB-METER

A. Furnish and install, where shown on the Drawings, ONICON or equal, model F-5500 thermal mass flow meter. Furnish 24VDC power supply with plug connection. Coordinate power wiring with Section 260000.

B. Unit shall be capable of providing BACnet output. All BACnet control wiring shall be by Section 230000.

C. Install meter per manufacturer’s installation requirements.

2.23 EMERGENCY GAS SOLENOID VALVE

A. Emergency gas solenoid valve shall be normally closed FM approved gas solenoid valve ASCO “Red-Hat” Series 8040/8215. Valve shall operate on 120volt power and shall close the gas flow on the main gas feed to the Kitchen cooking equipment. This solenoid valve is furnished and installed by Section 220000.

B. Gas solenoid valves shall be manufactured by ASCO, QMI, ISIMET, or equal.

2.24 DOMESTIC WATER SUB-METER

A. For meters located on piping 3-inch and larger, furnish and install ONICON or equal, model F-3500 water flow meter at the main water service entrance downstream of the water meter. Furnish 24VDC power supply with plug connection. Coordinate power wiring with Section 260000. Include Onicon N-100 network interface module.
B. For meters located on piping 2-1/2-inch and smaller, furnish and install ONICON or equal, model F-4600, inline ultrasonic water flow meter with backlit display and user interface. Furnish 24VDC power supply with plug connection. Coordinate power wiring with Section 260000.

C. Unit shall be capable of providing BACnet output. All BACnet control wiring shall be by Section 230000.

D. Install meter per manufacturer’s installation requirements.

2.25 SUMP PUMP SYSTEM:

A. Furnish and install one (1) complete simplex Weil Series 2400, model 2422, 2-inch discharge submersible sump pump. Sump pump system as shown on the drawings and herein specified. Include in this section all materials and equipment including pump, trim, fiberglass basin, control panel. Furnish and mount the pump control panel on wall above sump pit. The incoming power source to the panel, conduit from the panel to the basin, and all required conductors including power and controls between the basin and control panel are furnished under the Electrical section. The Electrical contractor will connect the pump. Final connection of all control wiring, sequencing, and start up are to be furnished under section 220000 and shall be performed by the pump supplier with factory trained technicians.

B. Furnish and install One (1) Simplex Weil series 2400, model 2422 2 inch discharge submersible sump pump. Pump rated to deliver 4 GPM at 20’ TDH. Pump to have stainless steel shaft and cast iron impeller.

C. Motor will not be less than .75 HP, three (3) phase, 208 volt, 60 cycle, AC, 1750 RPM. 20 foot of power cable. Air filled dry running type. Oil filled motor will not be considered equal.

D. The motor shall be housed in an air filled watertight cast iron motor shell with the windings having Class ‘F’ insulation and pre-lubricated double seal bearings. The motor shaft shall be 300 stainless steel with keyway for positive positioning and securing of the impeller. Motor end bell to be designed as a terminal box.

E. Impeller, cast iron, accurately machined to proper diameter and statically and dynamically balanced.

F. Provide three mechanical, suspended type, float switches suspended from the cover with 20 foot cord, all float and power wiring to be done by the site licensed electrical contractor.

1. 1-NEMA 1 8115 Simplex control panel containing:
2. 1-Comb. Manual disconnect switch & motor circuit protector
3. 1- Magnetic starter
4. 1- Selector switch
5. 1- Pilot light
6. 1- Alarm bell with silencer
7. 1- Set of isolated contacts for remote alarm
8. 1- Numbered and wired terminal strip
G. Provide one round 24-inch by 42-inch deep fiberglass basin with inlet and anchor flange as required. Include one 28-inch round steel pump cover with all necessary openings with 4 inch vent connection and gas tight gasket.

2.26 FIRESTOP SYSTEMS

A. General: Provide firestopping at all new fire-rated construction where penetrated by the Work of this Section.

B. Refer to Section 078400 - Firestopping, for all product requirements for maintaining integrity of fire-rated construction at penetrations.

2.27 SCAFFOLDS AND STAGING

A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 – Construction Facilities and Temporary Controls and herein.

1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of Section 01 50 00 – Construction Facilities and Temporary Controls shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contract requiring such scaffolding.

2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 – Construction Facilities and Temporary Controls and as additionally required for dust control).

3. General Contractor is responsible to provide enclosures required for temporary heat; refer to Section 01 50 00 – Construction Facilities and Temporary Controls.
   a. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Trade Contractor.

2.28 HOISTING MACHINERY AND EQUIPMENT

A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 – Construction Facilities and Temporary Controls.
PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

A. All work shall be installed in a first-class manner consistent with the best current practices. All materials shall be securely installed plumb and/or level, and all flush mounted equipment shall have front edge flush with finished wall surface.

B. All piping shall be installed true to line and grade in the case of underground piping. All piping above ceilings or exposed shall be grouped together, be parallel to each other, and be either parallel or perpendicular to the structure. Utilize gang hangers wherever feasible. Group all valves together where feasible.

C. Training:
   1. Train the Owner's maintenance personnel on troubleshooting procedures, and servicing and preventative maintenance schedules and procedures.
   2. Schedule training with Owner through the Architect with at least 7 days prior notice.

3.02 WORK COORDINATION AND JOB OPERATIONS

A. The equipment shall not be installed in congested and possible problem areas without first coordinating the installation of same.

B. Particular attention shall be directed to the coordination of piping and other equipment installed in the ceiling areas. Coordinate the elevations of all piping in hung ceiling areas to insure adequate space for the installation of recessed lighting fixtures before other mechanical equipment is installed.

C. Furnish to the General Contractor, and all other Subcontractors, all information relative to the portion of the Plumbing installation that will affect them, sufficiently in advance so that they may plan their work and installation accordingly.

D. In case of failure to give proper information as indicated above sufficiently in advance, pay for all back-charges for the modification, renovation, and relocation of any portion of the work already performed.

E. Obtain from the other trades, all information relative to the Plumbing Work to be executed in conjunction with the installation of their respective equipment.
3.03 CUTTING AND CORE DRILLING

A. Perform all cutting and core drilling operations that are outlined in Part 1 of this SECTION. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the walls, floors, overhead structure, and other structural components, which are to remain, is maintained until permanent work is installed. Prior to any coring or cutting, verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved Coordination Drawings.

B. Cut all masonry and concrete with an approved diamond blade concrete saw in a neat straight direction, perpendicular to the plane of the wall or floor.

C. Use a core drilling process which produces clean, sharp edges and the minimum hole size which will accommodate the size of pipe sleeve specified. Submit procedures for cutting thru existing steel beams to Architect for review.

D. The patching of holes shall be performed by Plumbing Sub-contractor utilizing methods outlined for the finish trade involved. Holes shall be patched to the satisfaction of the Architect.

3.04 CLEANING AND PROTECTION

A. Protect all materials and equipment during shipment and so as to prevent damage. Water closets, lavatories, and sinks shall be boarded over and all other fixtures shall be protected with pasted on paper. Post notice prohibiting the use of the fixtures prior to completion. Assume full responsibility for protection of work until its completion and final acceptance.

B. Keep the premises reasonably clean at all times and remove rubbish caused by the Plumbing Work as directed by the Architect.

C. Upon completion of this work, clean all fixtures and equipment installed herein and replace damaged parts. Failure to fulfill this obligation will result in back-charges for correction of the defective work.

3.05 SLEEVES, INSERTS, AND ESCUTCHEONS

A. All piping passing through slabs, floors, walls, partitions, foundation walls and grade beams, shall be sleeved and all such sleeves shall be furnished and installed by the Plumbing Subcontractor as detailed on the Drawings and herein specified. Set sleeves in concrete floors and walls as soon as forms are set and before concrete is poured. Core drilling openings shall have a sleeve caulked and leaded in place.

B. All pipes passing through floor, whether slab-on grade or above grade levels, shall be sleeved with sleeve extending 1 in. above floor. This includes all piping in toilet room pipe space, stairwells, closets, partitions and pre-cast planks.
C. All sleeves shall be Schedule 40 galvanized steel and shall be reamed. There shall be a minimum of 1 in. annular space between the sleeve and pipe provide greater clearance where seismic requirements dictate. Sleeves on insulated pipe shall be large enough to allow insulation to pass through sleeve. Sleeves on drywall, masonry, or concrete walls and partitions, shall be flush with wall on both sides.

D. The space between sleeve and pipe in all cases shall be filled with a U.L./F.M. approved caulking compound. This includes pipes concealed in chases and/or partitions.

E. Inserts where required shall be furnished and set by the Plumbing Subcontractor and where necessary may be drilled or power driven and shall be sized such that the insert will not exceed a depth of penetration of 1 in. into concrete.

F. Escutcheons: All exposed pipe, uncovered, passing through walls or floors or ceilings shall be fitted with C.P. brass spun or split type escutcheons with approved clamping device for holding in position. Floor escutcheons shall be deep enough to fit over sleeves, fastened to pipe, and extend down to floor.

3.06 TESTING

A. Test all Work in the presence of the Architect and/or Engineer and as required by Local Codes.

B. After Soil, Waste, and Vent Piping is in place and before being buried or furred in, plug lower ends and fill the system with water up to the top of stacks. Piping is to be left tight under these conditions and water lever shall be maintained intact for the period of at least four (4) hours.

C. Test all water piping by applying a hydrostatic pressure of 150 PSIG using a pump for this purpose. Make sure that all lines are properly plugged or capped and that air has been vented before applying pressure which shall remain constant without pumping for two (2) hours at least.

D. Test gas piping per State Gas Code.

E. Any leaks in joints or evidence of defective pipe on fittings disclosed by test shall be immediately corrected by replacing defective parts with new joints or materials. No makeshift repair effected by caulking threaded pipe with lead wool, application or Wilky or patented compounds will be permitted.

F. Provide testing report for all systems tested.

3.07 CHLORINATION

A. Upon completion of the Plumbing Work, thoroughly chlorinate the entire domestic water system before putting same in service. Chlorinate all work in the presence of the Architect and/or Engineer. The chlorinating agent shall be as a solution of sodium hypochlorite. Water shall be fed slowly into the new line with chlorine in the proper amount to produce a dosage of 50 PPM. Open and close all valves while system is being chlorinated.
B. After the sterilization agent has been applied for 24 hours, pay for an independent testing agency to test for residual chlorine. A residual of not more than 5 PPM shall be required in all parts of the line.

C. If test show 5 PPM or greater of residual chlorine, flush out system until all traces of the chemical used are removed.

D. Provide testing report from independent testing agency.

3.08 INSTALLATION OF FIRESTOP SYSTEMS

A. General: Install firestop systems at all fire-rated construction where penetrated by the Work of this Section.

B. Refer to Section 078400 - Firestopping, for all installation requirements for maintaining integrity of fire-rated construction at penetrations.

3.09 INSTALLATION OF EXHAUST BREECHING, CHIMNEYS AND STACKS

A. VIBRATION CONTROL AND SEISMIC RESTRAINT: Refer to section 230548 and drawing VS-1 for the appropriate support of each piece of equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS-1.

B. Install all gas vents in accordance with manufacturer's installation instructions and UL listing. Maintain minimum clearances from combustibles specified in UL listing.

C. Seal joints between sections of positive pressure vents in accordance with manufacturer's installation instructions, and using only sealants recommended by manufacturer.

D. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories, without exceeding loading of appliances.

E. Install barometric and thermostatically operated dampers in accordance with manufacturer's instructions. Locate as close to draft hood collar as possible.

F. Clean breechings internally during installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.

G. Temporary Closure: At ends of breechings and chimneys which are not completed or connected to equipment, provide temporary closure which will prevent entrance of dust and debris until installations are completed.
3.10 SYSTEM SHUTDOWNs

A. Coordinate shutdowns of existing systems with the Owner and submit a written request at least ten working days in advance. Minimize system shutdowns as much as possible. Submit a list of all affected areas, the proposed work to be performed, and the expected length of the shutdown including time for retesting.

B. Provide temporary services to maintain active system during extended shut-downs as required for demolition and construction phasing.

END OF SECTION
## SECTION 230000

**HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)**

(Filed Sub-Bid Required)

### PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS ........................................... 1
1.02 RELATED DOCUMENTS ............................................................................................................. 2
1.03 DEFINITIONS .......................................................................................................................... 2
1.04 DESCRIPTION OF WORK ......................................................................................................... 2
1.05 RELATED WORK UNDER OTHER SECTIONS ........................................................................ 3
1.06 CODES, ORDINANCES, AND PERMITS .................................................................................. 4
1.07 WELDING QUALIFICATIONS .................................................................................................... 4
1.08 QUALITY ASSURANCE .............................................................................................................. 5
1.09 DISCREPANCIES IN DOCUMENTS ............................................................................................ 6
1.10 CONTRACT DRAWINGS ............................................................................................................. 7
1.11 COORDINATION DRAWINGS ................................................................................................... 7
1.12 ACCESSIBILITY ...................................................................................................................... 8
1.13 ROUGH IN ............................................................................................................................... 8
1.14 PHASING ................................................................................................................................. 8
1.15 NOTIFICATION OF RELATED TRADES ..................................................................................... 8
1.16 MECHANICAL INSTALLATIONS ................................................................................................. 9
1.17 CUTTING AND PATCHING .......................................................................................................... 9
1.18 SUBMITTALS .......................................................................................................................... 10
1.19 SUBSTITUTIONS .................................................................................................................... 11
1.20 PRODUCT LISTING ................................................................................................................ 12
1.21 NAMEPLATE DATA .................................................................................................................. 12
1.22 DELIVERY, STORAGE AND HANDLING ..................................................................................... 12
1.23 RECORD DOCUMENTS ............................................................................................................. 13
1.24 OPERATION AND MAINTENANCE DATA .................................................................................. 13
1.25 WARRANTIES ........................................................................................................................... 15
1.26 ENERGY REBATE PROGRAM ................................................................................................... 15
1.27 HOISTING EQUIPMENT AND MACHINERY ............................................................................... 16
1.28 STAGING AND SCAFFOLDING ............................................................................................... 16
1.29 WELDING QUALIFICATIONS .................................................................................................. 16
1.30 COMMISSIONING ................................................................................................................... 17
1.31 TRADE RESPONSIBILITY COORDINATION MATRIX .............................................................. 17

### PART 2 - PRODUCTS

2.01 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT ............................................. 19
2.02 VALVES ................................................................................................................................... 21
2.03 METERS AND GAGES ............................................................................................................. 26
2.04 HANGERS AND ATTACHMENTS .............................................................................................. 28
2.05 MECHANICAL IDENTIFICATION ............................................................................................... 31
2.06 MECHANICAL INSULATION ..................................................................................................... 33
2.07 KITCHEN GREASE DUCT INSULATION .................................................................................. 36
2.08 REFRIGERANT PIPING .............................................................................................................. 37
2.09 STEAM AND CONDENSATE SPECIALTIES ............................................................... 39
2.10 STEAM AND CONDENSATE PIPING ................................................................. 40
2.11 HIGH EFFICIENCY, GAS-FIRED STEAM BOILER ............................................ 42
2.12 TERMINAL HEATING UNITS (STEAM) ............................................................ 46
2.13 POWER AND GRAVITY VENTILATORS ........................................................... 48
2.14 KITCHEN GAS FIRED MAKE-UP AIR UNIT (MAU) ......................................... 49
2.15 METAL DUCTWORK .......................................................................................... 51
2.16 DUCTWORK ACCESSORIES ............................................................................ 58
2.17 ACOUSTIC DUCT LINING ................................................................................ 61
2.18 DUPLEX CONDENSATE RECEIVERS (DCR) ..................................................... 61
2.19 AIR OUTLETS AND INLETS .............................................................................. 62
2.20 DUCTLESS COOLING UNITS .......................................................................... 62
2.21 CONDENSATE DISCHARGE PUMPS ............................................................... 64
2.22 FIRESTOP SYSTEMS ....................................................................................... 65
2.23 WALL AND CEILING ACCESS DOORS ............................................................ 65
2.24 AUTOMATIC TEMPERATURE CONTROLS (DDC) ............................................. 66

PART 3 - EXECUTION .................................................................................................. 95

3.01 CUTTING AND PATCHING ............................................................................. 95
3.02 INSTALLATION OF VALVES .......................................................................... 95
3.03 INSTALLATION OF METERS AND GAGES .................................................... 97
3.04 INSTALLATION OF HANGERS AND ATTACHMENTS ..................................... 97
3.05 INSTALLATION OF MECHANICAL IDENTIFICATION ...................................... 99
3.06 INSTALLATION OF MECHANICAL INSULATION ............................................ 100
3.07 INSTALLATION OF KITCHEN GREASE DUCT INSULATION ....................... 102
3.08 INSTALLATION OF REFRIGERANT PIPING AND ACCESSORIES .................. 104
3.09 INSTALLATION OF STEAM AND CONDENSATE SPECIALTIES ................... 105
3.10 INSTALLATION OF STEAM AND CONDENSATE PIPING ............................... 105
3.11 INSTALLATION OF STEAM BOILERS ............................................................ 106
3.12 INSTALLATION OF TERMINAL HEATING UNITS (STEAM) ......................... 107
3.13 INSTALLATION OF POWER AND GRAVITY VENTILATORS ....................... 108
3.14 INSTALLATION OF KITCHEN FIRED MAKE-UP AIR UNITS (MAU) ............. 109
3.15 INSTALLATION OF METAL DUCTWORK ....................................................... 110
3.16 INSTALLATION OF DUCTWORK ACCESSORIES ........................................ 111
3.17 INSTALLATION OF ACOUSTIC DUCT LINING ............................................. 112
3.18 INSTALLATION OF DUPLEX CONDENSATE RECEIVER .............................. 112
3.19 INSTALLATION OF AIR OUTLETS AND INLETS .......................................... 113
3.20 INSTALLATION OF DUCTLESS COOLING UNIT SYSTEMS .......................... 113
3.21 INSTALLATION OF CONDENSATE DISCHARGE PUMPS ................................ 114
3.22 INSTALLATION OF HEATED AIR CURTAIN ................................................. 115
3.23 INSTALLATION OF FIRESTOP SYSTEMS ...................................................... 116
3.24 INSTALLATION OF WALL AND CEILING ACCESS DOORS ....................... 116
3.25 AUTOMATIC TEMPERATURE CONTROLS (DDC) ........................................ 116
3.26 TESTING, ADJUSTING, AND BALANCING .................................................... 119

END OF INDEX 230000
SECTION 230000

HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER'S CHECK or CASHIER'S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

E. The Filed Sub-Bidder for the work of this SECTION 230000 shall list, in Paragraph E, of the FORM FOR SUB-BID, the name of each person, firm, or corporation, whom he proposes to use to perform the following classes of work or part thereof, at the bid price therefore:

<table>
<thead>
<tr>
<th>CLASSES OF WORK</th>
<th>REFERENCE PARAGRAPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Insulation</td>
<td>2.06, 2.07, 3.06, 3.07</td>
</tr>
<tr>
<td>Duct Insulation</td>
<td>2.06, 2.07, 3.06, 3.07</td>
</tr>
<tr>
<td>Sheetmetal (Ductwork)</td>
<td>2.15, 2.16, 2.17, 2.19, 2.16, 3.15, 3.16, 3.17, 3.19</td>
</tr>
<tr>
<td>Automatic Temperature Controls</td>
<td>2.24, 3.25</td>
</tr>
<tr>
<td>Testing, Adjusting, and Balancing</td>
<td>3.26</td>
</tr>
</tbody>
</table>

The Trade Contractor shall also examine all other Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section, not just those pertaining to this Sub-trade.
1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.03 DEFINITIONS

A. Most terms used within the documents are industry standard. Certain words or phrases shall be understood to have specific meanings as follows:

1. Provide: Furnish and install completely connected up and in operable condition.

2. Furnish: Purchase and deliver to a specific location within the building or site.

3. Install: With respect to equipment furnished by others, install means to receive, unpack, move into position, mount and connect, including removal of packaging materials.

4. Conduit: Raceways of the metallic type which are not flexible.

5. Connect: To duct, pipe or wire up, including all branch ductwork, piping, and/or circuitry, control and disconnection devices so item is complete and ready for operation.

6. Subject to Mechanical Damage: Equipment, ductwork, piping and raceways installed exposed and less than eight feet above finished floor in mechanical rooms or other areas where heavy equipment may be in use or moved.

7. General Contractor and Construction Manager are one in the same.

1.04 DESCRIPTION OF WORK

A. The work described herein shall be interpreted as work to be done by the HVAC Subcontractor. Work to be performed by other trades will always be specifically referenced to that trade.

B. Furnish all staging, rigging, temporary support, labor, materials, and perform all operations in connection with the installation of the HVAC work. Refer to Section 015000 – Construction Facilities and Temporary Controls for more information regarding responsibilities for staging and scaffolding.

C. Without limiting the generality thereof, the work to be performed under this Section includes complete new HVAC systems with the following major sub systems:

1. Low Pressure Steam and Condensate Piping, Insulation and accessories

2. Refrigeration Piping

3. Exhaust Fans

4. Ductwork With Insulation, Diffusers, Registers And Grilles

5. Terminal Heating Units including Unit Heaters and Fintube Radiation

6. Boilers

7. Condensate and Feedwater Handling Systems

8. Blowdown Coolers
9. Ductless Cooling Unit Systems
10. Direct Digital Automatic Temperature Controls (Refer to Section 230000)

D. Refer to section 230548 “Vibration Control and Seismic Restraint” for additional work to be provided under this Section 230000.

E. Refer to Section 078400 “Firestopping” for additional work to be provided under this Section 230000.

F. It shall be the responsibility of this Section 230000 to provide all personnel to fully coordinate with the commissioning agent. The hours of training and instruction outlined in this Section 230000 and the Testing requirements shall be in addition to those tests and requirements outlined in Division 01 and required to fulfill Section 019113 and Section 017855.

G. Include the following work as needed to perform the work of this section.
   1. Core drilling in accordance with Section 013100 – PROJECT MANAGEMENT AND COORDINATION.
   2. Cutting through non masonry construction in accordance with Section 013100 – PROJECT MANAGEMENT AND COORDINATION.
   3. Temporary facilities, including but not limited to stairs and ladders, staging, scaffolding, chutes and hoisting in accordance with Section 015000 – Construction Facilities and Temporary Controls.
   4. Fire stop systems in accordance with Section 078400 - Firestopping.
   5. Furnish access doors and frames in accordance with Division 08 – Openings.

H. Section 01 91 13 Commissioning Requirements is included as work of this Section.

I. Contractor shall provide an extended bond for five years to guarantee the workmanship for all soldered/brazed/welded piping system joints. Each leakage incident that occurs shall have a maximum exposure limit of $10,000 per event in order to cover expenses for loss of glycol, piping repairs, and damages to finishes. The maximum aggregate exposure shall be $50,000 over the five year period. The time period shall commence after the project twelve month period.

1.05 RELATED WORK UNDER OTHER SECTIONS

A. The following work is included in other sections. Coordinate the work of this section with listed section.

B. Cutting beyond the requirements as stated herein, and patching of all openings regardless of size, is specified in the respective Sections of the trade responsible for furnishing and installing similar new materials.

C. For temporary controls refer to Section 015000.

D. For flashing of vents through roof and setting of roof curbs and flashing of such, refer to Section 075419.
E. For power wiring of mechanical equipment refer to Section 260000.

F. For excavation and backfill of below grade mechanical and related systems refer to Division 31.

G. For structural steel refer to Section 055000.

H. For firestopping not called for in this Section refer to Section 078400.

I. For finished painting of mechanical systems not called for in this Section refer to Section 099100.

J. For Food Service Equipment refer to Section 114000.

K. For interior concrete work relating to this Section refer to Section 033000.

L. For exterior concrete work relating to this Section refer to Section 033000.

M. Installation of hollow metal doors and frames refer to Section 081113 – Hollow Metal Doors and Frames.

N. Section 019113 – Commissioning Requirements.

1.06 CODES, ORDINANCES, AND PERMITS

A. Perform all work in accordance with the requirements of New Bedford Building Department, State of Massachusetts Building Code, 8th Edition, and applicable State and Federal Laws. Give all requisite notices, file all requisite plans, and obtain all permits required to perform HVAC Work.

B. HVAC Subcontractor is responsible for obtaining all permits and Construction Manager is responsible for paying all permit and inspection fees.

C. All HVAC equipment shall be installed to meet all State, Local and Federal sound ordinances.

1.07 WELDING QUALIFICATIONS

A. Piping shall be welded in accordance with qualifications procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operations qualified by another employer may be accepted as permitted by ASME B31.1. The Owner’s Representative shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Division 01.
B. When open-flame or spark producing tools such as welding equipment, and the like are required in the process of executing the work, the Construction Manager shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant fire watch/fire detail (by the New Bedford Fire Department) where work is being performed and until it is completed. The HVAC Subcontractor shall be responsible for obtaining required permit and paying all permit fees and Firewatch detail expenses.

1.08 QUALITY ASSURANCE

A. Codes and Standards:

1. HI Compliance: Design, manufacture, and install HVAC pumps in accordance with HI Hydraulic Institute Standards".

2. UL Compliance: Design, manufacture, and install HVAC pumps in accordance with UL 779 "Motor Operated Water Pumps".

3. ANSI Standards: Comply with ANSI A13.1 for pipe, valve, and equipment identification.

4. I=B=R Compliance: Provide boilers that have been tested and rated in accordance with Institute of Boiler and Radiator Manufacturers (I=B=R) "Testing and Rating Standard for Cast Iron and Steel Heating Boiler", and bear I=B=R emblem on nameplate affixed to boiler.

5. NFPA Compliance: Install boilers in accordance with NFPA Standard 54.

6. ASME Compliance: Construct boilers in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".

7. UL and NEMA Compliance: Provide boiler ancillary electrical components and safety control devices, which have been listed and labeled UL, and comply with NEMA Standards.

8. FM Compliance: Provide control devices and control sequences in accordance with requirements of Factory Mutual System (FM).

9. IRI Compliance: Provide control devices and control sequences in accordance with requirements of Industrial Risk Insurance (IRI).

10. AMCA Compliance: Test and rate air handling units in accordance with AMCA standards.

11. AGA Compliance: Provide gas controls and devices in accordance with American Gas Associates.

12. ARI Compliance: Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air Handling Units", display certification symbol on units of certified models.

13. ASHRAE Compliance: Construct and install refrigerant coils in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".

HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

230000 - 5
14. NFPA Compliance: Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

15. UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA standards.

16. NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.

17. ETL Compliance: Induction Units/Active Chilled Beams shall be independently tested and certified in accordance with ETL, UL or equivalent third party testing standards for thermal performance, throw and sound data.

18. LEED: Install all HVAC systems in accordance with all current requirements.

B. MSS Standard Practices: Comply with the following standards for valves:
   1. MSS SP-45: Bypass and Drain Connection Standard
   2. MSS SP-67: Butterfly Valves
   3. MSS SP-70: Cast Iron Gate Valves, Flanged and Threaded Ends
   4. MSS SP-71: Cast Iron Swing Check Valves, Flanged
   5. MSS SP-72: Ball Valves with Flanged or Butt-Welding Ends for General Service
   6. MSS SP-78: Cast Iron Plug Valves, Flanged and Threaded Ends
   7. MSS SP-80: Bronze Gate, Glove Angle and Check Valves
   8. MSS SP-84: Steel Valves - Socket Welding and Threaded Ends
   9. MSS SP-85: Cast Iron Globe and Angle Valves, Flanged with Threaded Ends
   10. MSS SP-92: MSS Valve User Guide

C. Automatic Temperature Control Contractor Qualifications: Building automation and energy management systems vendor and contractor specializing in manufacturing and installation of control system.
   1. Codes and Standards:
      a. Electrical Standards: Provide electrical components of control systems which have been UL-listed and labeled, and comply with NEMA standards.
      b. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

1.09 DISCREPANCIES IN DOCUMENTS

A. Where Drawings or Specifications conflict or are unclear, advise Architect in writing before Award of Contract. Otherwise, Architect’s interpretation of Contract Documents shall be final, and no additional compensation shall be permitted.

B. Where Drawings or Specifications do not coincide with manufacturers recommendations, or with applicable codes and standards, alert Architect in writing before installation.
C. If the required material, installation, or work can be interpreted differently from drawing to drawing, for between drawings and specs, The HVAC Subcontractor shall provide that material, installation, or work which is of the more stringent.

D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where, insufficient information exists to precisely describe a certain component or subsystem, or the routing of a system. In cases such as this, where the contractor has failed to notify the Architect of the situation in accordance with Paragraph (A) above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner.

1.10 CONTRACT DRAWINGS

A. All work shown on the Drawings is intended to be approximately correct to scale, but shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make complete working systems ready for use.

B. The HVAC Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.

C. Refer to the Architectural, Structural, and other Mechanical and Electrical Drawings which indicate the construction in which this work shall be installed. Locations shown on the plans shall be checked against the general and detailed Drawings of the construction proper. All measurements must be taken at the building.

1.11 COORDINATION DRAWINGS

A. Coordination requirements specific to the Work of this Section include the following:

1. Before materials are purchased or work is begun, the respective Subcontractor shall prepare and submit to the Architect Coordination Drawings showing the size, elevation and location of his equipment, fixtures, ductwork, conduit, and piping lines relevant to the complete system. He shall ensure that these drawings are compatible and correctly annotated and cross-referenced at their interfaces.

2. Coordination drawings are for the Contractor's and the Architect's use during construction and shall not be construed as replacing any shop or record drawings required elsewhere in the Contract Drawings.

3. All coordination drawings shall be prepared in a large enough scale to accurately identify work of each trade and in addition to each sub-contractors systems, shall also show architectural floor plan, reflected ceiling plan, and structural framing with grid identification.
4. The coordination drawing shall be prepared in REVIT (version 2015 or later) or alternate approved BIM Modeling Software and shall be started by the sheet metal sub-contractor and after applying all ductwork, the drawing shall be submitted for ductwork approval by the engineer. After approval, the drawing shall be circulated to the remaining sub-contractors for application of their work.

5. During coordination drawing preparation the sub-contractors shall meet periodically to discuss overall coordination of all sub systems, and shall adjust their systems accordingly. When all drawings are complete the Construction Manager shall submit to the architect and engineers for review.

6. Areas of conflict that cannot be resolved between the sub-contractor must be flagged on the drawings with adequate information to assist the architect and engineer in resolving noted issues.

B. Refer to Section 013100 of these Contract Documents for general requirements and additional procedures relative to the preparation of Coordination Drawings.

1.12 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Extend all grease fittings to an accessible location.

1.13 ROUGH IN

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

1.14 PHASING

A. The mechanical subcontractor shall construct the subject project in phases as directed by the Architect to suit the project progress schedule, as well as the completion date of the project.

B. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural drawings.

1.15 NOTIFICATION OF RELATED TRADES

A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, and louvers when ready for such installation and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.

B. Leave openings in walls for pipes, and ducts for mechanical and electrical work as shown on Drawings or required by layout of mechanical or electrical systems.
1.16 MECHANICAL INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components.

B. Verify all 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 and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

H. 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.

I. Coordinate connection of mechanical system with overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.17 CUTTING AND PATCHING

A. Penetrations through construction for the Work of this Section:

1. Coring/Cutting: Perform all coring for required work up to and including 12” in diameter or equivalent in area of 12” square. Coring beyond 12” or cutting beyond the equivalent of 12” square will be performed by the General Contractor.

2. Notify Masonry Sub-Contractor of exact locations and sizes for openings required in masonry, to be executed under Section 042000 – Unit Masonry, utilizing lintels furnished per Section 055000 – Metal Fabrications.

3. Cut openings in new and existing non-masonry construction where required for penetrations. All cutting shall conform to the requirements of Section 024119 – SELECTIVE DEMOLITION.

4. Refer to Section 024119 – Selective Demolition for restrictions on all alterations to structural elements.
B. Patching at penetrations through construction for the Work of this Section:
   1. Notify Masonry Sub-Contractor when plumbing work is complete at penetrations through masonry construction, and ready for patching under Section 042000 – Unit Masonry.
   2. Notify appropriate Sub-Contractors when mechanical work is complete at penetrations through non-masonry construction, and ready for patching under respective sections.

C. Drilling, coring, and cutting of new and existing structures (through walls, floors, ceiling) where the largest dimension does not exceed 12 in. diameter for drilling/coring or the equivalent of an area equal to or less than 12” square shall be by The HVAC Subcontractor.

D. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the existing walls, floors, overhead structure, and other structural components, which are to remain, is maintained until permanent work is installed. Prior to any coring or cutting verify all locations of same with the Construction Manager. All cutting and coring is to be performed in accordance with approved coordination drawings. All cutting or coring of structural must receive approval of the Architect prior to proceeding.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Patching of surfaces shall be by the trade responsible for the surface penetrated.

G. Refer to related architectural sections including Section 013100 for additional reference.

1.18 SUBMITTALS

A. General: Refer to Section 013300 – Submittal Procedures for general requirements for submittal of product data, shop drawings and other materials for review by the Architect and their Consultants. The following paragraphs supplement the requirements of Section 013300.

B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by the Construction Manager. Data submitted by Sub-contractors and material suppliers directly to the Architect/Engineer will not be processed.

C. Submittal requirements specific to the Work of this Section include the following:
   1. Valves
   2. Meters and Gages
   3. Hangers and Attachments
   4. Mechanical Identification
   5. Mechanical Insulation
   6. Steam and Condensate Piping
   7. Refrigeration Piping
   8. Boilers
   9. Terminal Heating Units
   10. Condensate Receivers/Pumps
11. Feedwater Pumps
12. Stack Economizers
13. Blowdown Coolers
14. Chemical Treatment Systems
15. Power and Gravity Ventilators
16. Metal Ductwork
17. Ductwork Accessories
18. Air Outlets and Inlets
19. Makeup Air Unit
20. Ductless Cooling Units
21. Automatic Temperature Controls
22. Testing, Adjusting, Balancing, and Commissioning
23. Steel opening coordination drawing and/or sketches: submit to Construction Manager as early as possible size and orientation of all openings required under this section referenced from column centerlines. Sketches are to include dunnage for support of HVAC equipment. Drawings and/or sketches will be used as the basis of establishing openings with the steel fabricator.
24. Coordination Drawings: Submit a layout of the main boiler room including all HVAC equipment in BIM 3-D Model and CAD format.

D. If a Shop Drawing is not accepted after two submissions, a third submission from the same manufacturer will not be considered.

E. Check Shop Drawings and other submittals to assure compliance with contract documents before submittal to A/E.

F. Review of Shop Drawings is final and no further changes shall be considered without written application. Shop Drawings review does not apply to quantities, nor relieve The HVAC Subcontractor of his responsibility for furnishing materials or performing his work in full compliance with these Contract Drawings and Specifications. Review of these shop drawings shall not be considered a guarantee of the measurements of this building or the conditions encountered.

1.19 SUBSTITUTIONS

A. Refer to, Section 012513 – PRODUCT SUBSTITUTION PROCEDURES for requirements in requesting substitutions. The following paragraphs supplement the requirements of Section 012513.
B. If materials or equipment are substituted for basis of design specified items that alter the systems shown or its physical characteristics, or which have different operating characteristics, clearly note the alterations or difference and call it to the attention of the Architect/Engineer. Contractor shall be responsible for coordinating dimensional fit of equipment that varies from basis of design equipment. Under no circumstances shall substitutions be made unless material or equipment has been successfully operated for at least three consecutive years.

C. Any modifications to the design, as a result of approving a substitution from the basis of design equipment, shall be the responsibility of The HVAC Subcontractor. Any additional cost to The HVAC Subcontractor or any other contractor, directly or indirectly, as a result of such substitutions, shall be the responsibility of The HVAC Subcontractor.

1.20 PRODUCT LISTING

A. Prepare listing of major mechanical equipment and materials for the project.

B. Provide all necessary information.

C. Submit to the A/E through the Construction Manager, within twenty days of signing contract, this listing indicating all equipment and manufacturers, as a part of the submittal requirement. If the product list is not submitted, it will be the responsibility of the sub-contractor to submit one of the three named equal manufacturers.

D. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

E. Provide products, which are compatible within systems and other connected items.

1.21 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, mode, number, serial number, capacity, operating, and power characteristics labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.22 DELIVERY, STORAGE AND HANDLING

A. Refer to Section General Conditions for delivery, storage, and handling of equipment. The following paragraphs supplement the requirements of Section General Conditions.

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.

1.23 RECORD DOCUMENTS

A. General: Refer to Division 01 – General Requirements for general requirements for maintaining as-built drawings and submitting final reproducible record documents. The following paragraphs supplement the above.

B. Record Drawings for the Work of this Section shall include the following: Provide electronic AutoCAD drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.

1.24 OPERATION AND MAINTENANCE DATA

A. General: Refer to Section 017823 – Operation and Maintenance Data for general requirements for submittal of operations and maintenance manuals, training of personnel and related closeout procedures. The following paragraphs supplement the requirements of Section 017823.

B. In addition to the information required by Section 017823 for maintenance data, Closeout procedures specific to the Work of this Section include the following:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and user summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and trouble-shooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

5. Provide start-up reports for all major HVAC systems and equipment, including but not limited to, boilers, all air handling equipment, ductless cooling unit systems, pumps and fans.
6. Provide DVD recording of operation and maintenance training sessions and include as part of O & M Manual submittal. Training session video recording and DVDs shall be performed by a professional videographer. Provide indexed table of contents for DVD recording.

7. Cooperate with Commissioning agent to complete system and equipment start-up reports and testing. Refer to Section 019113 and Section 017855.

8. Provide an excel spreadsheet in the O&M manuals that includes the following, at a minimum:
   a. All required equipment filter types, sizes and models, designated by equipment tag.
   b. All required fan belt types, sizes and models designated by equipment tag.
   c. All required lubricants, with suggested manufacturer and type, designated by equipment tag.
   d. Provide a manufacturer’s recommended preventive maintenance schedule and routine and task list for each HVAC equipment/system type.
   e. Three copies of O&M Manuals are required for Owner’s use. Include 1 electronic .pdf format of all final O&M materials on flash drive for Owner’s Use.

C. Contractor shall provide a computerized maintenance management system spreadsheet in format compatible with School Dude (excel or other similar program) for all HVAC equipment. The preventative maintenance program includes the following fields:

1. Step 1: PM Schedule Name
2. Step 2: Classification
3. Step 3: Type
4. Step 5: Location
5. Step 6: Building
6. Step 9: Job Startup
7. Step 10: Safety Points
8. Step 11:
   a. Task 1
   b. Task 2
   c. Task 3
   d. Task 4
   e. Task 5
   f. Task 6
   g. Task 7
   h. Task 8
   i. Task 9
   j. Task 10
9. Step 12: Tools
10. Step 14: Journal Notes
11. Step 15:
    a. Assigned To
    b. Hours
    c. Craft
    d. Budget
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

c. Project
f. Custom
g. Category

12. Step 16: PM Frequency

D. Submittals shall be confirmed by Town hired staff who will input Contractor provided data into School Dude.

1.25 Warranties

A. The contractor shall provide a one year minimum warrantee on all product (unless otherwise stated in the product specification for a specific product) and labor for work under this section. Refer to general conditions for additional warranty requirements.

B. Refer to Section General Conditions and Section 017700 – Project Closeout for additional procedures and submittal requirements for warranties.

C. In addition to the one year warranty period against component and/or workmanship defects, the 20 hours of training and the 20 hours of extra programming as it relates to the control system and as indicated in section 230000, the ATC Sub-subcontractor shall provide a seasonal site visit to confirm, verify and modify as required the sequence and/or programming of each piece of equipment to ensure the system is functioning as required and per the sequence of operations. The ATC Sub-subcontractor shall provide 8 labor hours per season (four times within a year, total of 32 hours). During each visit they shall, for each piece of equipment confirm operation and functionality, modify and/or repair any control related issues and/or programming and provide training as requested by the owner. This requirement will ensure the equipment/building is operating properly and efficiently as it cycles through each season. These seasonal site visits shall begin the following season after substantial completion of each Phase of the project is issued. Upon substantial completion the engineer of record shall issue four dates to the ATC Sub-subcontractor and owner. Signatures and time logs will be kept by both parties to ensure these visits occur.

1.26 Energy Rebate Program

A. This project has been designed to incorporate equipment approved for energy rebate such as boilers, high efficiency motors, VFDs, and rooftop air handling units. Contractor shall review Utility Company requirements prior to submitting shop drawing to ascertain that submittal meets program guidelines. All submitted equipment shall meet utility company rebate program efficiency requirements. Contractor shall furnish equipment submittals, related equipment/system pricing data and all required rebate application information and forms to utility company.
1.27 HOISTING EQUIPMENT AND MACHINERY

A. Hoisting Equipment and Machinery: Unless otherwise specified, all hoisting equipment and machinery required for the proper and expeditious prosecution and progress of the work shall be furnished, installed, operated and maintained in safe condition by the individual Non Trade and Trade Contractors and is so stated in each appropriately related Section of the Specifications. All costs for hoisting operating services shall be borne by the Non Trade and Trade Contractors unless specifically excepted in the Contract Documents.

1. A licensed equipment manufacturer’s representative shall be present at all times, to witness the erection and dismantling of all hoisting equipment and machinery, whenever such equipment is being erected or dismantled. No such work will be performed without the presence of such representative.

2. Hoisting equipment and machinery erection and dismantling shall be performed only by trained, certified, and experienced riggers qualified to perform such work.

1.28 STAGING AND SCAFFOLDING

A. Staging and scaffolding shall be of engineered design adequate and suitable for the intended purpose and loading and in compliance with all applicable Federal, State and local laws and regulations, shall have all accident prevention devices and other features required by Federal, State and local laws and regulations, and shall be erected, maintained and removed by experienced scaffolding/staging builders.

B. Each Trade Contractor entering upon the Work shall furnish, erect and maintain all staging and scaffolding required for work under his subcontract. Each Trade Contractor shall provide access to staging and scaffolding for all inspections by the CM, Owner, OPM, Commissioning Agent or Inspection Agency. Each Trade Contractor shall dismantle and remove such staging and scaffolding on completion of his work and at other times as necessary to accommodate and facilitate orderly progress of the Work including work by other trades.

1.29 WELDING QUALIFICATIONS

A. Piping shall be welded in accordance with qualifications procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operations qualified by another employer may be accepted as permitted by ASME B31.1. The Owner’s Representative shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Division 01.

B. When open-flame or spark producing tools such as welding equipment, and the like are required in the process of executing the work, the Construction Manager shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant fire watch/fire detail (by the New Bedford Fire Department) where work is being performed and until it is completed. The HVAC Subcontractor shall be responsible for obtaining required permit and paying all permit fees and Firewatch detail expenses.
1.30 COMMISSIONING

A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 – COMMISSIONING REQUIREMENTS.

B. Complete installation and startup checks and functional tests according to Section 019113 – COMMISSIONING REQUIREMENTS.

C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the start-up procedure.

D. Verify that equipment is installed and commissioned as per requirements of Section 019113 – COMMISSIONING REQUIREMENTS.

1.31 TRADE RESPONSIBILITY COORDINATION MATRIX

<table>
<thead>
<tr>
<th>Device</th>
<th>Furnished By</th>
<th>Installed By</th>
<th>Power Wiring</th>
<th>Control Wiring</th>
<th>Fire Alarm Wiring</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke Detectors (Area type)</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00</td>
<td></td>
</tr>
<tr>
<td>Smoke Detectors (Duct mounted)</td>
<td>26 00 00</td>
<td>23 00 00</td>
<td>26 00 00</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00</td>
<td></td>
</tr>
<tr>
<td>Smoke &amp; Fire/Smoke Dampers</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Smoke &amp; Fire/Smoke Damper Actuators</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>26 00 00</td>
<td>2</td>
</tr>
<tr>
<td>Fire Dampers</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>VAV Boxes</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>26 00 00</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>VAV Box Damper Actuator</td>
<td>23 00 00 (ATC)</td>
<td>Box Mfr</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>VAV Box DDC Controller</td>
<td>23 00 00 (ATC)</td>
<td>Box Mfr</td>
<td>23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>2</td>
</tr>
</tbody>
</table>
## ELIZABETH CARTER BROOKS SCHOOL
### WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

<table>
<thead>
<tr>
<th>Description</th>
<th>Division 1</th>
<th>Division 2</th>
<th>Division 3</th>
<th>Division 4</th>
<th>Division 5</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydronic Control Valves</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>23 00 00</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Hydronic Control Valve Actuator</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Sheet Metal Damper</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Sheet Metal Damper Actuators</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Natural Gas Energy Meters</td>
<td>22 00 00</td>
<td>22 00 00</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>3</td>
</tr>
<tr>
<td>Electrical Energy Meters</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>3</td>
</tr>
<tr>
<td>Domestic Water Meters</td>
<td>22 00 00</td>
<td>22 00 00</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>3</td>
</tr>
<tr>
<td>HVAC Hydronic Energy Meters</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>3</td>
</tr>
<tr>
<td>Airflow Measuring Stations</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>23 00 00</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>DDC Panels</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>26 00 00 &amp; 23 00 00 (ATC)</td>
<td>23 00 00 (ATC)</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td>VFDs at AHU, EFs</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>26 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Elevator Hoistway Vent Damper</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Elevator Hoistway Vent Damper Actuator</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>23 00 00</td>
<td>26 00 00</td>
<td></td>
</tr>
<tr>
<td>Boiler/DHW/Generator Breeching</td>
<td>22 00 00</td>
<td>22 00 00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Kitchen Emergency Gas Valve</td>
<td>22 00 00</td>
<td>22 00 00</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td>26 00 00</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Division 23 00 00 and Division 230000 (ATC) Contractors shall fully coordinate all airflow damper and hydronic valves sizes and quantities.
2. Smoke Damper and VAV Box power wiring shall be provided by Division 26 00 00 to junction box locations shown on electrical drawings; Division 230000 (ATC) Contractor shall provide final power wiring from junction box to end device location.

3. Division 26 00 00 Contractor shall provide all line-voltage power wiring required for meters; Division 23 00 00 (ATC) Contractor shall provide all low-voltage power wiring required for meters.

4. Division 26 00 00 shall provide power at main DDC Panel. Division 230000 (ATC) shall provide power to all other DDC Panels.

PART 2 -PRODUCTS

2.01 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT (Refer to Section 019113)

A. Pursuant to Massachusetts General Laws Chapter 141, a Massachusetts Licensed electrician shall install all low voltage wiring required by this section.

B. General: The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1. All motors for all mechanical equipment shall be NEMA premium efficiency matching the following:

<table>
<thead>
<tr>
<th>HP</th>
<th>RPM</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>1</td>
<td>1800</td>
</tr>
<tr>
<td>b.</td>
<td>1.5</td>
<td>1800</td>
</tr>
<tr>
<td>c.</td>
<td>2</td>
<td>1800</td>
</tr>
<tr>
<td>d.</td>
<td>3</td>
<td>1800</td>
</tr>
<tr>
<td>e.</td>
<td>5</td>
<td>1800</td>
</tr>
<tr>
<td>f.</td>
<td>7.5</td>
<td>1800</td>
</tr>
<tr>
<td>g.</td>
<td>10</td>
<td>1800</td>
</tr>
<tr>
<td>h.</td>
<td>15</td>
<td>1800</td>
</tr>
<tr>
<td>i.</td>
<td>20</td>
<td>1800</td>
</tr>
<tr>
<td>j.</td>
<td>25</td>
<td>1800</td>
</tr>
<tr>
<td>k.</td>
<td>30</td>
<td>1800</td>
</tr>
<tr>
<td>l.</td>
<td>40</td>
<td>1800</td>
</tr>
<tr>
<td>m.</td>
<td>50</td>
<td>1800</td>
</tr>
</tbody>
</table>

2. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

3. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.

4. Temperature Rating: Rated for 40 deg. C. environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class F Insulation). All ratings shall be for inverter duty applications.
5. Starting Capability: Frequency of starts by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.

6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.


8. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.

9. Bearings:
   a. Ball or roller bearings with inner and outer shaft seals.
   b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
   c. Designed to resist thrust loading where belt drivers or other drives produce lateral or axial thrust in motor.
   d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.

10. Enclosure Type:
    a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
    b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
    c. Weather protected Type I for outdoor use, Type II where not housed.

11. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.

12. Noise Rating: "Quiet".

13. Efficiency: "Premium Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, Test Method B.

14. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

15. Provide magnetic bearing protection rings for all inverter rated motors that are controlled by variable speed drives. The bearing protection ring shall channel harmful shaft voltages to ground and protect bearing races from pitting.

C. Starters, Electrical Devices, And Wiring: (Provided By The HVAC Subcontractor For Each Packaged Piece Of HVAC Equipment Requiring Such):

1. Motor Starter Characteristics:
   a. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC proper class and division.
   b. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.

2. Manual Switches shall have:
   a. Pilot lights and extra position for multi-speed motors.
   b. Overload Protection: Melting alloy type thermal overload relays.
3. Magnetic Starters:
   a. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation.
   b. Trip-free thermal overload relays, each phase.
   c. Interlocks, pneumatic switches and similar devices for co-ordination with control requirements of Division 23 Controls Sections.
   d. Built-in 120 volts control circuit transformer, fused from line side, where service exceeds 240 volts.
   e. Externally operated manual reset.
   f. Under-voltage release or protection.

4. Capacitors:
   a. Individual unit cells.
   b. All welded steel housing.
   c. Each capacitor internally fused.
   d. Non-flammable synthetic liquid impregnant.
   e. Craft tissue insulation.
   f. Aluminum foil electrodes.
   g. KVAR size shall be to correct motor power factor to 90 percent or better and shall be installed on all motors 1 horsepower and larger, that have an uncorrected power factor of less than 85 percent at rated load.

5. Disconnect Switches:
   a. Fusible Switches: Fused, each phase; general duty; horsepower rated; non-teasable quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics.
   b. Non-fusible Switches: For equipment 2 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

2.02 VALVES

A. General:
1. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
2. Valves shall have rising stem, or rising outside screw and yoke stems; except, non-rising stem valves may be used where headroom prevents full extension of rising stems.
3. Pressure and temperature ratings shall suit system pressures and temperatures.
4. Unless otherwise indicated, provide valves of same size as upstream pipe size. Automatic control valves shall be sized by the ATC Contractor and shall not exceed a 3 PSI drop.
5. Provide the following special operator features:
   a. Handwheels fastened to valve stem, for valves other than quarter turn, by brass nut on a square-topped stem.
b. Lever handle on quarter-turn valves 6 in. and smaller, except for plug valves. Provide one wrench for every 10 plug valves, and one years supply of recommended lubricant and sealant.

c. Chain-wheel operators for valves 2-1/2 in. and larger installed 72 in. or higher above finished floor elevation. Extend chains to an elevation of 5 ft.-0 in. above finished floor elevation.

d. Gear drive operators on quarter-turn valves 8 in. and larger.

6. Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

7. Bypass and drain connections shall comply with MSS SP-45.

8. End connections shall be as specified in the individual valves specifications.


10. Caution: Where soldered end connection are used, use solder having a melting point below 840 deg. F. for gate, globe, and check valves; below 421 deg. F. for ball valves.

B. Gate Valves:

1. Gate Valves - 2 in. and smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze, threaded ends, solid disc, bronze alloy stem with less than 6 percent zinc content, brass packing gland, in. Teflon" impregnated packing, and malleable iron handwheel.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>NRS</th>
<th>RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane:</td>
<td>x</td>
<td>431UB</td>
</tr>
<tr>
<td>Jenkins:</td>
<td>x</td>
<td>47CU</td>
</tr>
<tr>
<td>Lunkenheimer:</td>
<td>x</td>
<td>3151</td>
</tr>
<tr>
<td>Nibco:</td>
<td>T-136</td>
<td>T-134</td>
</tr>
<tr>
<td>Stockham:</td>
<td>B-130</td>
<td>B-120</td>
</tr>
<tr>
<td>Milwaukee:</td>
<td>41M</td>
<td>1151M</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>OS&amp;Y RS</th>
<th>NRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane:</td>
<td>465-1/2</td>
<td>461</td>
</tr>
<tr>
<td>Jenkins:</td>
<td>651C</td>
<td>326C</td>
</tr>
<tr>
<td>Lunkenheimer:</td>
<td>1430</td>
<td>1428</td>
</tr>
<tr>
<td>Nibco:</td>
<td>F-617-0</td>
<td>F-619</td>
</tr>
<tr>
<td>Stockham:</td>
<td>G-623</td>
<td>G-612</td>
</tr>
<tr>
<td>Milwaukee:</td>
<td>F-2885-M</td>
<td>F-2882-M</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Gate Valves (Hot) 2-1/2 in. and larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B, flanged ends, and "Teflon" impregnated packing and two-piece backing gland assembly.
C. Ball Valves:

1. **Ball Valves 1 in. and smaller:** Rated for 150 psi saturated steam pressure, 600 psi WOG pressure, 2-piece construction, bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for service, threaded ends for heating hot water.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>THREADED ENDS</th>
<th>SOLDER ENDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milwaukee:</td>
<td>BA-100</td>
<td>BA-150</td>
</tr>
<tr>
<td>Conbraco (Apollo)</td>
<td>70-100</td>
<td>70-200</td>
</tr>
<tr>
<td>Crane:</td>
<td>9302</td>
<td>9322</td>
</tr>
<tr>
<td>Jamesbury:</td>
<td>21-1000TT</td>
<td>X</td>
</tr>
<tr>
<td>Jenkins:</td>
<td>900A</td>
<td>902A</td>
</tr>
<tr>
<td>Lukenheimer:</td>
<td>AQ311</td>
<td>X</td>
</tr>
<tr>
<td>Nibco:</td>
<td>T-585</td>
<td>S-585</td>
</tr>
<tr>
<td>Watts:</td>
<td>B-6000</td>
<td>B-6001</td>
</tr>
<tr>
<td>Stockham:</td>
<td>S-216 BR-R-T</td>
<td>S-216 BR-R-S</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. **Ball Valves 1-1/4 in. to 2 in.:** Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; 3-piece construction, bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for services, threaded ends for heating hot water.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>THREADED ENDS</th>
<th>SOLDER ENDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milwaukee:</td>
<td>BA-300</td>
<td>BA-350</td>
</tr>
<tr>
<td>Conbraco (Apollo):</td>
<td>82-100</td>
<td>82-200</td>
</tr>
<tr>
<td>Nibco:</td>
<td>T-595-Y</td>
<td>S-595-Y</td>
</tr>
<tr>
<td>Watts:</td>
<td>B-6800</td>
<td>B-6801</td>
</tr>
<tr>
<td>Stockham:</td>
<td>S-216 BR-R-T</td>
<td>S-216 BR-R-T</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   For grooved end connections use Victaulic Style 721.

D. **Plug Valves**

1. **Plug Valves - 2 in. and smaller:** 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rockwell:</td>
</tr>
<tr>
<td>Lukenheimer:</td>
</tr>
<tr>
<td>Crane:</td>
</tr>
<tr>
<td>Or equal</td>
</tr>
</tbody>
</table>

HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

230000 - 23
2. Plug Valves - 2-1/2 in. and larger: MSS SP-78; 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.
   MANUFACTURER
   Rockwell: 305.
   Nordstrom: 143.
   Serck-Audco: LSW-133-GG.
   Homestead: 612.
   Victaulic Series 377
   Or equal

E. Globe Valves:

1. Globe Valves - 2 in. and smaller: MSS Sp-80; Class 150, body and union bonnet of ASTM B 62 cast bronze, threaded ends, brass or replaceable composition disc, bronze alloy stem with less than 6 percent zinc content, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel.
   MANUFACTURER
   Jenkins: 106-B.
   Lunkenheimer: 407.
   Nibco: T-235-Y.
   Stockham: B-22.
   Or equal

2. Globe Valves - 2-1/2 in. and larger: MSS SP-85; Class 125 iron body and bolted bonnet conforming to ASTM A 126, Class B; outside screw and yoke, bronze mounted, flanged ends, and "Teflon" impregnated packing and two-piece backing gland assembly.

<table>
<thead>
<tr>
<th>STRAIGHT BODY</th>
<th>ANGLE BODY</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANUFACTURER</td>
<td></td>
</tr>
<tr>
<td>Milwaukee:</td>
<td>F-2981-M</td>
</tr>
<tr>
<td>Crane:</td>
<td>351</td>
</tr>
<tr>
<td>Jenkins:</td>
<td>613C</td>
</tr>
<tr>
<td>Lunkenheimer:</td>
<td>1123</td>
</tr>
<tr>
<td>Nibco:</td>
<td>F-718-B</td>
</tr>
<tr>
<td>Stockham:</td>
<td>G-512</td>
</tr>
<tr>
<td>Or equal</td>
<td>G-515</td>
</tr>
</tbody>
</table>
F. Butterfly Valves:

1. Butterfly Valves - 2-1/2 in. and larger: MSS SP-67; 200 psi, cast iron body conforming to ASTM A 126, Class B. Valves shall have field replaceable EPDM sleeve, with aluminum bronze disc, stainless steel, and EPDM 0-ring stem seals. Sizes 2 through 6 in. shall have lever operators with locks, and sizes 8 through 24 in. shall have gear operators with position indicator. Valves on dead end service or requiring additional body strength shall be lug-wafer type, drilled and tapped.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>WAFER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LEVER</td>
</tr>
<tr>
<td>Milwaukee:</td>
<td>x</td>
</tr>
<tr>
<td>Center Line:</td>
<td>x</td>
</tr>
<tr>
<td>Crane:</td>
<td>42</td>
</tr>
<tr>
<td>Keystone:</td>
<td>100</td>
</tr>
<tr>
<td>Nibco:</td>
<td>WD-20003</td>
</tr>
<tr>
<td>Stockham:</td>
<td>LG-512-BS3E</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
</tr>
</tbody>
</table>

G. Check Valves:

1. Swing Check Valves - 2 in. and smaller: MSS SP-80; Class 150, cast bronze body and cap, conforming to ASTM B 62, horizontal swing, with a Teflon disc, and having threaded ends. Valve shall be capable of being repaired while the valve remains in the line.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milwaukee:</td>
</tr>
<tr>
<td>Crane:</td>
</tr>
<tr>
<td>Jenkins:</td>
</tr>
<tr>
<td>Lunkenheimer:</td>
</tr>
<tr>
<td>Nibco:</td>
</tr>
<tr>
<td>Stockham:</td>
</tr>
<tr>
<td>Or equal</td>
</tr>
</tbody>
</table>

For grooved connections use Victaulic Series 716, 779.
2. Swing Check Valves - 2-1/2 in. and larger: MSS SP-71; Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>CLASS 125</th>
<th>CLASS 175</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milwaukee:</td>
<td>F-2974-M</td>
<td>x</td>
</tr>
<tr>
<td>Crane:</td>
<td>373</td>
<td>375</td>
</tr>
<tr>
<td>Jenkins:</td>
<td>624C</td>
<td>477</td>
</tr>
<tr>
<td>Lunkenheimer:</td>
<td>1790</td>
<td>x</td>
</tr>
<tr>
<td>Nibco:</td>
<td>F-918B</td>
<td>x</td>
</tr>
<tr>
<td>Stockham:</td>
<td>G-931</td>
<td>G-940</td>
</tr>
<tr>
<td>Victaulic:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For equal

3. Wafer Check Valves - (Non-Slam): Class 250, cast iron body, replaceable lapped bronze seat, lapped and balanced twin bronze flappers and stainless steel trim. Valve shall be designed to open and close at approximately one foot differential pressure. Twin flappers shall be loaded with a stainless steel torsion spring to minimize flapper drag and assure even non-slam checking action.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Milwaukee:</td>
<td>1400-2C</td>
</tr>
<tr>
<td>Center Line:</td>
<td>CLC</td>
</tr>
<tr>
<td>Metraflex:</td>
<td>Chexx</td>
</tr>
<tr>
<td>Mission:</td>
<td>12HMP</td>
</tr>
<tr>
<td>Stockham:</td>
<td>WG970</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
</tr>
</tbody>
</table>

For grooved connection use Victaulic Series 716 and 779.

4. Lift Check Valves - 2 in. and smaller: Class 125, cast bronze body and cap conforming to ASTM B 62, horizontal, lift type valve, bronze disc and threaded ends. Valve shall be capable of being refitted and ground while the valve remains in the line.

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Milwaukee:</td>
<td>544</td>
</tr>
<tr>
<td>Hammond:</td>
<td>901</td>
</tr>
<tr>
<td>Jenkins:</td>
<td>117C</td>
</tr>
<tr>
<td>Lunkenheimer:</td>
<td>2142</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
</tr>
</tbody>
</table>

2.03 METERS AND GAGES

A. Glass Thermometers

1. General: Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2. Case: Die cast aluminum finished in baked epoxy enamel, glass front, spring secured, 9 in. long.

3. Adjustable Joint: Die cast aluminum, finished to match case, 180 deg. adjustment in vertical plane, 360 deg. adjustment in horizontal plane, with locking device.
4. Tube and Capillary: magnifying red liquid, 1 percent scale range accuracy, shock mounted.

5. Scale: Satin faced, non-reflective aluminum, permanently etched markings.

6. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.

7. Range: Conform to the following:

8. Manufacturer: Subject to compliance with requirements, provide glass thermometers of one of the following:
   a. Ernst Gage Co.
   b. Marshalltown Instruments, Inc.
   c. Trerice (H.O.) Co.
   d. Weis Instruments, Inc.
   e. Or Equal.

B. Thermometer Wells

1. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2 in. extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

2. Manufacturer: Subject to compliance with requirements, provide glass thermometers of one of the following:
   a. Ernst Gage Co.
   b. Marshalltown Instruments, Inc.
   c. Trerice (H.O.) Co.
   d. Weis Instruments, Inc.
   e. Or Equal.

C. Pressure Gages

1. General: Provide pressure gages of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2. Type: General use, 1 percent accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.

3. Case: Drawn steel or brass, glass lens, 4-1/2 in. diameter.

4. Connector: Brass with 1/4 in. male NPT. Provide protective siphon when used for steam service.

5. Scale: White coated aluminum, with permanently etched markings.

6. Range: Conform to the following:
   a. Water: 0 - 100 psi.
      50 - 300 psi.

7. Manufacturer: Subject to compliance with requirements, provide pressure gages of one of the following:
   c. Marshalltown Instruments, Inc.
d. Trrice (H.O.) Co.
e. Weiss Instruments, Inc.
f. Or Equal.

D. Pressure Gage Cocks
1. General: Provide pressure gage cocks between pressure gages and gage tees on piping systems. Construct gage cock of brass with 1/4 in. female NPT on each end, and "T" handle brass plug.
2. Siphon: 1/4 in. straight coil constructed of brass tubing with 1/4 in. male NPT on each end.
3. Manufacturer: Same as for pressure gages.

2.04 HANGERS AND ATTACHMENTS (Refer to section 230548 for coordination)
A. Horizontal-Piping Hangers and Supports:
1. General: Except as otherwise indicated, provide factory-fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacture for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
   a. Adjustable Steel Clevises Hangers: MSS Type 1.
   b. Steel Pipe Clamps: MSS Type 4.
   c. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
      1) Plate: Unguided type.
      2) Plate: Guided type.
      3) Plate: Hold-down clamp type.
   d. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.
   e. Pipe Stanchion Saddles: MSS Tube 37, including steel pipe base support and cast-iron floor flange.
   f. Adjustable Pipe Saddle Supports: MSS Type 38, including steelpipe base support and cast-iron floor flange.
   g. Single Pipe Rolls: MSS Type 41.
   h. Adjustable Roller Hangers: MSS Type 43.
   i. Pipe Roll Stands: MSS Type 44.
   j. Pipe Rolls and Plates: MSS Type 45.
   k. Adjustable Pipe Roll Stands: MSS Type 46.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
   a. Carpenter and Patterson, Inc.
   b. Corner & Lada Co., Inc.
   c. Elcen Metal Products Co.
   d. Fee & Mason Mfg. Co.; Div. Figgie International
   e. ITT Grinnel Corp.
f. Or Equal.

B. Vertical-Piping Clamps:
   1. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps, complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
      a. Two-Bolt Riser Clamps: MSS Type 8.
      b. Four-Bolt Riser Clamps: MSS Type 42.
   2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
      a. Carpenter and Patterson, Inc.
      b. Corner & Lada Co., Inc.
      c. Elen Metal Products Co.
      d. Fee & Mason Mfg. Co.; Div. Figgie International
      e. ITT Grinnel Corp.
      f. Or Equal.

C. Hanger-Rod Attachments:
   1. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-pipe hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
      a. Steel Turnbuckles: MSS Type 13.
      b. Swivel Turnbuckles: MSS Type 15.
      c. Malleable Iron Sockets: MSS Type 16.
   2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
      a. Carpenter and Patterson, Inc.
      b. Corner & Lada Co., Inc.
      c. Elen Metal Products Co.
      d. Fee & Mason Mfg. Co.; Div. Figgie International
      e. ITT Grinnel Corp.
      f. Or Equal.
D. Building Attachments:
   1. General: Except as otherwise indicate, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
      a. Concrete Inserts: MSS Type 18.
      b. Top Beam C-Clamp: MSS Type 19.
      c. Side Beam or Channel Clamps: MSS Type 20.
      d. Center Beam Clamps: MSS Type 21.
      e. Welded Beam Attachments: MSS Type 22.
      f. C-Clamps: MSS Type 23.
      g. Top Beam Clamps: MSS Type 25.
      h. Side Beam Clamps: MSS Type 27.
      i. Steel Beam Clamps W/Eye Nut: MSS Type 28.
      j. Linked Steel Clamps W/Eye Nut: MSS Type 29.
      k. Malleable Beam Clamps: MSS Type 30.
      l. Steel Brackets: One of the following for indicated loading:
         1) Light Duty: MSS Type 31.
         2) Medium Duty: MSS Type 32.
         3) Heavy Duty: MSS Type 33.
      m. Side Beam Brackets: MSS Type 34.
      n. Plate Lugs: MSS Type 57.
      o. Horizontal Travelers: MSS Type 58.

   2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
      a. Carpenter and Patterson, Inc.
      b. Corner & Lada Co., Inc.
      c. Elcen Metal Products Co.
      d. Fee & Mason Mfg. Co.; Div. Figgie International
      e. ITT Grinnel Corp.
      f. Or Equal.

E. Saddles and Shields:
   1. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
   2. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
   3. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
   4. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
      a. Elcen Metal Products Co.
      b. Pipe Shields, Inc.
      c. Carpenter Patterson, Inc.
      d. ITT Grinnel Corp.
e. Or Equal.

F. Miscellaneous Materials:
1. Metal Framing: Provide products complying with NEMA STD ML 1.
2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A 36.
3. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
4. Heavy Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.
5. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.05 MECHANICAL IDENTIFICATION (Refer to section 019113 Commissioning Requirements)

A. Plastic Pipe Markers:
1. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1
2. All exposed piping that is visible shall be provided with color coordinated PVC jacketing by pipe type and system PVC
3. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1
4. Insulation: Furnish 1 in. thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 deg. F (52 deg. C) or greater. Cut length to extend 2 in. beyond each end of plastic pipe marker.
5. Small Pipes: For external diameters less than 6 in. (including insulation if any), provide full-band pipe markers, extending 360 deg. around pipe at each location, fastened by one of the following methods:
   a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   b. Adhesive lap joint in pipe marker overlap.
   c. Laminated or bonded application of pipe marker to pipe (or insulation).
   d. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 in. wide; full circle at both ends of pipe marker, tape lapped 1-1/2 in.

B. Application: Provide pipe labels for the following piping system:
1. Steam supply and condensate return.
2. Refrigerant liquid and suction.
3. Condensate drain.
4. Make-up water
5. Feed Water
6. Blowdown

C. Valve Tags:
1. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4 in. high letters and sequenced valve numbers 1/2 in. high, and with 5/32 in. hole for fastener.
   a. Provide 1-1/2 in. diameter tags, except as otherwise indicated.
   b. Provide size and shape as specified or scheduled for each piping system.
   c. Fill tag engraving with black enamel.
2. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

D. Valve Schedule Frames:
1. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

E. Plastic Equipment Markers:
1. General: Provide manufacturer's standard laminated plastic, color-coded equipment markers. Conform to the following color code:
   a. Green: Cooling equipment and components.
   b. Yellow: Heating equipment and components.
   c. Yellow/Green: Combination cooling and heating equipment and components.
   d. Blue: Equipment and components that do not meet any of the above criteria.
2. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
   a. Equipment label “ID” from schedules.
   b. Design capacity from schedules.
3. Size: Provide approximate 2-1/2 in. x 6 in. markers for each piece of equipment.
4. Application: Provide equipment labels for the following equipment:
   a. Boilers
   b. Pumps
   c. Feedwater Tanks
   d. Stack Economizers
   e. Exhaust Fans
   f. Air Cooled Condensing Units
   g. Terminal Heating Units equipped with fans
   h. Ductless Cooling Unit Systems
   i. Make-up air unit
   j. Blowdown Cooler
   k. Condensate Pumps
F. Ductwork Labels:
   1. Provide painted stencils or standard laminated plastic, color coded labels for the following systems:
      a. Supply Ductwork
      b. Return Ductwork
      c. Exhaust Ductwork
      d. Outside Air Ductwork

2.06 MECHANICAL INSULATION (Note: Insulation for pipe and equipment within boiler enclosure shall be field installed and provided by HVAC insulation contractor).

A. Piping Insulation Materials:
   1. Fiberglass Piping Insulation: ASTM C 547, Class 45 required.
      a. Class 1 for use to 450 degrees F; Class 2 for use to 650 degrees F; Class 3 for use to 1200 degrees F.
   2. Flexible Unicellular Piping Insulation: ASTM C 534, Type as required.
      a. Type I - tubular; Type II - sheet. For use between -40 degrees F and 200 degrees F.
   4. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations.
   5. Encase straight pipe insulation, where exposed in visible areas, including piping located in mechanical room with one piece 20-mil thick PVC Jacketing. PVC covering color shall be per ANSI/ASME 13.1 Standard. Submit color chart for Architect/Engineer review and approval. Fasten and seal as per manufacturer's recommendations.
   6. Encase all exterior piping insulation with embossed aluminum jacket with weather-proof construction.
   7. Staples, Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.
   8. Adhesives, Sealants and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
      a. Refer to section 230000, 2.05 for insulated pipe jacketing requirements.

B. Piping Insulation Application and Thickness:
   1. Application: Cold Piping (40 Degrees F to Ambient):
      a. Insulate the following cold HVAC piping systems:
         1) HVAC make-up water piping.
         2) Air conditioner condensate drain piping.
         3) Refrigerant liquid and suction piping.
      b. Insulate piping system specified above with the following type and thickness of insulation:
         1) Fiberglass: 1-1/2 in. thick for all pipe sizes.
2. Application: Hot HVAC Piping (to 200 Degrees F)
   a. Insulate the following hot HVAC piping systems
      1) Steam and Condensate Piping
      2) Hot gas refrigerant piping.
   b. Insulate each piping system specified above with the following type and thickness of insulation:
      1) Fiberglass: 2-1/2 in. thick for pipe sizes up to and including 3 in, 3 in. thick for all 4 in. pipe and larger.
      2) Flexible Unicellular: (Refrigerant piping only) 1 in. thick.

3. Insulation on Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish embossed aluminum jacketing installed as recommended by the manufacturer. Insulation thickness shall be increased by one size versus specified pipe insulation thickness.

4. Refrigerant liquid and suction piping exposed indoors shall have armaflex insulation and be protected with weatherproof/UV resistant PVC jacketing. Exterior refrigerant piping insulation shall be double the specified thickness and have an embossed aluminum jacket.

5. Provide PVC colored pipe jacket for all exposed HVAC piping in mechanical room. PVC jacketing shall be based on pipe type colors in accordance with ANSI/ASME B.1 Standard for the identification of pipes. A full color chart of recommended PVC jacket colors shall be submitted to the architect and engineer for final selections and approval.
   a. Recommended PVC color jacket color chart should be as follows:
      1) Steam shall be yellow. Condensate shall be magenta.
   b. All colors shall be confirmed in ANSI/ASME 13.1 standard for identification of pipes and submitted to the architect and engineer for final review and approval.

C. Ductwork Insulation Materials:
   1. Rigid Fiberglass Ductwork Insulation (R-8): ASTM C 612, Class as required.
      CLASS 2 - 400 DEGREES F; 4 LBS./FT3.
      CLASS 3 - 850 DEGREES F; 12 LBS./FT3.
      CLASS 4 - 1000 DEGREES F; 12 LBS./FT3.
      CLASS 5 - 1800 DEGREES F; 20 LBS./FT3.

   2. Flexible Fiberglass Ductwork Insulation (R-5): ASTM C 512, Class as required.
      CLASS 2 - 400 DEGREES F; .75 LBS./FT3.
      CLASS 3 - 850 DEGREES F; 1.5 LBS./FT3.


   4. Ductwork Insulation Accessories: Provide staples, bands, wire, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

   5. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

D. Ductwork Insulation Application and Thickness:
   1. Application: Ventilation and AC System Ductwork:
      a. Insulate the following ductwork:
1) Outdoor air intake ductwork between air entrance and air handling unit inlet. Provide a crown at top layer to shed water.
2) HVAC supply ductwork between HVAC unit discharge and room terminal outlet.
3) Insulate neck and bells of supply diffusers.
4) HVAC return ductwork between room terminal inlet and HVAC unit inlet; except omit insulation on return ductwork located in return air ceiling plenums.
5) HVAC plenums and unit housing not pre-insulated at factory or lined.
6) Exhaust ductwork between in-line exhaust fan and point of exit in building.

b. Insulate each ductwork system specified above with the following type and thickness of insulation:
1) Rigid Fiberglass: In machine rooms, fan rooms, and mechanical spaces insulate all supply air, return air and outside air ductwork with 2 in. thick rigid (minimum R-8). All exposed supply air, return air and outside air ductwork in occupied areas shall be insulated internally with same thickness and material.
2) Flexible Fiberglass: 1-1/2 in. thick (minimum R-6), application limited to concealed locations which shall include above ceilings, in chases, and shafts.
3) All outside air ductwork shall be 2 in. rigid (minimum R-8).

2. Equipment Insulation Materials:

3. Rigid Fiberglass Equipment Insulation (R-8): ASTM C 612, Class as required.
   CLASS 2 - 400 DEGREES F; 12 LBS./FT3.
   CLASS 3 - 850 DEGREES F; 12 LBS./FT3.
   CLASS 4 - 1000 DEGREES F; 12 LBS./FT3.
   CLASS 5 - 1800 DEGREES F; 20 LBS./FT3.

4. Flexible fiberglass Equipment Insulation (R-5): ASTM C 553, Type and Class.
   TYPE I - RESILIENT, FLEXIBLE;
   CLASS B-1 - 0.65 LBS./FT3
   CLASS B-2 - 0.75 LBS./FT3
   CLASS B-3 - 1.00 LBS./FT3
   CLASS B-4 - 1.50 LBS./FT3
   CLASS B-5 - 2.00 LBS./FT3
   CLASS B-6 - 3.00 LBS./FT3
   TYPE II - FLEXIBLE; CLASS F-1 - 4.50 LBS./FT3
   TYPE III - SEMIRIGID; CLASS F-2 - 4.50 LBS./FT3

5. Flexible Unicellular Equipment Insulation: ASTM C 534, Type as required.
   TYPE I - TUBULAR.
   TYPE II - SHEET.
6. Jacketing material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.

7. Equipment Insulation Compounds; Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

8. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

E. Equipment Insulation Application and Thickness:

1. Application: Cold Equipment (Below Space Temperature):
   a. Insulate the following cold equipment:
      1) Drip pan under chilled equipment.

2. Application: Hot Equipment
   a. Insulate the following:
      1) Feedwater Tank
      2) Air Separator

2.07 KITCHEN GREASE DUCT INSULATION

A. MATERIAL

1. Thermal Material: 2192 degrees F rated core blanket, manufactured from patented bio-soluble Superwool chemistry (Calcium Magnesium Silicate).
   a. Product: FireMaster FastWrap XL or Pyroscat Duct Wrap XL as manufactured by Thermal Ceramics.
   b. Fully encapsulated thermal material in fiberglass reinforced aluminum/polypropylene scrim (FSP).
      1) Encapsulation FSP marked with UL Classification Mark.
      2) Encapsulation FSP marked with ICC-ES report number ESR 2213 or ESR 2832.
      3) Collars supplied in 6 in. (150 mm) wide by 25 ft. (7620 mm) long rolls.

2. Product Characteristics:
   a. Thickness: 1-1/2 in. (38 mm).
   c. R-Value: 7.35 per layer of FireMaster FastWrap XL or Pyroscat Duct Wrap XL when tested in accordance with ASTM C 518 at 75 F.
   d. Flame Spread: <25 when tested in accordance with ASTM E 84.
   e. Smoke Development: <50 when tested in accordance with ASTM E 84.

B. ACCESSORY MATERIALS:

1. Glass Filament Tape: Minimum 3/4 in. (19 mm) wide - used to temporarily secure blanket until permanent attachment using steel banding and/or steel insulation pins.

2. Aluminum Foil Tape: Minimum 3 in. (76 mm) used to seal cut edges.

3. Carbon Steel or Stainless Strapping Material Minimum: 1/2 in. (13 mm) wide and 0.015 in. (.38 mm) thick
4. Steel Insulation Pins: Minimum 12-gauge, length sufficient to penetrate through duct wrap insulation.

5. Insulation Clips: Galvanized steel, minimum 1-1/2 in. (38 mm) round or square.

6. Through Penetration Firestop Sealants:
   a. Packing Material: Remove encapsulation material from FireMaster FastWrap XL or Pyroscat Duct Wrap XL, use core blanket (white) as penetration packing material.
   b. Firestop sealants per applicable building code report and/or laboratory design listings.

7. Grease and HVAC Duct Access Doors:
   a. Thermal Ceramics FastDoor XL Access doors; Supplied in standard door sizes of 6 by10 in. (152 mm by 254 mm), 8 by12 in. (203 mm by 305 mm), 12 by12 in. (305 mm by 305 mm) 12 by16 in. (305 mm by 406 mm), and 20 by20 in. (508 mm by 508 mm).

2.08 REFRIGERANT PIPING

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as shown on drawings. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for refrigeration piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems. Where more than one type of materials and products are indicated, selection is Installer’s option.

B. Material: Provide pipes and pipe fittings in accordance with the following listing:
   1. Tube Size 4-1/8 in. and Smaller: Copper tube; Type ACR, hard-drawn temper; wrought-copper, solder-joint fittings; brazed joints.

C. COMPOSITE PIPE OPTION
   1. At contractor’s option the use of “Multi -Flex Pipe” may be used for pipe up to 1-1/8” and connecting any components (evaporator, manifold or condenser) up to 5 tons. It shall be capable of a temperature range from -40°F-220°F and a working pressure of 650psi.
   2. Pipe must carry the following approval: ICC-ES LC 1035-2013 report PMG-1221.
   3. Pipe must be in Compliance with the following codes:
      a. 2015- (IMC) International Mechanical Code
      b. 2015- (IRC) International Residential Code
      c. 2012- (UMC) Uniform Mechanical Code
   4. Pipe shall carry a 25 year warranty against defects in material and workmanship.” Multi-Flex Pipe” is represented by Green Technology Associates – Hanover, MA. (781) 635-4901.

D. Soldered Joints: Solder joints using silver-lead solder, ASTM B32, Grade 96 TS.

F. Piping Specialties: Provide piping specialties complying with Division 23 “Hydronic Piping” in accordance with the following listing:
   1. Pipe escutcheons.
   2. Drip pans.
   3. Sleeves.
   4. Sleeve seals.

G. Refrigerant Valves: Special valves required for refrigerant piping include the following types.
   2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided piston and stainless steel spring, 250 deg. F (121 deg. C) temperature rating, 500 PSI working pressure.
   3. Manufacturer: Subject to compliance with requirements, provide globe and check valves of one of the following:
      a. Henry Valve CO.
      c. Sporlan Valve Co.
      d. Or Equal
   4. 2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL-listed, ½ in. conduit adapter, 250 deg. F (121 deg. C) temperature rating, 400 PSI working pressure.
   5. Manufacturer: Subject to compliance with requirements, provide solenoid valves of one of the following:
      a. Alco Controls Div.; Emerson Electric Co.
      b. Automatic Switch Co.
      c. Sporland Valve Co.
      d. Or Equal
   6. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL-listed, 350 PSI working pressure.
   7. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-listed, 200 deg. F (93 deg. C) temperature rating, 500 PSI working pressure.
   8. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, solder connections, UL-listed, 500 PSI working pressure.
   9. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron coverplate with steel cap screws, replaceable filter-drier core, 500 PSI working pressure.
   10. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.
11. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL-listed.

12. Manufacturer: Subject to compliance with requirements, provide refrigeration accessories of one of the following:
   a. Alco Controls Div.; Emerson Electric CO.
   b. Henry Valve CO.
   d. Sporlan Valve Co.
   e. Or Equal.

H. Basic Vibration Control: Provide vibration control products in accordance with the following listing:
   1. Isolation hangers.
   2. Riser isolators.
   3. Riser support isolators.
   4. Flexible pipe connectors.

2.09 STEAM AND CONDENSATE SPECIALTIES

A. Description Of Work:
   1. Extent of steam and condensate specialties requires by this section is indicated on drawings and/or specified in other Division-23 sections.
   2. Types of steam and condensate specialties specified in this section include the following:
      a. Float and Thermostatic Traps.

B. Quality Assurance:
   1. Steam and Condensate Specialty Types: Provide steam and condensate specialties of same type by same manufacturer.
   2. Codes and Standards:
      a. ASME Compliance: Manufacture and install steam and condensate specialties in accordance with ASME B31.9 "Building Services Piping".

C. Submittals:
   1. Product Data: Submit manufacturer's technical product data and installation instructions for each type of steam and condensate specialty. Submit schedule indicating manufacturer's figure number, size, location, rated capacities, and features for each required steam and condensate specialty.
   2. Shop Drawing: Submit manufacturer's assembly-type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of components.
3. Maintenance Data: Submit maintenance data and spare parts lists for each type of steam and condensate specialty. Include this data, product data, shop drawings in maintenance manual; in accordance with requirements in Division-1.

D. Steam and Condensate Specialties:

1. General: Provide factory-fabricated steam and condensate specialties recommended by manufacturer for use in service indicated. Provide steam and condensate specialties of types, capacities, and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Size traps with appropriate industry standard safety factor for service indicated. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's opinion, but more than one type cannot be used on project.

E. Float and Thermostatic Traps

1. General: Provide float and thermostatic traps as indicated, with body and cover constructed of stainless steel, designed so all internal parts are accessible without disturbing piping. Provide thermostatic element of diaphragm or bellows type with stainless steel valve cone. Provide stainless steel float, with positive snap-action valve mechanism, stainless steel valve with renewable seat. Design trap for discharging condensate, air, and other non-condensable gases without loss of steam within the following pressure ranges:

2. Low Pressure Traps: -25" Hg to 15 psi.
3. Size traps based on capacities at 2 psi differential in accordance with FCI 65-3.
4. Manufacturer; Subject to compliance with requirements, provide float and thermostatic traps of one of the following:
   a. Armstrong
   b. Hoffman Specialty ITT Fluid Handling Div
   c. Barnes & Jones, Inc.

2.10 STEAM AND CONDENSATE PIPING

A. Description of Work:

1. Extent of steam and condensate piping work, is indicated on drawings and schedules, and by requirements of this section.

B. Quality Assurance:

1. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with steam and condensate piping work similar to that required for project.

2. Codes and Standards:
   a. ASME Compliance: Fabricate and install steam and condensate piping in accordance with ASME B31.9 "Building Services Piping".
   b. UMC Compliance: Fabricate and install steam and condensate piping in accordance with IAPMO "Uniform Mechanical Code".

HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)
230000 - 40
C. Submittals:
   1. Product Data: Submit manufacturer's technical product data and installation instructions for steam and condensate piping materials and products.
   2. Record Drawing: At project closeout, submit record drawings of installed steam and condensate piping and piping products.
   3. Maintenance Data: Submit maintenance data and parts lists for steam and condensate piping materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements in Division-1.

D. Materials and Products:
   1. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure-ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selections as determined by Installer to comply with installation requirements. Provide materials and products complying with ASME B31.9 Code for Building Services Piping where applicable, base pressure ratings on steam and condensate piping maximum design pressure. Provide sizes and types matching piping and equipment connections; provide fittings and materials which match pipe materials used in steam and condensate piping systems. Where more than one type of materials or products are indicated, selection is installer's option.

E. Basic Pipes and Pipe Fittings
   1. General: Provide pipes and pipe fittings complying with the following listings:
      a. Low Pressure Steam Piping:
         1) Pipe size 2” and smaller: Black steel pipe: Schedule 40 cast – iron threaded fittings, Class 125. ASTM A-53 grade B.
         2) Pipe Size 2-1/2" and Larger: Black steel pipe; Standard Weight; Schedule 40 wrought-steel buttwelding fittings, welded joints.
   2. Condensate Piping:
      a. Pipe Size 2-1/2" and Larger: Black steel pipe; Schedule 80; extra heavy wrought-steel buttwelding fittings, welded joints.
      b. Pipe Size 2" and Smaller: Black steel pipe; Schedule 80; extra heavy malleable-iron threaded fittings, Class 250.

F. Piping Specialties Accessories
   2. Flanges: Class 300 forged carbon steel, ASTM A105, weld neck.
5. Gaskets: Flexitallic Style CG, ASTM A304, stainless steel, Grafoil filled, spiral wound, class 150.
6. Unions: malleable iron, class 300, hexagonal with ball and socket joints, metal to metal bronze seating surfaces

G. Basic Supports and Anchors

1. General: Provide piping specialties complying with Division-23 Basic Materials and Methods section "Supports and Anchors", in accordance with the following listings:
   a. Adjustable steel clevises, adjustable pipe saddle supports, single pipe rolls, and adjustable roller hangers, for horizontal-piping hangers and supports.
   b. Steel turnbuckles, for hanger-rod attachment.
   c. Concrete inserts, C-clamps, malleable beam clamps, and steel brackets, for building attachments.
   d. Protection saddles for saddles and shields.

2.11 HIGH EFFICIENCY, GAS-FIRED STEAM BOILER (Refer to Section 019113 and Commissioning Requirements)

A. General Boiler Design

1. The boiler shall be a single pass horizontal commercial gas fired firetube design producing low pressure steam. It shall be mounted on a heavy-duty steel frame with premix forced draft burner and burner controls provided as a complete package from one manufacturer.
2. Approvals - The complete package including the burner shall be Underwriters Laboratories, Inc. listed and the official UL/cUL label shall be affixed to the package attesting to its certification.
3. As a preassembled package, the standard boiler shall be factory fire tested.
4. The complete package as shipped, shall be ready for connections to water, fuel, blowdown, and exhaust venting. Certain items may be shipped loose to prevent their damage such as the safety valves and gauges.
5. The boiler performance shall be as scheduled.
6. Performance: shall be as specified in Paragraph 5 below.

B. Boiler Shell:

1. The boiler shell must be constructed in accordance with the ASME Code, either Section I for high-pressure steam or Section IV for low-pressure steam. The vessel must be subjected to the required inspections of the Code conducted by an independent third party inspector. A signed inspection sheet shall be provided to the purchaser and the appropriate ASME symbol shall be affixed or stamped onto the boiler.
   a. Boiler shall be mounted on base rails suitable for transporting by fork lift.
   b. Burner housing shall be hinge-mounted to allow tube inspection.
   c. Each carbon steel boiler tube shall be a minimum of 0.105 tube wall thickness.
   d. To facilitate waterside inspection, 3 hand holes shall be provided.
   e. An observation port for flame inspection shall be provided.
   f. Boiler insulation shall consist of 2-inch fiberglass blanket, which shall be covered with a powder coated sheet metal jacket. This jacket and insulation design shall permit field removal and reattachment if necessary for inspection, etc.
The entire boiler and base frame shall be factory painted.

Exhaust vent shall be located at the rear of the boiler and shall be a slip connection. Stack support shall be by means other than the boiler connection.

C. Boiler Shell Tappings/Openings:

1. The following boiler vessel tappings/openings shall be furnished:
   a. Steam supply by flanged connection for low pressure steam.
   b. Bottom blowdown.
   c. Feedwater make-up.
   d. Surface blowoff.
   e. Chemical Feed.
   f. High Water Level Overflow Drain to discharge water in the boiler if water level reaches an unacceptable level.

D. Steam Boiler Trim (All Piping And Devices Per Asme CSD-1):

1. Water Column
   a. A water column shall be furnished complete with gauge glass and water column blowdown valve.
      1) Feedwater Pump control - shall be integral with the water column via probe control device and electronics for on/off pump operation.
      2) Low Water cutoff - shall be integral with the water column via probe control device and solid state electronics mounted and wired in the control panel.

2. An Auxiliary Low Water Cutoff shall be provided. It shall be located on the top centerline of the boiler using an internal probe and shall be of the manual reset design.

3. For safety steam pressure lockout a high limit pressure control, manual reset shall be provided. The device shall be mercury free.

4. To provide steam demand tracking a steam pressure transmitter shall be provided that provides an input signal for burner positioning in accordance to steam demand.

5. A 3” Steam Pressure Gauge shall be piped onto the trim piping, including an inspectors test cock.

6. In accordance with the A.S.M.E. Code an approved A.S.M.E. rated and stamped safety valve shall be provided and set at [15 or 150]#.

E. Burner and Burner Controls:

1. Mode of Operation - To minimize short cycling and provide highest efficiency the burner for the specified boiler shall be of the electronic modulation with a turndown ratio of 5:1 for Natural Gas for sizes of 40 horsepower and greater, and 4:1 for sizes below 40 horsepower. On/off or low/high burner operation shall not be accepted.

2. The burner shall be enclosed in a NEMA 1 type enclosure. A lift off top cover shall be provided to gain access to the burner and controls.
3. Design - The burner design shall be of the linkage-less premix technology wherein the fuel and air are mixed in the fan housing assembly prior to entering the burner canister. Separately driven linkage or servo motor driven fuel and air valves shall not be permitted.
   a. Fan housing shall utilize non-sparking material and shall be approved for premix operation.
   b. The fan shall be driven by a variable speed motor which shall react to output demand requirements via the demand control. Motor shall be a high efficiency DC Brushless type. Continuous speed synchronous motors will not be acceptable.

4. Ignition of the fuel shall be of the direct spark design; separate pilot gas train is not required. Dual ignition electrodes shall used for the spark generated from the panel mounted ignition transformer.

5. Combustion shall take place on the surface of the burner canister. The canister shall be constructed of Fecralloy material and stainless steel and shall be warranted for five years against failure from defects or poor workmanship.

6. Air Filter - shall be fitted to the intake air venturi to filter the incoming air supply when using boiler room air. The air filter shall be designed to be easily cleaned and re-used.

7. Fuel - The burner shall be designed for operation with natural gas or LP gas. Gas Train, shall be located at the front of the burner and along the left side of the boiler. In accordance with UL/cUL and ASME CSD-1, the following components shall be furnished:
   a. Single body dual solenoid safety shutoff valve incorporating the following:
      1) The valve shall be a 1:1 ratio valve with an integral trim regulator and shall operate in relation to the fan speed. An air sensing line shall be connected from the air inlet venturi (mounted to the fan motor) and to the gas valve for control of gas input.
      2) As fan speed increases, a negative pressure will be applied to the valve, allowing the valve to open further, permitting more fuel to flow into the venturi for mixing. As fan speed is reduced, fuel input shall be reduced accordingly. Air shall always lead fuel from low to high or high to low.

F. Control Panel:

1. A NEMA 1 type enclosure is furnished and located at the front of the boiler to house the following components:
   a. The Boiler shall include a Computerized Boiler Burner control which shall be an integrated, solid state digital micro-processor modulating device, complete with sequence indication, fault reset, mode selection, and configurable parameter settings. It shall be mounted at the front of the boiler panel for easy access and viewing. The controller combines flame supervision, burner sequencing, modulating control, and operating limit control.
   b. Controller shall provide for both flame safeguard and boiler control and shall perform the following functions:
      1) Burner sequencing with safe start check, pre-purge, electronic direct spark ignition, and post purge. Flame rod to prove combustion.
2) Flame Supervision. The control shall provide pre-purge and post-purge and shall maintain a running history of operating hours, number of cycles, and the most recent 15 faults. The control shall be connected to a touchscreen display interface that will retrieve this information.

3) Safety Shutdown with display of error.

4) Modulating control of the variable speed fan for fuel/air input relative to load requirements.

5) Gas pressure supervision, high and low.

6) Combustion Air Proving Supervision.

7) High Air Pressure (back draft too high) supervision.

8) The active steam pressure and set-point pressure shall be displayed at all times. Output shall be modulating PID set point control via analog signal.

9) Controller shall be capable of BACnet communication to interface with PC or Building Energy Management System.

c. All parameter input control set-points shall be factory pre-configured with jobsite conditions programmed at the time of initial operation.

d. Demand switch.

e. Provide terminals for control interface wiring, customer connections, and connections for incoming power.

f. Install solid state circuit boards for water level controls.

g. Options: Alarm Light Package to provide indication of Low Water, Flame Failure, Load Demand, Fuel Valve On, including a horn with silencing for alarm conditions.

G. Performance:

1. The proposed Boiler shall provide the following operating performance targets for Natural

a. Efficiency - Fuel to Steam Efficiency shall be guaranteed at 85% for 15# steam. Efficiency rating shall account for radiation and convection losses.

b. Emissions - NOx emissions shall be less than 20 PPM corrected to 3% O2 and less than 10 PPM CO over the operating range of the burner turndown. If emissions exceed this level, the boiler manufacturer shall correct at their expense until this level is achieved on a repeatable basis.

c. Noise - Sound shall not exceed 70 dBA at high fire when measured 3 feet in front of the burner.

d. Radiation losses shall be less than 0.5% of the rated input at maximum firing.

e. Steam quality shall be 99.5% at maximum firing regardless of operating pressure.

H. Warranty:

1. The package boiler shall be warranted for a period of one year from date of start-up or 18 months from shipment whichever shall occur first.

I. Economizer Package:

1. An economizer package shall be field installed and field piped. The package shall include an economizer coil located in the rear of the boiler, integral to the stack outlet with integral make-up water supply and outlet piping.
J. Manufacturer: Subject to compliance with requirements, provide boilers of one of the following:
   1. Cleaver Brooks
   2. Or Equal

2.12 TERMINAL HEATING UNITS (STEAM) (Refer to section 019113 Commissioning Requirements)

A. Finned Tube Radiation:
   1. General: Provide finned tube radiation of lengths and in locations as shown on drawings, and of capacities, style, and having accessories as scheduled.
   2. Cabinets: Minimum 18-ga cold-rolled steel full back plate, minimum 14-ga front. Brace and reinforce front minimum of 4 ft.-0 in. o.c. without visible fasteners.
   3. Elements: Copper tube and aluminum fins, or steel tube and steel fin (as scheduled) with tube mechanically expanded into fin collars to eliminate noise and insure durability and performance at scheduled ratings.
   5. Grilles: Aluminum discharge grille shall be one continuous length. Grille shall have standard mill finish with 0 degree deflection and be a pencil proof design.
   6. Brackets: Brackets must provide for lengthwise movement of elements during expansion and contraction as well as aligning elements to prevent contact with brackets, walls or enclosure. Brackets shall be made of 3/16” steel with ¾” coupling for pedestal mounting. The pedestal mount shall include a pipe nipple and floor flange, fasteners to secure the pedestal to the floor by others.
   7. Provide sample selection chart.
   8. Accessories:
      a. End panels, inside and outside corners, and enclosure extension.
      b. Access panels in front of valves, balancing cocks, and traps.
      c. Factory-mounted dampers.
      d. Ball bearing hangers.
   9. Manufacturer: Subject to compliance with requirements, provide finned tube radiation of one of the following:
      a. Slant/Fin Corp.
      b. Rittling
      c. Sterling Radiator; Div. of Reed National Corp.
      d. Or equal

B. Unit Heaters (UH) (Cabinet Type)

   1. General: Provide cabinet unit heaters having cabinet sizes and in locations as shown on drawings, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coil, fan board, fan wheels, housings, motor, and insulation.
2. Construction:
   a. Chassis: Galvanized steel wrap-ground structural frame with edges flanged.
   b. Insulation: Faced, heavy density glass fiber.
   c. Cabinet: 14-ga removable front panel, 18-ga top and side panels. Insulate front panel over entire coil section. Provide access door on coil connection side. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer and baked enamel finish paint with color as selected by Architect.
   d. Provide sample selection chart.
   e. Water Coils: Construct of 5/8 in. seamless copper tubes mechanically bonded to configured aluminum fins. Design for 300 psi and leak test at 300 psi under water. Provide same end connections for supply and return.
   g. Motors: Provide shaded pole motors with integral thermal over-load protection, and motor cords for plug-in to junction box in unit. Provide three speed switch on fan motor.
   h. Filters: Provide 1 in. thick throwaway type filters in fiberboard frames.

3. Manufacturer: Subject to compliance with requirements, provide cabinet heaters of one of the following:
   a. McQuay Inc.
   b. Trane (The) Co.
   c. Young Radiator Co.
   d. Sterling Radiator; Div. of Reed National Corp.
   e. Or Equal.

C. Unit Heaters (UH) (Horizontal Type)
1. General: Provide horizontal unit heaters in locations as shown on drawings, and of capacities, style, and having accessories as scheduled.
2. Construction:
   a. Casings: Construct of steel, phosphatized inside and out, and finished with baked enamel. Color selected by the architect. Provide adjustable face air diffuser.
   b. Provide sample selection chart.
   c. Fans: Construct of aluminum and factory-balance. Design so motor and fan assembly is removable through fan outlet panel.
   d. Coils: Construct of plate-type aluminum fins, mechanically bonded to copper tubes. Design coil for use in steam applications.
   e. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.
3. Manufacturer: Subject to compliance with requirements, provide horizontal unit heaters of one of the following:
   b. Rittling
   c. Sterling Radiator; Div. of Reed National Corp.
   d. Modine
   e. Or Equal.
2.13  POWER AND GRAVITY VENTILATORS (Refer to Section 019113 - Commissioning Requirements)

A.  General:  Except as otherwise indicated, provide standard prefabricated power and gravity ventilator units of type and size indicated, modified as necessary to comply with requirements, and for complete installation.

B.  Refer to Section 230000 - Automatic Temperature Control for control sequence.

C.  Roof Fans (EF)
   1.  Type:  Centrifugal fan, direct or belt driven as scheduled.  Provide aluminum, or galvanized steel, weatherproof housings as scheduled.  Provide square base to suit roof curb.  Provide permanent split-capacitor type motor for direct driven fans; capacitor-start, induction-run type motor for belt driven fans.
   2.  Electrical:  Provide factory-wired non-fusible type disconnect switch at motor in fan housing.  Provide thermal overload protection in fan motor.  Provide conduit chase within unit for electrical connection.
   3.  Bird Screens:  Provide removable bird screens, 1/2 in. mesh, 16-ga. aluminum or brass wire.
   4.  Motor Operated Dampers:  Provide louvered dampers with linkage below curb base (maximum of 6 in.).
   5.  For garage exhaust fans units bear AMCA label for sound and airflow performance, and shall be UL listed for smoke exhaust application.
   6.  Manufacturer:  Subject to compliance with requirements, provide centrifugal roof ventilators of one of the following:
      a.  Carnes Co., Div. of Wehr Corp.
      b.  Cook Co., Loren.
      c.  Greenheck Fan Corp.
      d.  Penn Ventilator Co., Inc.
      e.  Twin City Fans
      f.  Or Equal.

D.  Centrifugal In-Line Fans (EF)
   1.  General:  Fans shall be of the centrifugal belt or direct driven in-line type.  Units shall bear AMCA label.
   2.  Fan Housing:  Shall be of the square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars.  Unit shall include two removable access panels located perpendicular to the motor mounting panel.  The access panels must be of sufficient size to permit easy access to all interior components.
   3.  Fan Wheel:  Shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances.  Wheels shall be statically and dynamically balanced.
4. Motors: Shall be heavy duty ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase, and enclosure. Motors and drives shall be mounted out of the airstream. Motors shall be readily accessible for maintenance.

5. Shafts and Drives: Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing. A NEMA 1 disconnect switch shall be provided, factory wired.

6. Manufacturer: Subject to compliance with requirements, provide centrifugal in-line fans of one of the following:
   a. Greenheck Fan Corp.
   b. Penn Ventilator Co., Inc.
   c. Cook Co., Loren.
   d. Penn Ventilator Co., Inc.
   e. Twin City Fans
   f. Or Equal.

E. Prefabricated Roof Curbs
   1. Manufacturer of ventilating unit shall provide his standard 18 in. high roof curb compatible with unit being provided. Curb shall be insulated and sloped to allow for level installation of device. Provide all necessary nailers and cants for a complete installation.

2.14 KITCHEN GAS FIRED MAKE-UP AIR UNIT (MAU) (Refer to Section 019113 - Commissioning Requirements)

   A. Gas Train and Controls: Indirect fired gas system shall have a draw through design, field adjustable burner baffles and Maxon type NP burner for optimal burning efficiency. Flame safeguard shall be Honeywell 7800 series with digital coded fault indicator capability. Fault indicator shall provide service history by storing codes for the last five faults. Safety shutoff valves shall be industrial duty and use 120 VAC control signals. Temperature control shall incorporate an electronic modulation control system.

   B. Unit Casing and Frames: Unit shall be of internal frame type construction of galvanized steel. All frames and panels shall be G90 galvanized steel. Where top panels are joined there shall be a standing seam to insure positive weather protection. All metal-to-metal surfaces exposed to the weather shall be sealed, requiring no caulking at job site. All components shall be easily accessible through removable or hinged doors.

   C. Insulation: Unit casing to be lined with 1 in. fiberglass insulation. Insulation in accordance with NFPA 90A and tested to meet UL 181 erosion requirements and secured to unit with waterproof adhesive and permanent mechanical fasteners.
D. Fan Section: Centrifugal fans shall be double width, double inlet. Fan and motor shall be mounted on a common base and shall be internally isolated. All blower wheels shall be statically and dynamically balanced. Ground and polished steel shafts shall be mounted in permanently lubricated ball bearings (up to size 118) or ball bearing pillow blocks (size 120 or larger). Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged speeds.

E. Heat Exchanger: The heat exchanger shall be heavy-duty stainless steel with airfoil contoured die-formed tubes, individually removable aluminized steel burner with stainless steel ribbons and cross lighter, pilot assembly, and slide out burner tray. Burner shall also include a balanced flue design, gravity venting system for operation with either natural or LP gas at the inlet pressure indicated on the schedule. Each furnace shall be constructed with an aluminized steel casing with baked on enamel finish. Standard controls shall include a main gas pressure regulator, main modulating gas valve with 10 to 1 turndown, spark ignition, safety pilot, high limit, and 24 V control transformer. Electric ignition, standing pilots lights are unacceptable.

F. Motors and Drives: Motors shall be VFD rated energy efficient, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy-duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be cast and have machined surfaces, 10 horsepower and less shall be supplied with an adjustable drive pulley.

G. Electrical: All internal electrical components shall be pre-wired for single point power connection. All electrical components shall be UL listed, recognized or classified where applicable and wired in compliance with the National Electrical Code. Control center shall include control circuit fusing, control transformer for 120 VAC circuit, integral door interlocking disconnect switch with separate motor fusing and terminal strip. Contactors, Class 20 adjustable overload protection and single phase protection shall be standard. Division 260000 shall furnish and install the variable frequency drive.

H. Filter Mixing Box: Filters shall be 2 in. MERV 13 mounted in a V-bank arrangement such that velocities across the filters do not exceed 550.0 ft. per minute. Filters shall be accessible through a removable access panel. Filter quantities shall be provided as indicated in Part III. Filter mixing box section shall be provided with factory mounted low leak hollow core air foil blades, outside air and return air dampers. Dampers shall be constructed of galvanized steel in galvanized frame. Dampers shall be fully gasketed and have continuous vinyl seals between damper blades with stainless steel seals along the end of the dampers. The leakage rate shall be less than two tenths of one percent at 2 inch sp. differential tested in accordance with AMCA standard 500.

I. Temperature Controls are to be furnished and installed by the ATC Sub-sub-contractor. Unit manufacturer shall provide terminal strips control devices not furnished by ATC Sub-sub-contractor, including modulating gas valve. Refer to Specification Section 230000 ATC control specification requirements and Control Diagram Drawings for Rooftop unit control requirements and expanded sequence of operation and required points list. HVAC and ATC Sub-sub-contractors shall coordinate with unit manufacturer to ensure all sequence of operation and control points are achieved with the BMS to complete the specified sequence of operation and points lists.
J. Weather Hood: Weather hood shall be constructed of G90 galvanized steel with bird screen mounted at the intake.

K. Manufacturer: Subject to compliance with the above, provide Kitchen Make-Up Air Unit of one of the following:
   1. Greenheck
   2. Cook
   3. Reznor
   4. CaptiveAire
   5. Or Equal.

2.15 METAL DUCTWORK (Refer to Section 019113 – Commissioning Requirements)

A. Reference Standards: Material, construction and installation shall meet requirements of most recent editions of the following standards and references, except for more stringent requirements specified or shown on Drawings:

   Standard As Applicable To:

   SMACNA HVAC Duct Sheet Metal Ductwork;
   Construction Standards Duct Liners; Adhesives;
   Metal and Flexible Fasteners; Flexible Ductwork.
   SMACNA HVAC Air Duct Leakage Duct Leakage Testing
   Test Manual
   SMACNA Fibrous Glass Duct Fibrous Glass Ductwork; Tapes
   Construction Standards
   SMACNA Thermaoplastic Duct (PVC) PVC Ductwork
   Construction Manual
   ADC and TIMA Flexible Duct Flexible Ductwork
   Performance Standards
   NFPA 96 Kitchen Hood Exhaust Ductwork
   SMACNA Guidelines for Welding Welded Galvanized, Black Iron
   Sheet Metal and Stainless Steel Ductwork
B. General

1. Provide supporting and hanging devices necessary to attach entire HVAC system including ductwork and equipment, and to prevent vibration.

2. Provide vertical and horizontal supports as required by codes to meet minimum applicable earthquake resistance standards.

3. Ductwork shall be free from vibration under all conditions of operation. Dimensions shown on Drawings for lined ductwork are net inside dimensions. Increase ductwork to accommodate lining requirements.

4. Pipe or conduit crossing duct:
   a. No pipe, conduit, hanger, Architectural element nor structural member shall pass through duct without Designer’s written approval.
   b. Where it is impossible to reroute pipe or conduit and when written approval has been obtained, increase duct size to maintain constant cross sectional area at point of interference. Provide streamlined enclosure for pipe or conduit, as illustrated in SMACNA.

5. When making offsets and transformations necessary to accommodate structural conditions, preserve full cross sectional area of ductwork shown on Drawings.

6. Ductwork shall have pressure velocity classifications as follow:

<table>
<thead>
<tr>
<th>DUCT CONSTRUCTION CLASS</th>
<th>STATIC PRESSURE RATING</th>
<th>PRESSURE</th>
<th>SMACNA SEAL CLASS</th>
<th>SMACNA LEAKAGE CLASS</th>
<th>VELOCITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>1&quot;</td>
<td>Pos. or Neg.</td>
<td>A</td>
<td>6</td>
<td>2500 fpm or less</td>
</tr>
<tr>
<td>½&quot;</td>
<td>½&quot;</td>
<td>Pos. or Neg.</td>
<td>A</td>
<td>6</td>
<td>2000 fpm or less</td>
</tr>
</tbody>
</table>

Ductwork shall have pressure velocity classifications as follow:

<table>
<thead>
<tr>
<th>DUCT CONSTRUCTION CLASS</th>
<th>STATIC PRESSURE RATING</th>
<th>PRESSURE</th>
<th>SMACNA SEAL CLASS</th>
<th>SMACNA LEAKAGE CLASS</th>
<th>VELOCITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>1&quot;</td>
<td>Pos. or Neg.</td>
<td>B</td>
<td>12</td>
<td>2500 fpm or less</td>
</tr>
<tr>
<td>½&quot;</td>
<td>½&quot;</td>
<td>Pos. or Neg.</td>
<td>B</td>
<td>12</td>
<td>2000 fpm or less</td>
</tr>
</tbody>
</table>

*for negative pressures over 3" w.g., refer to SMACNA Round and Rectangular Industrial Duct Construction Standards for joint and intermediate reinforcement requirements.
a. Unless otherwise specified or shown on the drawings, the following pressure and construction classifications shall be used for the types of ductwork listed below:
   1) 2" Class: All other ductwork.

7. Sealing Requirements for Class B, Leakage Class 12, Galvanized, Non-Welded Aluminum or Non-Welded Stainless Steel, Ductwork.
   a. Transverse Joints
      1) During assembly seal all flanged transverse joints with sealing tape of quality equal to Hardcast Inc. 1902-FR. Corners shall be sealed as described by SMACNA and when applicable per manufacturer's published procedures.
      2) Seal all non-flanged transverse joints with Hardcast Inc. Versa Grip 102 or approved equal.
   b. Longitudinal Seams
      1) Seal all longitudinal seams during ductwork fabrication with Hardcast Inc. Cold Seal 1001 or approved equal.

8. Support
   a. Space hangers as required by SMACNA (8 ft max) for horizontal duct on 8 ft. centers, unless concentrated loadings require closer spacing.
   b. Support vertical duct on each floor or slab it penetrates.
   c. Supports for ductwork and equipment shall be galvanized unless specified otherwise.

9. Connections
   a. Connect inlets and outlets of air handling units and fans to ductwork with flexible connections unless fan has vibration isolator mounts inside unit with flexible connections and no external vibration isolators. Exception: Do not use flex on life safety smoke exhaust fans.
   b. Indoors, flexible connections shall be neoprene coated fibrous glass fire retardant fabric, by Ventfabrics, or Durodyne. Outdoors, flexible connections shall be Dupont hypalon coated fibrous glass fire, weather, and UV resistant by Ventfabrics or Durodyne.
   c. Secure flexible connections tightly to air handlers with metal bands. Bands shall be same material as duct construction.
   d. Connections from trunk to branch ducts shall be as detailed on Drawings.

10. Construction
    a. No sharp metal edges shall extend into air streams.
    b. Install drive slips on air leaving side of duct with sheet metal screws on 6" centers.

11. Joints
    a. Longitudinal lock seams shall be double locked and flattened to make tight joints.
    b. Make transverse joints, field connections, collar attachments and flexible connections to ducts and equipment with sheet metal screws or bolts and nuts. Do not use rivets and staples.
12. Prefabricated Transverse Duct Joints
   a. Transverse joints in galvanized sheet metal ductwork may be made with galvanized
gasketed frame and angle duct joint system by Ductmate, TDF, TDC or approved
equal. Angles shall be at least 20 gauge. Prefabricated transverse duct joints shall
not be used for duct 16 GA. and heavier, nor for duct 23 GA. or lighter.
b. Secure angles to duct with screws (using clutched arbor) or spot welds spaced as
recommended by manufacturer for duct pressure class.

13. Elbows and Bends
   a. Elbows and bends for rectangular ducts shall have centerline radius of 1 1/2 times
duct width wherever possible. Elbows for grease exhaust and fume hood exhaust
shall be full radius. Vanes or mitered duct are not allowed.
b. Where centerline radius is less than 1 1/2 times duct width (on supply, return and
exhaust ductwork), elbows shall be radius throat (square throat allowed when
turning around column or other close objects) with radius heel. For elbows whose
width is greater than 48 inches and/or where shown on plans, provide splitter vanes.
   Install vanes in accordance with SMACNA. Where multiple elbows are separated
by less than ten duct diameters use splitter (full length) vanes.
c. For round ductwork provide stamped elbows, with centerline radii equal to 1 1/2
times duct diameter, or gored elbows as follows:

<table>
<thead>
<tr>
<th>Elbow Angle</th>
<th>No. of Gores</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° - 36°</td>
<td>2</td>
</tr>
<tr>
<td>37° - 72°</td>
<td>3</td>
</tr>
<tr>
<td>73° - 90°</td>
<td>5</td>
</tr>
</tbody>
</table>

d. Elbows for flat oval ducts shall have centerline radii equal to 1 1/2 times duct
diameter in plane of bend, or gored elbows with gores as specified for round ducts.

   a. Provide proper pressure and leakage rated, gasketed, duct mounted access
panels/doors for the following items with minimum sizes, as indicated. Access
doors shall be of double wall construction doors in insulated ducts shall be
insulated. Gauges of door materials, no. of hinges, no. and type of door locks shall
be as required by the SMACNA Duct Construction Standards. Hinged doors are
not acceptable, screwed or bolted access panels are not acceptable. Doors shall be
chained to frame with a minimum length of 6" to prevent loss of door. For seal
Class A, access doors shall be leakage rated, neoprene gasketed UL 94 HF1 listed,
DUCTMATE "sandwich" or approved equal. Door metal shall be the same as the
attached duct material. For grease and high temperature ducts, door assembly shall
be rated for 2300°F. The minimum sizes are:
   1) Fire dampers 12" x 12", or larger.
   2) Combination Fire/Smoke dampers 12" x 12", or larger.
   3) Smoke dampers 6" x 6" minimum.
   4) Automatic control dampers 6" x 6" minimum.
   5) Manual volume dampers 2 sq. ft. and larger 6" x 6" minimum.
   6) Inlet side to all coils 12" x 12", or larger.
   7) Suction and discharge sides of inline fans 24" x 24" minimum.
   8) At additional locations indicated on drawings, or specified elsewhere 12" x
12" minimum.
b. Generally access doors are not shown on the drawings, but shall be provided in accordance with the above.

15. Extractors shall have adjusting rod and locknut on outside of duct.

16. Connections to roof fans:
   a. Shall be at least 22 ga. galvanized steel soldered watertight.
   b. Solder side seams at least 12” up from bottom.
   c. Provide suitable dielectric gaskets to join dissimilar materials.

17. Plenums and connections to louvers:
   a. Shall be 18 ga. minimum cross broken and properly reinforced with galvanized angle irons to SMACNA requirements.
   b. Shall have bottom and corner seams soldered watertight at least 12” up from bottom.
   c. Shall have neoprene gaskets or other non corrosible material to make connections to louvers watertight.
   d. Shall pitch connection back towards the louver. Provide half coupling drain connection at bottom of plenum unless noted otherwise. Pipe drain to nearest floor drain.
   e. Shall have unused portions of louvers blocked off with sheet metal; sealed air and water tight; insulated with 2” thick 6 lb. density rigid or board insulation.

18. Duct Pressure Tests
   a. Pressure test all duct classes after takeoffs and wall penetrations are in place and before applying exterior insulation. Correct any leaks.
   b. Pressure and leak test 100% of all duct work according to SMACNA procedures and as indicated below. Duct shall be constructed so there is no joint or structural failure at the test pressure.

19. Duct Leakage Tests
   a. Leak testing shall be provided for all ductwork and testing shall be performed per SMACNA HVAC Air Duct Leakage Test Manual procedures and in accordance with the leakage class 3 as minimum requirements for all ductwork. Provide orifice assembly including straightening vanes, orifice plate mounted in straight tube with properly located pressure taps, and U tube manometer or other device as indicated in SMACNA Air Duct Leakage Test Manual. Orifice assembly shall be calibrated accurately and shall come with calibration curve. Leakage classes shall be as previously specified. Submit leak test report (per SMACNA format) for Designer review. Drawings of ductwork tested shall also be submitted with report, indicating presence of takeoffs, wall penetrations, joints, etc.

20. Materials
   a. Sheet metal ducts shall be constructed of hot dipped galvanized sheet metal with G90 Commercial coating according to ASTM 527 unless specified otherwise.
b. Kitchen grease exhaust ductwork shall be 16-ga minimum carbon steel where concealed, and of 18-ga minimum stainless steel where exposed. For duct construction and installation requirements, comply with SMACNA “HVAC Duct Construction Standards”, NFPA 96 “Standard for Ventilation Control and Fire Protection of Commercial Cooling Operations” latest approved edition, and International Mechanical Code Section 506. Provide access panels in accordance with NFPA 96 and IMC 2012, at least every 12’ in horizontal runs and at every floor level in vertical runs. All kitchen exhaust ductwork to be provided with 2 hr rated insulation, refer to insulation requirements.

c. Flexible Ductwork

1) Flexible ductwork, connecting to uninsulated or unlined duct, shall be polyester core with corrosion resistant helical wire reinforcing. The polyester core shall be minimum two ply and shall have a minimum thickness of 0.0017”. Flex duct shall be U.L. rated for 6” W.C. positive pressure, 2” W.C. negative pressure with a maximum velocity of 4000 FPM. Flex duct must be listed as a Class 1 Connector according to UL 181 and shall meet the requirements of NFPA 90A maximum ASTM E 84 fire hazard rating shall be 25 flame spread, 50 fuel contributed and 50 smoke developed. Uninsulated flexible duct shall be equivalent to Wiremold, Type WB, or Flexmaster Types 2 and 4 (not type 9).

2) Flexible duct connected to insulated or lined duct shall also be insulated and shall be equivalent to Wiremold Type WK or Flexmaster Types 2 or 4 (not type 9), with 1 1/2”, 3/4 lb. density fiberglass insulation and an aluminized reinforced vapor barrier.

3) Submittals shall include data on no. of polyester plies and minimum thickness of polyester core, in addition to other data listed above required to ensure that submitted product meets the requirements of these specifications.

4) If flexduct other than the model numbers of the vendors listed above is submitted, a sample of the flex shall be submitted to the Designer. The Designer shall have sole discretion in determining whether the submitted flex is equivalent to that of the named vendors above.

5) Unless otherwise indicated, flexible duct shall not exceed 5’-0” long.

C. 2” and Lower Pressure Class Ductwork, Rectangular:

1. Ducts wider than 19” with more than 10 square feet of unbraced panel shall be beaded or cross broken.

2. Internal stiffening struts shall only be used upon prior written approval of the Designer.

3. Make changes in duct size with tapered connections as required by SMACNA. Changes shall NOT exceed 30°from line of air flow. Take off to the diffusers shall be 45° leading edge type or Bellmouth type.

4. Transverse joints shall be TDF/TDC or slip joints; use flat or standing seam according to SMACNA. Where duct size requires standing seam but space restrictions dictate flat seam, notify Designer prior to fabrication.
D. Volume Dampers

1. Provide Young Regulator manual adjustable rectangular opposed blade dampers for duct heights less than 12" with factory installed locking hand quadrants extended 2" for all dampers installed in externally insulated duct:
   a. On each supply, return and general exhaust duct take off.
   b. At each take off to register, grille or diffuser (not all are shown on Drawing).

2. Dampers are manufactured approximately 5/16" smaller in width and 1/8" smaller in height than size of duct in which they are installed; e.g., nominal damper size is 24" x 10"; actual size is approximately 23 11/16" x 9 7/8".

3. Damper frame shall be constructed of #6063 extruded aluminum reinforced channel with minimum thickness of .050". Opposed damper blades shall be #6063 extruded aluminum with minimum thickness of .050" and shall include reinforcing ribs. Each blade shall be supported in the damper frame by individual Teflon axle bearings, and shall be driven by stainless steel connecting slide linkage controlled by 3/8" square steel control shaft.

4. Note: All required volume dampers may not be indicated on drawings but dampers shall be provided as necessary for systems balancing.

5. Dampers 12" and larger in height shall be opposed multi blade equal to Greenheck, Nailor, or Vent Products.

6. Where dampers are inaccessible, use Young Regulator locking type ceiling regulators and miter gear or worm gear for all horizontal dampers. Bearing coupling for bottom duct control may be used for shaft on vertical blade dampers. The 3/8" rod between ceiling regulator and damper shall be provided by contractor.

7. Damper blades shall be two gauges heavier than adjoining ductwork, and shall be riveted to supporting rods. Hem over edges parallel to rods.

8. Brackets shall be galvanized metal, secured to ductwork with sheet metal screw with locking quadrant arms (see seal class section for additional requirements). Provide 2" handle extension for all dampers on externally insulated ductwork.

9. Note: All required volume dampers may not be indicated on Drawings but dampers shall be provided as necessary for system balancing.

E. Automatic Dampers: Install automatic dampers furnished under Automatic Temperature Control Paragraph of this Section, as shown on Drawings, and as specified. Provide sealed wall penetrations for Seal Class A ductwork.

F. Branch Duct Take off Fittings

1. Contractor shall provide Buckley Bellmouth Take offs at all branch duct locations.

2. Bellmouth Fitting shall be Model BMD with damper. In areas where sufficient duct height is not available, the contractor shall provide the Buckley Mini mouth fitting, Model M BMD with damper or the flat oval Bellmouth, Model FOBMD with damper.
3. Bellmouths shall be constructed of heavy duty galvanized steel. Bellmouths shall include an air tight Neoprene gasket to ensure a tight fitting with minimal leakage. Pre drilled holes shall be provided for quick mounting. Bellmouth shall be as manufactured by Buckley Associates or equal (617 878 5000).

4. Standard damper hardware to be constructed of 26 gauge galvanized material with a quadrant damper and tight fitting gasketing to ensure minimal leakage at damper pivot points.

5. Optional heavy duty hardware shall be provided at locations of higher static pressure where shown on the drawings.

6. Ninety degree take offs are not permitted on this project.

2.16 DUCTWORK ACCESSORIES (Refer to Section 019113 – Commissioning Requirements)

A. Dampers:

1. Low Pressure Manual Dampers: Provide dampers of single blade type or multi-blade type, constructed in accordance with SMACNA "HVAC Duct construction Standards".

2. Automatic Control Dampers: Refer to Section 230000 section "Automatic Temperature Control" for control dampers; not work of this section.

3. Backdraft Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at .05 in. static pressure. Construct blades of 16-ga. aluminum; provide 1/2 in. diameter ball bearings, 1/2 in. diameter steel axles spaced on 9 in. centers. Construct from 2 in. x 1/2 in. x 1/8 in. steel channel for face areas 25 sq. ft. and under: 4 in. x 1-1/4 in. x 16 ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up. Provide felted or rubber trim to assure tight, leak-proof seal when closed.

4. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
   a. Air Balance, Inc.
   b. Airguarde Corp.
   c. American Warming & Ventilating, Inc.
   d. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
   e. Louvers & Dampers, Inc.
   f. Penn Ventilator Co.
   g. Ruskin Mfg. Co.
   h. Or Equal.

B. Fire Dampers and Fire/Smoke:

1. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casings of 11-ga. galvanized steel. Provide fusible link rated at 160 to 165 deg. F (71 to 74 deg. C) unless otherwise indicated. Provide out of air stream type damper in open position and with positive lock in closed position with stainless steel heat treated type 301 closure spring, and with the following additional features:
   a. Damper Blade Assembly: Curtain type.
   d. Class II Minimum Construction
2. Combination Fire/Smoke Dampers: Provide fire/smoke dampers, of types and sizes indicated. Construct casing of 11-ga. galvanized steel with bonded red acrylic enamel finish. Provide fusible link rated at 160 to 165 deg. F (71 to 74 deg. C) unless otherwise indicated. Provide additional frangible link containing explosive charge, connected in series with fusible link. Provide stainless steel spring loaded leakage seals in sides of casing, and 36 in. long wire leads for connecting smoke link to smoke detector, and the following additional features:
   b. Damper Blade Assembly: Multi-blade type.
   c. Damper Blade Assembly: Curtain type.
   e. Blade material: Stainless steel.
   f. Class II Minimum Construction

C. Turning Vanes:
   1. Manufactured Turning Vanes: Provide double thickness airfoil turning vanes constructed of 1-1/2 in. wide curved blades set at 3/4 in. o.c., supported with bars perpendicular to blades set at 2 in. o.c, and set into side strips suitable for mounting in ductwork.
   2. Manufacturer: Subject to compliance with requirements, provide turning banes of one of the following:
      a. Aero Dyne Co.
      b. Airsan Corp.
      c. Anemostat Products Div.; Dynamics Corp. of America.
      d. Barber-Colman Co.
      e. Duro Dyne Corp.
      f. Environmental Elements Corp.; Subs, Koppers Co., Inc.
      h. Register & Grille Mfg. Co., Inc.
      i. Souther, Inc.
      j. Or Equal.

D. Duct Hardware:
   1. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
      a. Test Holes: Provide in ductwork at fan inlet and outlet, duct test holes, consisting of slot and cover, for instrument tests.
      b. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 in. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
2. Manufacturer: Subject to compliance with requirements. Provide duct hardware of one of the following:
   a. Ventfabrics, Inc.
   b. Young Regulator Co.
   c. Or Equal.

E. Duct Access Doors:
   1. General: Provide duct access doors of a size as required to service and maintain device in duct. Refer to list for access door sizes. All access doors shall be gasketed and installed air tight. Provide one access door at each control damper, humidifier, coil, fire damper, and any device that requires attention.

2. Duct Depth Access Door Size
   - 8 inch: 6 x 6 inch
   - 10-12 inch: 8 x 8 inch
   - 14-18 inch: 12 x 12 inch
   - 20-30 inch: 14 x 14 inch
   - 30+ inch: 18 x 18 inch

3. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12 in. high and smaller, 2 handle-type latches for larger doors.

4. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
   a. Air Balance, Inc.
   b. Duro Dyne Corp.
   c. Register & Grille Mfg. Co., Inc.
   e. Ventfabrics, Inc.
   g. Or Equal.

F. Flexible Connectors:
   1. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibration of connected equipment.

2. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
   b. Duro Dyne Corp.
   c. Flexaust (The) Co.
   d. Ventfabrics, Inc.
e. Or Equal.

2.17 ACOUSTIC DUCT LINING

A. Lining for Rectangular Metal Ducts: All ducts, where shown or noted on the drawings, shall be lined with 1 ½ in. (r-5) thick hospital grade liner similar to Johns Manville "Permacote Linacoustic HP" fiberglass duct liner with factory-applied surface and edge coating. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the airstream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071 and C1104, with an NRC not less than .75 as tested per ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than .24 at 75EF mean temperature.

B. Material Handling and Storage: Liner shall be kept clean and dry during transportation, storage and installation. Care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.

C. Manufacturer: Subject to compliance with the above provide duct sound lining in accordance with the above performance criteria description.

2.18 DUPLEX CONDENSATE RECEIVERS (DCR)

A. General: Provide as indicated, condensate receivers of capacity as scheduled, consisting of cast-iron receiver, 2 condensate discharge pumps, control panel enclosure, and accessories as specified herein. Factory test complete unit.

B. Receiver: Construct of cast iron and equip with isolation valves between pump suction and receiver.

C. Condensate Discharge Pumps: Provide 2 centrifugal design, permanently aligned and flange mounted for vertical operation. Provide bronze fitted pump with stainless steel shaft. Provide mechanical seals suitable for 250 deg. F (121 deg. C) operation. Provide 3500 RPM vertical drip proof motor, close-coupled to pump.

D. Accessories: Provide water gauge glass with shut-off valves and protective rod guards.

E. Control Panel: Provide control panel enclosure mounted on receiver, factory-wired, and containing automatic alternator and pump control prime alternating float switch.

F. Manufacturers: Subject to compliance with requirements, provide condensate receiver of one of the following:
   1. Armstrong
   2. ITT/Domestic Pump
   3. Shipco

HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)
230000 - 61
AIR OUTLETS AND INLETS (Refer to section 019113 – Commissioning Requirements)

1. Wall Registers and Grilles:
   a. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicted, for a complete installation.
   b. Performance: Provide registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
   c. Compatibility: Provide registers and grilles with border styles that are compatible with adjacent systems, and that are specifically manufactured to fit into wall and ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction which will contain each type of register and grille.
   d. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule:
   e. Pattern: Register and grille patterns shall have style as identified on Drawings:
   f. Dampers: Opposed Blade adjustable assembly, key operated from face of register.
   g. Material: Registers and grilles shall be constructed of aluminum.
   h. Accessories:
      1) Plaster Frame: Perimeter frame designed to act as plaster stop and register or grille anchor. Provide where required.
      2) Operating Keys: Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.
   i. Finish: Register and Grille Finishes shall be baked enamel color as selected by the Architect.
   j. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one the following:
      1) Tuttle & Bailey Agitair Series (Air Devices)
      2) Metalaire
      3) Price
      4) Or Equal.

DUCTLESS COOLING UNITS (Refer to Section 019113 – Commissioning Requirements)

Evaporator (Stand-Alone):

A. General: The unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board, and fan motor. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from factory.

B. Cabinet: The casing shall be ABS plastic factory finish. Cabinet shall be designed for suspension mounting and horizontal operation. The rear cabinet panel shall have provisions for a field installed filtered outside air intake connection.
C. Fan: The evaporator fan shall have three high performance, double inlet, forward curve sirocco fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of four speeds: Low, M1, M2 and Hi.

D. Vane: There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five vertical airflow patterns selected by remote control. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.

E. Filter: Return air shall be filtered by means of an easily removable washable filter.

F. Coil: The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

G. Control: The control system shall consist of two microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. For A-Control, a three conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. Where separate power is supplied to the indoor and outdoor units, a two 20 ga. AWG wire shall be run between the units to provide for bidirectional control communication. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

H. Condensing (Stand Alone):
   1. General: The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions. The outdoor unit shall be capable of operating at 0 deg. F, (-18 deg. C) ambient temperature without additional low ambient controls. The outdoor unit shall be able to operate with a maximum height difference of 100 feet and have maximum refrigerant tubing length of 165 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
   2. Cabinet: The casing shall be constructed from galvanized steel plate, coated with a finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a factory finish. The fan grille shall be of ABS plastic.
3. Fan: The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across if from the rear and disspelling it through the front. The fan shall be provided with a raised guard to prevent contact with moving parts.

4. Coil: The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.

5. Compressor: The compressor shall be a scroll compressor with variable speed inverter technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

6. Electrical: The electrical power of the unit shall be as indicated on the drawings. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have Pulse Amplitude Modulation circuit to utilize 98 percent of input power supply.

2.21 CONDENSATE DISCHARGE PUMPS (Refer to various equipment schedules for locations and Section 019113 – Commissioning Requirements)

A. General: Provide where indicated, condensate pumps of capacity as scheduled, to be field installed in various air handling equipment drain pans, consisting of ABS housing, pump, check valve, safety switch, and thermal overload protection. Factory assembled unit must be UL/CSA listed.

B. High-Capacity Pumps
   1. Reservoir: Construct of ABS plastic with a 3/10 capacity volume.
   2. Pump: 25 GPH at 15TDH vertical type pump with stainless steel motor shaft, rustproof, ABS volute, with safety switch.
   3. Housing and Cover: Each shall be ABS plastic.
   4. Manufacturers: Subject to compliance with requirements, provide high-capacity condensate pump from one of the following:
      a. Little Giant
      b. Sauermann
      c. Or equal

C. Low-Capacity Pumps
   1. Pump: 8 GPH at 33TDH reciprocating piston pump direct discharge with no storage reservoir.
2. Detection Unit: Low-maintenance filter free with a three level float (on/off/alarm).
3. Pump Housing and Detection Unit: Each shall be ABS plastic.
4. Manufacturers: Subject to compliance with requirements, provide high-capacity condensate pump from one of the following:
   a. Little Giant
   b. Sauermann
   c. Or equal

2.22 FIRESTOP SYSTEMS
   A. General: Provide firestopping at all fire-rated construction where penetrated by the Work of this Section. Provide smoke sealing at all penetrations through smoke rated partitions and/or smoke barriers. Utilize smoke sealing products as required for its intended use and install per manufacturers recommendation and installation instructions.
   B. Refer to Section 078400 - Firestopping, for all product requirements for maintaining integrity of fire and/or smoke rated construction at penetrations.

2.23 WALL AND CEILING ACCESS DOORS
   A. General: Furnish access panels for installation by others, at all new and existing construction where required for access to the Work of this Section. Furnish access doors for access to all concealed control valves, motor operated dampers, fire doors, etc., and all other concealed parts of the HVAC system that require accessibility for the proper operation and maintenance of the system.
   B. Refer to Division 08 – Openings, for all product requirements for furnishing access panels.
   C. Coordinate locations and schedule with the work of trades involved with construction in which access panels will be installed.
   D. Access doors shall be heavy gage steel with 1 in. frame. Door shall be fastened to frame with continuous piano hinge. Entire door and frame assembly shall be prime painted and be completed with cylinder lock and two keys. Door and frame shall match fire rating of wall or ceiling installed into.
   E. Manufacturer: Subject to compliance with requirements, provide access doors of one of the following:
      1. Inland Steel Products Company, "Milcor"
      2. Walsh-Hannon-Gladwin Inc., "Way Locor"
      3. Or Equal.
2.24 AUTOMATIC TEMPERATURE CONTROLS (DDC) (Refer to Section 019113 - Commissioning Requirements)

A. Basic Components and Systems:

1. General: Provide control products in sizes and capacities indicated, consisting of dampers, thermostats, clocks, sensors, controllers, and other components as required for completed installation. Except as otherwise indicated, provide manufacturer’s standard materials and components as published in their product information, designed and constructed as recommended by manufacturer and as required for application indicated. All equipment and systems shall be installed by factory trained contractors with the following functional and construction features.

2. The building automation system shall be based on the Siemens Apogee platform installed by the local Siemens branch office.

3. Provide all required control wiring including CAT6 Ethernet wiring for any controllers requiring Ethernet connectivity. Terminate Ethernet cable in MDF and IDF closets on patch panels proceed under Technology Section 270000.

4. Install an open-protocol (BacNet) energy management system (EMS) to monitor and trend the energy consumed by the following systems throughout the school:
   a. HVAC systems
   b. Hot and cold domestic water systems
   c. Main electric service meter
   d. Electrical sub-panels
   e. Main gas meter

5. The ATC control and building EMS system shall have the following attributes with characteristics and performance as specified within this Specification section, related Electrical and Plumbing section specifications and the Control Diagram drawings:
   a. Sensors as follows:
      1) Sensors to trend outdoor air temperature
      2) Indication and trending of damper and valve commanded positions.
      3) Sensors to monitor building electrical and natural gas consumption. Main service electrical meters shall be provided by the Electrical Contractor and control wiring from the meter to the EMS system shall be provided by the ATC contractor. Gas meters shall be furnished and installed by the Plumbing contractor. The ATC contractor shall provide control wiring from the meter to the BMS. Flow meters for building cold water consumption will be installed by the Plumbing Contractor and furnished and wired to the BMS by the ATC Contractor. Domestic hot water shall be relays on each domestic water heater burner and through BMS programming utilizing burner on/off operation domestic hot water consumption will be determined, all provided by the ATC Contractor.
      4) Sensors to monitor indoor and outdoor CO2.
5) Sensors to monitor and trend (create trend logs) controlled variables at the operator interface. Control variables may include air and/or water flow, temperature, pressure, CO2, and pump or fan speed. Relevant multiplexed data from microprocessors located in chillers, boilers, variable speed drives and other equipment with multiplexing capabilities may be used in lieu of specifying separate sensors.

6) All densely occupied spaces, with occupant density of 25 people or more per 1000 s.f. must be provided with CO2 sensors per LEED IEQC1 requirements. Provide multi functioning sensors with temperature, humidity and CO2 for each classroom space, gym, cafe, media center, life skills rooms, special needs, auditorium, stage, band room, music room and robotics.

b. Points matrix – including all hardwired input and output devices connected to the automation system, all set points, upper and lower control limits.

c. Trend capabilities – including a trend point list and preprogrammed sample of point (performed by controls contractor), sample rate, storage interval, upload interval, custom trend abilities, alarms, and automated trend data review and notification (automated diagnostics).

d. System architecture – capable of allowing sampling of these points to facilitate building commissioning and diagnostics without significantly affecting system performance.

e. Data storage system – with adequate capacity to record trend data for use by building operators. Data export requirements must facilitate user-friendly data access and manipulation.

f. Operator interface – designed for remote/web access, monitoring requirements, trend-log reporting and diagnosing building problems through a user-friendly interface. This includes providing a visual (non-text based) operations and reporting interface to facilitate rapid system assessment that utilizes color-coding, diagrams of floor plans and graphing capabilities.

g. The remote access shall use a web browser only and not require a VPN with remote desktop application.

6. Electric Wiring: All electric wiring and wiring connections, either line voltage or low voltage, from the emergency electric panels to the ATC panels, and from the ATC related panels to the individual control devices i.e. rooftop units, exhaust fans, boilers, chillers, valves, and dampers required for the installation of the control system, as herein specified shall be provided by the control contractor unless specifically shown on the electrical drawings or called for in the electrical specifications.

a. The wiring installation shall be in accordance with National and Local Codes and with the Electrical portion of these specifications. All wiring shall be run concealed wherever possible. Exposed wiring in occupied areas shall be run in raceways. Raceways shall be Wiremold 200 series with all elbows, raceways, covers, mounting stops, box extensions and wiring for a complete and neat installation. All wiring located in mechanical spaces, boiler rooms, and fan rooms shall be installed in metal conduit.
b. All wiring above ceilings, in boiler rooms, and all mechanical spaces shall follow routing of piping and where not possible shall be in conduit. All exposed wire shall be bundled and wire tied and shall be supported to adjacent piping. Draped and free floating wire will not be allowed.

c. All terminations of wire at control devices shall be looped and supported adequately.

d. All wiring shall comply with the requirements of the electrical section of the specification.

B. Controls Systems Wiring

1. All conduit raceways, wiring, accessories and wiring connections required for the installation of the Controls Systems shall be provided by the Controls Contractor except as shown on the Electrical Drawings. All wiring shall comply with the requirements of applicable portions of the Electrical Section 260000 and all local and national electric codes and the requirements of the AHJ.

2. All Controls Systems wiring materials and installation methods shall comply with the original equipment manufacturer recommendations and standards.

3. The sizing type and provision of cable, conduit, cable trays and raceways shall be the design responsibility of the Controls Contractor.

4. Class 2 Wiring
   a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5ft. from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines.

5. Class 2 signal wiring and 24VAC power may be run in the same conduit. Power wiring 120VAC and greater shall not share the same conduit with Class 2 signal wiring.

6. Perform circuit tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:
   a. All circuits are continuous and free from short circuits and grounds.
   b. All circuits are free from unspecified grounds; that resistance to ground of all circuits is no less than 50 megaohms.
   c. All circuits are free from induced voltages.

7. Provide complete testing for all cables and wiring. Provide all equipment, tools, and personnel as necessary to conduct these tests.

8. Provide for complete grounding of all signal and communication cables, panels and equipment so as to ensure integrity of Controls Systems operation. Ground cabling and conduit at panel terminations. Do not create ground loops.

C. Line Voltage Power Sources

1. 120-volt AC circuits for the Controls Systems shall be taken by the Controls Contractor from electrical emergency panelboards and circuit breakers as designated on the electrical drawings.

2. Circuits used for the Controls Systems shall be dedicated to these Controls Systems and shall not be used for any other services.
3. Controls DDC terminal unit controllers may use 120-volt AC power from motor power circuits.

D. Controls Systems Raceways

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in the Specification. Minimum conduit size 3/4 in.
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the supporting surface.
4. UL/ULC Listed Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 ft. in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls and for final connection to equipment.
   a. Penetrations
5. Firestopping for all penetrations used by dedicated Controls Systems conduits and raceways shall be by other trades.
6. All openings in fire proofed or fire stopped components shall be closed by other trades using approved fire resistive sealant.
7. All wiring passing through penetrations, including walls, shall be in sleeves, conduit or enclosed raceway.
8. No penetrations through building structural elements, slabs, ceilings and walls shall be made before receipt of written approval from the Architect.

E. Controls Systems Identification Standards

1. Node Identification: All nodes shall be identified by a permanent label fastened to the outside of the enclosure. Labels shall be suitable for the node environmental location.
2. Cable shall be labeled at every termination with cross-referencing to record documentation.
3. Raceway Identification: Exposed covers to junction and pull boxes of the FMS raceways shall be identified at primary points.
4. Wire Identification: All low and line voltage wiring shall be identified by a number, as referenced to the associated shop and record drawing, at each termination.
5. Wires and cabling shall not be spliced between terminations. Cable shields shall be single end grounded – typically at the panel end outside the panel.
6. Suggested color coding, for use at the Contractors option, are:
   a. Analog Input Cable Yellow
   b. Analog Output Cable Tan
   c. Binary Input Cable Orange
   d. Binary Output Cable Violet
   e. 24 VAC Cable Gray
   f. General Purpose Cable Natural
   g. Tier 1 Comm Cable Purple
h. Other Tier Comm Cable Blue
i. Ethernet cable Blue

7. Provide permanent identification labels at all valve and damper actuators to indicate open and closed positions.

F. Field Panel And Device Installations And Locations
1. The Controls Systems panels, enclosures and cabinets shall be located as coordinated with the Architect at an elevation of not less than 2 ft. from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer’s recommendations.
2. All field devices shall be installed per the manufacturer recommendation and in accessible locations as coordinated with the Architect.
3. Panels to be located in damp areas or areas subject to condensation shall be mounted with wall standoffs.
4. Conduit configurations entering or leaving panels and devices shall be such as to preclude condensation traps.

G. Networking Communications
1. The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of multiple levels for communication efficiency, a campus-wide (Management Level Network) Ethernet network based on TCP/IP protocol, high performance peer-to-peer building level network(s) and DDC Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs.
   a. Provide an extension to an existing SiemensAPOGEE System as installed by the Siemens Industry branch office.
2. System shall communicate with a BACnet network over Ethernet or BACnet/IP (according to Annex J). The intent is to use the system provided under this contract to communicate with control systems and/or devices provided by other vendors. A PICS must be provided describing the BACnet, ANSI/ASHRAE 135-95, implementation. The product shall be Network Application Engine level 1 controllers with field equipment controller for level 2 controllers no substitutions. Minimum system functionality must include monitoring, commanding, and alarming for daily operator functions from a common workstation.
   a. System shall have the capability to be an OPC Client and Server for dynamic communication with OPC Clients or Servers over an Ethernet network. At a minimum, the following must be supported:
      1) Data Access 1.0 (96), 1.0A (97) and 2.0 (11/98)
      2) Alarms & Events 1.0 (1/99)
3. Network Switches
   a. Provide HP ProCurve 2910 al series 2910-48G al 48 ports network switch Brocade, Cisco or equal in MDF/IDF rooms as required.
4. Ethernet Wiring
   a. Ethernet wiring shall be CAT6 UTP cable plenum rated. CAT6 UTP cables shall conform to ANSI/TIA/EIA-568-B1, B2, B3 Commercial Building Telecommunications Cabling Standard (latest amendment and including all applicable addenda) and ISO/IEC 11801 (International) Generic Cabling for Customer Premises standard (latest amendment and including all applicable addenda).

5. Building Data Network:
   a. All operator devices either network resident shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.
   b. The network shall support a minimum of 100 DDC controllers and PC workstations
   c. The system shall support integration of third party systems (fire alarm, security, lighting, PLC, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for interprocess control. All exchange points shall have full system functionality as specified herein for hardwired points.
   d. Field panels must be capable of integration with open standards including Modbus, BACnet, and Lonworks as well as with third party devices via existing vendor protocols.
   e. The Building Network shall use the TCP/IP over Ethernet. All devices must:
      1) Auto-sense 10/100/1000 Mbps networks.
      2) IP Address will be assigned by Owner’s IT staff.
      3) DNS and Gateway IP address will be provided by Owner’s IT staff. A VLAN will be setup by Owner’s IT staff.
      4) Allow access using Telnet.

6. Internet access
   a. Web Based Operator Interface
      1) The BAS shall provide a web based graphical interface that allows users to access the BAS data via the Internet. The interface shall use HTML based ASP pages to send and receive data from the BAS to a web browser.
      2) All information exchanged over Internet shall be encrypted and secure via SSL.
      3) Access to the web interface will be password protected. A users rights and privileges to points and graphics will be the same as those assigned at the BAS workstation. An option will exist to only allow users “read” access via the web browser, while maintaining “command” privileges via the BAS workstation.
      4) Commissioning of the Web interface shall not require modification or creation of HTML or ASP pages. All graphics available at the BAS graphical workstation shall be available to users via a web browser.
5) The web-based interface shall provide the following functionality to users, based on their access and privilege rights:
   a) Logon Screen – allows the user to enter their user name, password and Domain name for logging into the web server.
   b) Alarm Display – a display of current BAS alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the web interface will be written to the BAS central workstation activity log.
   c) Graphic Display – Display of system graphics, including animated motion, available in the BAS workstation will be available for viewing over the web browser. Software that requires creation of dedicated “web” graphics in order to display them via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user accounts rights.
   d) Point details – users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.
   e) Point Commanding – users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the BAS central workstation activity log.

7. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Owner as required to support the web access feature.

H. DDC Controller Floor Level 2 Network
1. This level communication shall support a family of application specific controllers and shall communicate with the network through DDC Controllers for transmission of global data.

I. DDC & HVAC Mechanical Equipment Controllers
1. The DDC and HVAC Mechanical Equipment Controllers shall reside on the Building Level Network.
2. DDC and HVAC Mechanical Equipment Controllers shall use the same programming language and tools. DDC and HVAC Mechanical Equipment Controllers which require different programming language or tools on a network are not acceptable.
3. DDC and HVAC Mechanical Equipment Controllers which do not meet the functions specified are not acceptable.

J. DDC Controller
1. A 32 bit, stand alone, multi-tasking, multi user, real-time 100MHz digital control microprocessor module. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three Floor Level Application Specific Controller Device Networks.
2. Each DDC Controller shall have 72 Megabytes of memory to support its own operating system and databases, including:
   a. Control processes
   b. Energy management applications
   c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
   d. Historical/trend data for points specified
   e. Maintenance support applications
   f. Custom processes
   g. Operator I/O
   h. Dial-up communications
   i. Manual override monitoring

3. Each DDC Controller shall support firmware upgrades without the need to replace hardware.

4. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

5. DDC Controllers shall provide a RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

6. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
   a. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
   b. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.

7. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

8. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote announcement of any detected component failures, low battery conditions or repeated failure to establish communication.

9. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
   a. RF-Conducted Immunity (RFCl) per ENV 50141 (IEC 1000-4-6) at 3 V
b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact

c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power

d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)

e. Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:
   1) IEEE Standard 587-1980
   2) UL 864 Supply Line Transients
   3) Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

f. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.

b. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

c. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

10. Provide a separate DDC Controller for each AHU or other HVAC system as indicated in Section 3.02. It is intended that each unique system be provided with its own point resident DDC Controller.

K. HVAC Mechanical Equipment Controllers

1. A 32 bit, stand alone, multi-tasking, multi user, real-time 100MHz digital control microprocessor module.

2. Each HVAC Mechanical Controller shall have 72 Megabytes of memory to support its own operating system and databases, including:
   a. Control processes
   b. Energy management applications
   c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
   d. Historical/trend data for points specified
   e. Maintenance support applications
   f. Custom processes
   g. Operator I/O
   h. Remote communications

3. HVAC Mechanical Equipment Controllers shall provide a RS-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.

4. HVAC Mechanical Equipment Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.
5. Each HVAC Mechanical Equipment Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The HVAC Mechanical Equipment Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

6. In the event of the loss of normal power, there shall be an orderly shutdown of all HVAC Mechanical Equipment Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
a. Upon restoration of normal power, the HVAC Mechanical Equipment Controller shall automatically resume full operation without manual intervention.
b. Should HVAC Mechanical Equipment Controller memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

L. DDC and HVAC Mechanical Equipment Controller Resident Software Features
1. General:
a. The software programs specified in this Section shall be provided as an integral part of DDC and HVAC Mechanical Equipment Controllers and shall not be dependent upon any higher level computer for execution.
b. All points shall be identified by up to 30 character point name and 16 character point descriptor. The same names shall be used at the PC workstation.
c. All digital points shall have user defined two-state status indication (descriptors with minimum of eight characters allowed per state (i.e. summer/winter).

2. Control Software Description:
a. The DDC and HVAC Mechanical Equipment Controllers shall have the ability to perform the following pre-tested control algorithms:
   1) Two-position control
   2) Proportional control
   3) Proportional plus integral control
   4) Proportional, integral, plus derivative control
   5) Automatic tuning of control loops

3. DDC and HVAC Mechanical Equipment Controllers shall provide the following energy management routines for the purpose of optimizing energy consumption while maintaining occupant comfort.
a. Start-Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy. The SSTO program shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period, and still maintain desired comfort conditions.
   1) The SSTO program shall operate in both the heating and cooling seasons.
a) It shall be possible to apply the SSTO program to individual fan systems.

b) The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.

2) The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.

b. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.

1) It shall be possible to individually command a point or group of points.

2) For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start or stop within that group.

3) The operator shall be able to define the following information:
   a) Time, day
   b) Commands such as on, off, auto, and so forth.
   c) Time delays between successive commands.
   d) There shall be provisions for manual overriding of each schedule by an appropriate operator.

4) It shall be possible to schedule events up to one year in advance.
   a) Scheduling shall be calendar based.
   b) Holidays shall allow for different schedules.
   c) Enthalpy switchover (economizer) The Energy Management Control Software (EMCS) will control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover set point the EMCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly changeover to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.
   
   e) Temperature-compensated duty cycling.
      • The DCCP (Duty Cycle Control Program) shall periodically stop and start loads according to various patterns.
      • The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.
   
   f) Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.

   g) Night setback control: The system shall provide the ability to automatically adjust setpoints for night control.

   h) The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.
      • PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.
      • PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.
If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.

Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.

4. DDC and HVAC Mechanical Equipment Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
   a. A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and HVAC Mechanical Equipment Controllers on the network. Database shall support 30 character, English language point names, structured for searching and logs.
   b. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
   c. DDC and HVAC Mechanical Equipment Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task orientated information from the user manual.
   d. DDC and HVAC Mechanical Equipment Controller shall be capable of comment lines for sequence of operation explanation.

5. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC Mechanical Equipment Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC and HVAC Mechanical Equipment Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
   a. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
   b. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller) to provide full flexibility in defining the handling of system alarms. Each DDC and HVAC Mechanical Equipment Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
   c. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hours destinations) or based on priority.
   d. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
e. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

6. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.
   a. Any point, regardless of physical location in the network, may be collected and stored in each DDC and HVAC Mechanical Equipment Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to seven days shall be provided. Each DDC and HVAC Mechanical Equipment Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a sufficient number of data samples. All trend data shall be available for transfer to a Workstation without manual intervention.
   b. DDC and HVAC Mechanical Equipment Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.
      1) Loop tuning shall be capable of being initiated either locally at the DDC and HVAC Mechanical Equipment Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

7. DDC and HVAC Mechanical Equipment Controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.

8. The peer to peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to access any data from or send control commands and alarm reports directly to any other DDC and HVAC Mechanical Equipment Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC and HVAC Mechanical Equipment Controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer to peer network shall also allow any DDC and HVAC Mechanical Equipment Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

9. The network shall allow the DDC and HVAC Mechanical Equipment Controllers to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.
M. Application Specific Controllers:

1. Each Application Level Control Panel shall operate as a standalone controller capable of performing its user selectable control routines independently of any other controller in the system. Each application specific controller shall be a microprocessor based, multi-tasking, real time digital control processor.

2. Basis of design is Siemens TEC controller or PTEC for unique applications.

3. Provide an Application Specific Control Panel for each of the following types of equipment (if applicable):
   a. Constant Air Volume (CAV) boxes
   b. Chilled beams
   c. Duct mounted reheat coils
   d. Fan coil units
   e. Fan powered Variable Air Volume (VAV) Boxes
   f. Reheat Coils
   g. Supplemental AC units
   h. Variable Air Volume (VAV) Boxes
   i. Other terminal equipment

4. Each Application Specific Controller shall, at a minimum, be provided with:
   a. Appropriate NEMA rated enclosure
   b. Floor Level network communications ability
   c. Power supplies as required for all associated modules, sensors, actuators, etc.
   d. Software as required for all sequences of operation, logic sequences and energy management routines.
   e. A portable operator terminal connection port.
   f. Auxiliary enclosure for analog output transducers, isolation relays, etc. Auxiliary enclosure shall be part of primary enclosure or mounted adjacent primary enclosure.
   g. Each controller measuring air volume shall include provisions for manual and automatic calibration of the differential pressure transducer in order to maintain stable control and insuring against drift over time.
   h. Each controller measuring air volume shall include a differential pressure transducer.
   i. Approvals and standards: UL916; CE; FCC

5. Each Application Specific Controller shall continuously perform self-diagnostics on all hardware and secondary network communications. The Application Specific Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failure to establish communication to the system.
6. Provide each Application Specific Controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in nonvolatile EEPROM, EPROM and PROM. The controllers shall be able to return to full normal operation without user intervention after power failure of unlimited duration. Provide uninterruptible power supplies (UPSs) of sufficient capacities for all terminal controllers that do not meet this protection requirement. Operating programs shall be field selectable for specific applications. In addition, specific applications may be modified to meet the user’s exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.

7. The Application Specific Controller shall be powered from a 24 VAC source provided by this contractor and shall function normally under an operating range of 18 to 28 VAC (25% to +17%), allowing for power source fluctuations and voltage drops. Install plenum data line and sensor cable in accordance with local code and NEC. The controllers shall also function normally under ambient conditions of 32 to 122 F (0 to 50 C) and 10% to 95% RH (non condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.

N. Local User Display

1. Where specified in the sequence of operation or points list, the controllers on the peer to peer building level network shall have a display and keypad for local interface. A keypad shall be provided for interrogating and commanding points in the controller.

2. The display shall use the same security password and access rights for points in the display as is used in the associated controller.

3. The LCD display shall be a minimum of a 2 line 40 character display.

4. The LCD display shall include the full point name, value (numeric, digital or state text), point priority and alarm status on one screen.

5. The LCD shall dynamically update the value, priority, and alarm status for the point being displayed.

6. The display shall be mounted either on the door of the enclosure or remote from the controller.

O. Personal Computer Operator Workstation Hardware

1. Personal computer operator workstations shall be provided for command entry, information management, system monitor, alarm management and database management functions. All real-time control functions shall be resident in the DDC Controllers to facilitate greater distribution, fault tolerance and reliability of the building automation control.

   a. Provide workstation(s): Manufactured by Dell, HP, Toshiba or equal.

   b. Workstation shall consist of a personal computer with minimum 8.0GB RAM, hard drive with 1 TB available space, video card capable of supporting 1024 × 768 resolution with a minimum of 32 Bit color (Windows 7), DVD-ROM Drive, mouse and 101-key enhanced keyboard. Personal computer shall be a Windows 7 Compatible PC and shall include a minimum latest generation Intel Core i7 3.40 GHz processor.
c. The PC monitor shall support a minimum display resolution of no less than 1900 X 1280 pixels and shall be minimum 19 in. LCD display. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.

d. Also provide separate file server with available storage capacity to accommodate trending 15 min. interval of each control point for a period of one year for data archives, minimum 1 TB capacity.

2. Provide an HP LaserJet Pro 400 Color M451dn, Cannon, Brother or equal printer at each workstation location or on the network (Ethernet) for recording alarms, operator transactions and systems reports.

3. Alarm Display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message. The alarm display shall provide a mechanism for the operator to sort alarms.

4. Intranet/Internet access
a. Web Based Operator Interface
1) The BAS shall provide a web based graphical interface that allows users to access the BAS data via the Internet, extranet, or Intranet. The interface shall use HTML based ASP pages to send and receive data from the BAS to a web browser.

2) A web server computer will be supplied. The web server shall support browser access via Microsoft Internet Explorer 9.0 (or higher), or Navigator Netscape 6.0 (or higher).

3) All information exchanged over Internet shall be optionally encrypted and secure via SSL (provided by Owner).

4) Access to the web interface may be password protected. A users rights and privileges to points and graphics will be the same as those assigned at the BAS workstation. An option will exist to only allow users “read” access via the web browser, while maintaining “command” privileges via the BAS workstation.

5) Commissioning of the Web interface shall not require modification or creation of HTML or ASP pages. All graphics available at the BAS graphical workstation shall be available to users via a web browser.

6) The web-based interface shall provide the following functionality to users, based on their access and privilege rights:
   a) Logon Screen – allows the user to enter their user name, password and Domain name for logging into the web server.
   b) Alarm Display – a display of current BAS alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the web interface will be written to the BAS central workstation activity log.
Graphic Display – Display of system graphics, including animated motion, available in the BAS workstation will be available for viewing over the web browser. Software that requires creation of dedicated “web” graphics in order to display them via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user accounts rights.

d) Point details – users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.

c) Point Commanding – users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the BAS central workstation activity log.

7) The web server licensing options will allow concurrent access by a minimum of 10 browser connections.

8) Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Owner as required to support the web access feature.

P. Operators Laptop

1. A Lap Top Operators Terminal shall be provided for operator readout of system variables, override control and adjustment of control parameters and display graphics as called for in paragraphs following. Computer specification shall be similar to fixed station computer in Paragraph P.

2. Functionality to include ability to automatically display a sequential all point summary and a sequential alarm summary. The Lap Top shall also allow display and/or changing of digital point state, analog point value, time and date, application and DDC parameters, analog limits, time schedules, runtime counts and limits, daylight savings time changeover, time/event initiation, and programmable offset values. The Lap Top shall allow access into DCP initialization routines and diagnostics and enable/disable of points, initiators and programs, all similar to the fixed computer. Laptop shall have a minimum 15 in. color screen, 4GB ram, 500GB hard drive and Windows 7 Professional operating system.

Q. Workstation Operator Interface

1. Basic Interface Description

   a. Operator workstation interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, 30-character English language point identification, on-line help, and industry standard Windows application software. Interface software shall simultaneously communicate with existing system and share data between the dedicated, modem autodial, and Ethernet-connected building level networks. The software shall provide, as a minimum, the following functionality:

   1) Real-time graphical viewing and control of the BAS environment
   2) Reporting
   3) Scheduling and override of building operations
4) Collection and analysis of historical data
5) Point database editing, storage and downloading of controller databases.
6) Utility for combining points into logical Point Groups. The Point Groups shall then be manipulated in Graphics, trend graphs and reports in order to streamline the navigation and usability of the system.
7) Alarm reporting, routing, messaging, and acknowledgment
8) “Collapsible tree,” dynamic system architecture diagram application:
   a) Showing the real-time status and definition details of all workstations and devices on a management level network
   b) Showing the real-time status and definition details of all DDC and HVAC Mechanical Controllers at the building level
   c) Showing the status and definition details of all field-level application controllers
9) Definition and construction of dynamic color graphic displays.
10) Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
11) On-screen access to User Documentation, via online help or PDF-format electronic file.
12) Automatic database backup at the workstation for database changes initiated at DDC Controller operator interface terminals.

d. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a “drag and drop” approach to inter-application navigation. Selection of applications within the workstation software shall be via a graphical toolbar menu – the application toolbar menu shall have the option to be located in a docked position on any of the four sides of the visible desktop space on the workstation display monitor, and the option to automatically hide itself from the visible monitor workspace when not being actively manipulated by the user.

e. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAS software shall run on a Windows 7 Professional bit operating system. System database parameters shall be stored within an object-oriented database, which is compliant with the Open Database Connectivity (ODBC) or Structured Query Language (SQL) standards. Standard Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information.

1) Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via adjustable user-sized windows. Operator shall be able to drag and drop information between the following applications, reducing the number of steps to perform a desired function (e.g., Click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend on the desired point):
   a) Dynamic color graphics application
   b) Alarm management application
c) Scheduling application

d) Dynamic trend graph data plotter application

e) Dynamic system architecture diagram application

f) Control Program and Point database editing applications

g) Reporting applications

2) Report and alarm printing shall be accomplished via Windows Print Manager, allowing use of network printers.

f. Operator-specific password access protection shall be provided to allow the administrator/manager to limit users’ workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported). The administrator/manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and BAS workstation application. And each BAS workstation user account shall use a Windows 7 user account as a foundation.

g. Dynamic Color Graphics application shall include the following:

1) Must include graphic editing and modifying capabilities

2) A library of standard control application graphics and symbols must be included

3) Must be able to command points directly off graphics application

4) Graphic display shall include the ability to depict real-time point values dynamically with animation, picture/frame control, symbol association, or dynamic informational text-blocks.

5) Navigation through various graphic screens shall be optionally achieved through a hierarchical “tree” structure

6) Graphics viewing shall include zoom capabilities

7) Graphics shall automatically display the HAND status of points that have been overridden by a field HAND switch, for points that have been designed to provide a field HAND override capability.

8) Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls), internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.

h. Reports shall be generated on demand or via pre-defined schedule, and directed to CRT displays, printers or file. As a minimum, the system shall allow the user to easily obtain the following types of reports:

1) A general listing of all or selected points in the network

2) List of all points currently in alarm

3) List of all points currently in override status

4) List of all disabled points

5) List of all points currently locked out

6) List of user accounts and access levels

7) List all weekly schedules and events

8) List of holiday programming

9) List of control limits and dead bands

10) Custom reports from 3rd party software
11) System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal unit device points
12) List of programs
13) List of point definitions
14) List of logical point groups
15) List of alarm strategy definitions
16) List of DDC Control panels
17) Point totalization report
18) Point Trend data listings
19) Initial Values report
20) User activity report

i. Scheduling and override

j. Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation, DDC Controller, and HVAC Mechanical Equipment Controller to ensure time equipment scheduling when PC is off-line -- PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action or function key. Provide the following capabilities as a minimum:
1) Weekly schedules
2) Zone schedules
3) Event schedules – an event consists of logical combinations of equipment and/or zones
4) Report schedules
5) Ability to schedule for a minimum of up to 365 days in advance
6) Additionally, the scheduling application shall:
   a) Provide filtering capabilities of schedules, based on name, time, frequency, and schedule type (event, zone, report)
   b) Provide sorting capabilities of schedules, based on name, time and type of schedule (zone, event, report)
   c) Provide searching capabilities of schedules based on name – with wildcarding options

k. Collection and Analysis of Historical Data
1) Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals (up to four time-based definitions per point) or change of value, both of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of zones, events, and reports. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.
2) Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.

l. The ATC contractor shall provide an additional 40 hours of ATC/BMS system programming time to assist the owner/engineer with customized programming of the ATC/BMS system due to any changes and/or modifications.

2. Dynamic Color Graphic Displays
   a. Create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units and hot water boiler systems, and room level terminal units, shall be provided by the BAS contractor as indicated in the point I/O schedule of this specification to optimize system performance, analysis and speed alarm recognition.
   b. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of Autocad or scanned pictures for use in the system.
   c. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
      1) Provide the user the ability to display real-time point values by animated motion or custom picture control visual representation. Animation shall depict movement of mechanical equipment, or air or fluid flow. Picture Control shall depict various positions in relation to assigned point values or ranges. A library (set) of animation and picture control symbols shall be included within the workstation software’s graphics application. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed.
      2) Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint.
      3) Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.
      4) Equipment state or values can be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or setpoint.
      5) State text for digital points can be user-defined up to eight characters.
   d. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.
c. Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls), internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.

f. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

g. Off the shelf graphic software, html web-based graphic software shall be provided to allow the user to add, modify or delete system graphic background displays.

h. A clipart library of HVAC application and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams. The user shall have the ability to add custom symbols to the clipart library. The clipart library shall include a minimum of 400 application symbols. In addition, a library consisting of a minimum of 700 graphic background templates shall be provided.

i. The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller’s control values and parameters, without the need to create separate and individual graphic files for each controller.

3. System Configuration & Definition
   a. A “Collapsible tree,” dynamic system architecture diagram/display application of the site-specific BAS architecture showing status of controllers, PC workstations and networks shall be provided. This application shall include the ability to add and configure workstations, DDC Controllers or HVAC Mechanical Equipment controllers, as well as 3rd-party integrated components. Symbols/Icons representing the system architecture components shall be user-configurable and customizable, and a library of customized icons representing 3rd-party integration solutions shall be included. This application shall also include the functionality for real-time display, configuration and diagnostics of dial-up modems to DDC Controllers.

   b. Network wide control strategies shall not be restricted to a single DDC Controller or HVAC Mechanical Equipment controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.

   c. Provide automatic backup and restore of all DDC controller and HVAC Mechanical Equipment controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller or HVAC Mechanical Equipment Controller. Changes made at the user-interface of DDC Controllers or HVAC Mechanical Equipment Controllers shall be automatically uploaded to the workstation, ensuring system continuity.
d. System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system back-up must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.

e. Point database configuration shall be available to the user within a dedicated point database editor application included in the workstation software. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database. The point editor shall also allow the user to configure the alarm management strategy for each point. The editor shall provide the option for editing the point database in an online or offline mode with the DDC Controllers.

1) The workstation software shall also provide the capability to perform bulk modification of point definition attributes to a single or multiple user-selected points. This function shall allow the user to choose the properties to copy from a selected point to another point or set of points. The selectable attributes shall include, but are not limited to, Alarm management definitions and Trend definitions.

4. Alarm Management

a. Alarm Routing shall allow the user to send alarm notification to selected printers or workstation location(s) based on time of day, alarm severity, or point type.

b. Alarm Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each alarm point: name, value, alarm time and date, alarm status, priority, acknowledgement information, and alarm count. Each alarm point or priority shall have the ability to sound a discrete audible notification.

c. Alarm Display shall have the ability to list and sort the alarms based on alarm status, point name, ascending or descending alarm time.

d. Directly from the Alarm Display, the user shall have the ability to acknowledge, silence the alarm sound, print, or erase each alarm. The interface shall also have the option to inhibit the erasing of active acknowledged alarms, until they have returned to normal status. The user shall also have the ability to command, launch an associated graphic or trended graphical plot, or run a report on a selected alarm point directly on the Alarm Display.

e. Each alarm point shall have a direct link from the Alarm Display to further user-defined point informational data. The user shall have the ability to also associate real-time electronic annotations or notes to each alarm.

f. Alarm messages shall be customizable for each point, or each alarm priority level, to display detailed instructions to the user regarding actions to take in the event of an alarm. Alarm messages shall also have the optional ability to individually enunciate on the workstation display via a separate pop-up window, automatically being generated as the associated alarm condition occurs.

g. Alarm Display application shall allow workstation operators to send and receive real-time messages to each other, for purposes of coordinating Alarm and BAS system management.

h. Remote notification of messages

1) Workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point’s alarm condition.
2) There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.

3) On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.

4) Remote devices may be scheduled as to when they receive messages from the system to account for operators’ work schedules.

5) System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.

6) Message detail shall be configurable on a per user basis.

7) During a “flood” of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.

8) Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.

9) Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

R. Field Devices

1. Provide instrumentation as required for monitoring, control or optimization functions.

2. Room Temperature Sensors
   a. Book collection and Office areas shall be provided with digital combination room sensors for temperature, humidity and CO2 and shall have LCD display, day / night override button, and setpoint slide adjustment. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment. All other areas/spaces including but not limited to classrooms and teaching room areas shall have combination room sensors for temperature, humidity and CO2 and shall have day / night override button, and setpoint slide adjustment options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment. Public areas such as corridors, entry areas, vestibules, restrooms shall have chrome cover plate temperature sensors without adjustment or occupied/unoccupied capability. Combination temperature, humidity and CO2 sensors shall be provided in gymnasiums and locker rooms and shall be provided with tamper proof guard. All temperature sensors shall be BACnet compatible network type.

Temperature monitoring range  +20/120 deg. F -13 deg. to 49 deg. C)

Output signal Changing resistance

Accuracy at Calibration point  +0.5 deg. F (+/- 0.3 deg. C)

Set Point and Display Range  55 deg. to 95 deg. F (13 deg. to 35 deg. C)
3. **Liquid immersion temperature:**
   - Temperature monitoring range: +30/250 deg. F (-1 deg. /121 deg. C)
   - Output signal: Changing resistance
   - Accuracy at Calibration point: +0.5 deg. F (+/-0.3 deg. C)

4. **Duct (single point) temperature:**
   - Temperature monitoring range: +20/120 deg. F (-7 deg. /49 deg. C)
   - Output signal: Changing resistance
   - Accuracy at Calibration point: +0.5 deg. F (+/-0.3 deg. C)

5. **Duct Average temperature:**
   - Temperature monitoring range: +20 deg.+120 deg.F(-7 deg./+49 deg. C)
   - Output signal: 4 – 20 mA DC
   - Accuracy at Calibration point: +0.5 deg. F (+03 deg. C)
   - Sensor Probe Length: 25 ft. L (7.3m)

6. **Outside air temperature:**
   - Temperature monitoring range: -58deg.+122deg.F(-50deg.Cto 50deg.C)
   - Output signal: 4 – 20 mA DC
   - Accuracy at Calibration point: +0.5 deg. F (+/-0.3 deg. C)

7. **Liquid Differential Pressure Transmitter**
   - Ranges: 0-5/30 in. H20
     - 0-25/150 in. H20
     - 0-125/750 in. H20
   - Output: 4 – 20 mA DC
   - Calibration Adjustments: Zero and span
   - Accuracy: +0.2 percent of span
   - Linearity: +/-0.1 percent of span
   - Hysteresis: +/-0.05 percent of span

8. **Differential pressure:**
   - Unit for fluid flow proof shall be Penn P74.
   - Range: 8 to 70 psi
   - Differential: 3 psi
   - Maximum differential pressure: 200 psi
   - Maximum pressure: 325 psi
   - Unit for air flow settings.
   - Set point ranges: 0.5 in. WG to 1.0 in. WG (124.4 to 248.8 Pa)
     - 1.0 in. WG to 12.0 in. WG (248.8 to 497.6 Pa)
9. **Static pressure sensor:**
   - **Range**
     - 0 to .5 in.WG (0 to 124.4 Pa)
     - 0 to 1 in.WG (0 to 248.8 Pa)
     - 0 to 2 in. WG (0 to 497.7 Pa)
     - 0 to 5" in.WG (0 to 1.2 kPa)
     - 0 to 10" WG (0 to 2.5 kPa)
   - **Output Signal**
     - 4 – 20 mA VDC
   - **Combined static error**
     - 0.5 percent full range
   - **Operating Temperature**
     - -40 deg. to 175 deg. F (-40 deg. C to 79.5 deg. C)

10. **Air Pressure Sensor:**
    - **Range:**
      - 0 to 0.1 in. water (0 to 24.9 Pa)
      - 0 to 0.25 in. water (0 to 63.2 Pa)
      - 0 to 0.5 in. water (0 to 124.5 Pa)
      - 0 to 1.0 in. water (0 to 249 Pa)
      - 0 to 2.0 in water (0 to 498 Pa)
      - 0 to 5.0 in. water (0 to 1.25 kPa)
      - 0 to 10.0 in. water (0 to 2.49 kPa)
    - **Output signal**
      - 4 to 20 mA
    - **Accuracy**
      - +1.0 percent of full scale

11. **Pressure to Current Transducer**
    - **Range**
      - 3 to 15 psig (21 to 103 kPa) or
        - 3 to 30 psig (21 to 207 kPa)
    - **Output signal**
      - 4 – 20 mA
    - **Accuracy**
      - + 1 percent of full scale (+ 0.3 psig)

12. **Control Valves** (all control valves shall have electric actuators with position feedback to provide confirmation of valve position).
    - **Electric Control**
      1) **Range ability**
         - 40:1
      2) **Flow Characteristics**
         - Modified. Equal percentage
      3) **Control Action**
         - Normal open for hot water and normal closed for cooling
      4) **Medium**
         - Steam, water, glycol
      5) **Body Type**
         - Screwed ends 2 in. and smaller, flanged
      6) **Body Type**
         - Valves 2½ in. and larger
      7) **Body Material**
         - Bronze
      8) **Body Trim**
         - Bronze
      9) **Stem**
         - Stainless Steel
      10) **Actuator**
         - 0-10 VDC, 4-20 MA or 2 position
         - 24 VAC/120VAC – Modulating for all hot water and chilled water valves with a GPM value of 1 or above, 2 position valves for all GPM’s under 1.
a. All automatic temperature control valves in steam lines shall be provided with Characterized throttling plugs and shall be sized for minimum 25 percent of the system pressure drop.
   1) Positive positioning relays shall be provided on pneumatic control when required to provide sufficient power for sequencing.
   2) Two position valves shall be line size.

13. Damper Actuators
   a. Electric control shall be direct coupled actuators with position feedback to BMS.
   b. Damper actuators shall be Brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.
      1) The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard ½ in. diameter shaft or damper blade.
   c. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.
   d. All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator’s output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed “v” shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.
   e. All actuators having more than a 100 lb-in torque output shall accept a 1 in. diameter shaft directly, without the need for auxiliary adapters.
   f. All actuators shall be designed and manufactured by Belimo or approved equal using ISO900 registered procedures, and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 l.

14. Sensors to monitor building natural gas consumption. Gas meters shall be furnished and installed by the Plumbing contractor. The ATC contractor shall provide control wiring from the meter to the BMS.

S. Miscellaneous Devices
   1. Thermostats (Stand-alone electric type - only where specified or indicated on drawings)
      a. Room thermostats shall be of the gradual acting type with adjustable sensitivity.
      b. They shall have a bi-metal sensing element capable of responding to a temperature change of one-tenth of one degree. (Provide all thermostats with limit stops to limit adjustments as required.)
      c. Thermostats shall be arranged for either horizontal or vertical mounting.
      d. In the vertical position thermostat shall fit on a mullion of movable partitions without overlap.
      e. Mount the thermostat covers with tamper-proof socket head screws.
   2. Freezestats:
      a. Install freezestats on each coil that mixes outside and return air (air handling units, fan coils, unit ventilators) and provide protection for every square foot of coil surface area with one linear foot of element per square foot of coil.
         1) Upon detection of low temperature, the freezestats shall stop the associated supply fans and return the automatic dampers to their normal position close outside air dampers and open coil valve for full flow. Provide manual reset.
3. Firestats:
   a. Provide manual reset, fixed temperature line voltage type with a bi-metal actuated switch.
      1) Switch shall have adequate rating for required load.

4. Electronic Airflow Measurement Stations and Transmitters (Where indicated on Control Drawings):
   a. Provide air flow moving stations as shown on drawings.
   b. Stations – each insertion station shall contain an array of velocity sensing elements and straightening vanes. The velocity sensing elements shall be of the RTD or thermistor type. The sensing elements shall be distributed across the duct cross section in a quality to provide accurate readings. The resistance to airflow through the airflow measurement station shall not exceed 0.08 in. water gage at an airflow of 2,000 fpm. Station construction shall be suitable for operation at airflow of up to 5,000 fpm over a temperature range of 40 to 120 degrees F, and accuracy shall be plus or minus 3 percent over a range of 125 to 2,500 fpm scaled to air volume. Each transmitter shall produce a linear, temperature compensated 4 to 40 mA DC output corresponding to the required velocity pressure measurement. Provide local readout on unit.
   c. Fan inlet airflow sensing
      1) Where mounted into controllable pitch axial inlet bells, or inlet cones of centrifugal fans, the traverse probe assemblies shall be complete with all necessary end mounting plates and master takeoff fittings. All mounting bolts, lock washers and nuts; interconnecting tubing and compression fittings to be provided by the installing contractor.
      2) Primary flow elements shall not be used on fan inlet applications where the narrowest diameter of the inlet cone is under ten in. without prior approval. Fan inlet sensors shall not be used on fans having inlet guide vanes. The use of only one static element and one total pressure element on fan inlets is prohibited. Fan primary elements shall not exceed .562 in. in diameter on fans having inlet cone diameters less than 30 in..
      3) Fan inlet airflow sensing similar to Ebtron GTx116F or Paragon Controls model FE-1050.
   d. Electronic Transducers
      1) Provide individual differential static pressure and airflow transducers, selected for the required range of each of the above primary elements, and in accordance with the following:
      2) The transducer(s) shall be solid-state electronic type, with infinite output resolution, capable of performing dedicated static pressure and air volume control functions. Microprocessor based transducers with time-sharing of multiple square root extractors and/or controllers are not acceptable.
      3) Each transducer’s output shall not be affected by direction of mounting (attitude) or external vibrations, and shall be furnished with a factory-calibrated range that matches the application.
4) Airflow transducers shall be provided with an integral dual scale indicating meter operating independent of all other control devices. The top scale shall indicate the measured air volume in units of cubic ft. per minute (CFM), and the bottom scale shall indicate the air velocity in units of ft. per minute (FPM).
   a) The meter shall be a differential pressure type that is diaphragm actuated, and is to be flush mounted on the enclosure door.
   b) The meter shall be calibrated to an accuracy of +2 percent of span.

5) Transducer performance shall be equal to or better than the following:
   a) Accuracy: +/- 0.5 percent F.S. (Terminal Point) / +/- 0.35 percent F.S. (BFSL)
   b) Temperature Effects: <0.03 percent F.S./deg F
   c) Over-pressure: 5 PSIG Proof / 10 PSIG Burst
   d) Response: <0.25 seconds for full scale input
   e) Noise Filtration: Low Pass Filter, factory set @ 3.2Hz

6) Each transducer shall be selected for its respective duty. Supply, Exhaust and/or Return Airflow Transducers shall provide analog output signal linear to air volume that are factory set for a full scale value equal to 110 percent of the maximum design capacity of the flow measuring element served for variable air volume applications, or 200 percent of the design operating value for constant volume applications.

7) Airflow transducers for operating velocities below 1266 ft. per minute shall provide the following features:
   a) Local electronic indication of the measure airflow rate.
   b) The indicating meter shall be one-half in. high, three and one half digit light emitting diode (LED) type.
   c) The LED shall indicate the measured air volume in engineering units of cubic ft. per minute (CFM).
   d) Automatic zeroing circuit that shall maintain the transducer output to within 0.1 percent of value, and shall be field configurable for frequency of activation between one and seventy two hours.
   e) The transducer output shall be locked and maintained at the last given output value during the automatic zeroing period so as not to interrupt the automatic control process.
   f) The meter shall be auto calibrated to an accuracy of +/- 1 count.
   g) Transducer accuracy shall be +/- 0.25 percent F.S. (Terminal Point) / +/- 0.15 percent F.S. (BFSL)

5. Current Sensing Relay:
   a. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
   b. Adjust the relay switch point so that the relay responds to motor operation under load as an “on” state and so that the relay responds to an unloaded running motor as an “off” state. A motor with a broken belt is considered an unloaded motor.
   c. Provide for status device for all fans and pumps.

T. Manufacturers: Subject to compliance with requirements, provide an automatic temperature control system of one of the following:
   1. Siemens (Only) installed by local branch office
PART 3 -EXECUTION

3.01 CUTTING AND PATCHING

A. Penetrations through construction as required for the Work of this Section:
   1. Coring: Perform all coring for required work.
   2. Notify Masonry Sub-Contractor of exact locations and sizes for openings required in masonry, to be executed under Section 042000 – Unit Masonry, utilizing lintels furnished per Section 055000 – Metal Fabrications.
   3. Cut openings in new and existing non-masonry construction where required for penetrations. All cutting shall conform to the requirements of Section 013100 – Project Management and Coordination and Section 024119 – Selective Demolition.
   4. Refer to Section 024119 – Selective Demolition for restrictions on all alterations to structural elements.

B. Patching at penetrations through construction for the Work of this Section:
   1. Notify Masonry Sub-Contractor when plumbing work is complete at penetrations through masonry construction, and ready for patching under Section 042000 – Unit Masonry.
   2. Notify appropriate Sub-Contractors when mechanical work is complete at penetrations through non-masonry construction, and ready for patching under Sections 013100 – Project Management and Coordination.

3.02 INSTALLATION OF VALVES

A. Examine valve interior through the end ports, for cleanliness, freedom from foreign matter and corrosion. Remove special packing materials, such as blocks used which prevents disc movement during shipping and handling.

B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the position in which it was shipped.

C. Examine threads on both the valve and the mating pipe for form (out-of-round or local indentation) and cleanliness.

D. Examine mating flange faces for conditions which might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size and material, and for freedom from defects and damage.

E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
F. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select valves with the following ends or types of pipe/tube connections:
   1. Copper Tube 2 in. and smaller (Heating Hot Water): Solder ends.
   2. Steel Pipe Sizes 2 in. and smaller: Threaded or grooved-end.
   3. Steel Pipes Sizes 2-1/2 in. and larger: Grooved-end or welded.

G. Valve Installation
   1. Locate valves for easy access and provide separate support where necessary.
   2. Install valves and unions for each fixture and item of equipment in a manner to allow equipment removal without system shut-down. Unions are not required on flanged devices.
   3. Install valves in horizontal piping with the stem at or above the center of the pipe.
   4. Install isolation valves at all branch supply and return piping lines which serve more than two pieces of terminal heating equipment.
   5. Installation of Check Valves: Install for proper direction of flow as follows:
      a. Swing Check Valves: Install in horizontal position with hinge pin level.
      b. Wafer Check Valves: Install between 2 flanges in horizontal or vertical position.
      c. Lift Check Valves: Install in piping line with stem upright and plumb.

H. Threaded Connections
   1. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
   2. Align threads at point of assembly.
   3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
   4. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

I. Flanged Connections
   1. Align flanges surfaces parallel.
   2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using a torque wrench.

J. Grooved Connections
   1. Installation shall be in accordance with the latest published instructions from the manufacturer.

K. Field Quality Control
   1. Testing: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.
L. Adjusting and Cleaning
   1. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare to receive painting or insulation.

3.03 INSTALLATION OF METERS AND GAGES

A. Installation of Temperature Gages
   1. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.
   2. Temperature Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure Cap.

B. Installation of Pressure Gages
   1. General: Install pressure gages in piping tee with pressure gage located on pipe at most readable position.
   2. Pressure Gage Cocks: Install in piping tee with snubber. Install siphon for steam pressure gages.
   3. Pressure Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

C. Installation of Flow Measuring Fittings
   1. General: Install flow measure fittings in piping systems located in accessible locations.

D. Adjusting and Cleaning
   1. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.
   2. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked or broken windows; repair any scratched or marred surfaces with manufacturer's touch-up paint.

3.04 INSTALLATION OF HANGERS AND ATTACHMENTS

A. Vibration Control and Seismic Restraint: Refer to section 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS.1.

B. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
C. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachments.

D. Prior to installation of hangers, supports, anchors, and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purposes of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

E. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.

F. Install hangers, supports, clamps, and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

1. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

2. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.

3. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

4. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

5. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

6. Insulated Piping: Comply with the following installation requirements:
   a. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
   b. Shields: For pipe sizes up to and including 4 in. provide heavy gage shield at each hanger point.
   c. Saddles: For all pipe sizes over 4 in. provide saddle at each hanger point. Completely fill void in saddle with loose insulation.

G. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer for loading and stresses to connected equipment.
H. Fabricate and install anchor by welding steel shapes, plates, and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

I. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

J. Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors to accommodate both expansion and contraction of piping.

K. Provide concrete housekeeping bases for all floor-mounted equipment. Size bases to extend minimum of 4 in. beyond equipment base in any direction; and 4 in. above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

L. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

M. Adjusting and Cleaning:
   1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
   2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
   3. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.05 INSTALLATION OF MECHANICAL IDENTIFICATION

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces; install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. General: Install pipe markers of the following type on each system indicated to receive identification, and include arrows to show normal direction of flow:
   1. Plastic pipe markers, with application system. Install on pipe insulation segment where required for pipes.

C. Locate pipe markers and color bands as follows wherever piping is in or above occupied spaces or corridors, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
   1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
4. At access doors, manholes and similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50 ft. along each piping run, except reduce spacing to 25 ft. in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings.

D. Valve Identification:
   1. General: Provide valve tag on every valve, cock, and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
   2. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

E. Mechanical Equipment Identification:
   1. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device.
   2. Lettering Size: Minimum 1/4 in. high lettering for name of unit where viewing distance is less than 2 ft. - 0 in., 1/2 in. high for distances up to 6 ft. - 0 in., and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.

F. Adjusting and Cleaning:
   1. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
   2. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.06 INSTALLATION OF MECHANICAL INSULATION

A. Installation of Piping Insulation:
   1. Insulation Omitted: Omit insulation on hot piping within radiation enclosures which serve the zone: hot water passing through the zone must be insulated or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan. (Couplings in mechanical grooved systems will be insulated.)
   2. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
   3. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance tests.
4. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

5. Clean and dry pipe surfaces prior to insulating. Butt installation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

6. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

7. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated. Do not cover calibrated balance valves until testing adjusting and balancing has been completed.

8. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

9. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 in. wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 in. wide vapor barrier tape or band.

B. Installation of Ductwork Insulation:

1. General: Do not insulate ductwork until ductwork has been sealed successfully, pressure tested, and approved for application of insulation by engineer or commissioning agent. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

2. Install insulation materials with smooth and even surfaces.

3. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

4. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.

5. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

6. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

C. Installation of Equipment Insulation:

1. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

2. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
3. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

4. Do not apply insulation to equipment, breechings, or stacks while hot.

5. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

6. Coat insulated surfaces with layers of insulating cement, troweled in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

7. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2 in.. Apply over vapor barrier where applicable.

8. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruption of insulation.

9. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

D. Protection and Replacement:
1. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

2. Protection; Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.07 INSTALLATION OF KITCHEN GREASE DUCT INSULATION

A. Examination
1. Do not begin installation until substrates have been properly prepared.

2. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3. Coordinate installation of the Thermal Ceramics FastDoor XL access door between sheet metal and insulation trades.

B. Preparation
1. Remove dirt and dust from surfaces of openings and items penetrating rated floors and rated walls.

C. Installation
1. Install FireMaster FastWrap XL or Pyroscat Duct Wrap XL in direct contact with the ductwork in accordance with manufacturer's instructions, applicable laboratory listings and building code reports, and referenced standards. For additional complex duct design installation recommendations, see the Thermal Ceramics' complete installation guide.
2. Install two layers of FireMaster FastWrap XL or Pyroscat Duct Wrap XL for zero clearance and a 1 and 2 hour commercial kitchen grease duct applications per ASTM E 2336.
   a. General Installation Instructions for Double Layer Installations: The inside and outside layers of FireMaster or Pyroscat blankets are cut to a length that will fit around the duct and meet with a tight butt joint. Adjacent blankets on the inside and outside layers are tightly butted against each other. Joints between blankets on the outside layer shall be offset from joints on the inside layer by a minimum 6 in. (152 mm). Cut edges of the blanket shall be taped with aluminum foil tape. During installation the blankets are temporarily held in place with filament tape until the wrap is mechanically attached with steel bands or steel insulation pins.

3. Install 1 layer of FireMaster FastWrap XL or Pyroscat Duct Wrap XL for 1 and 2 hour air ventilation duct enclosures per ISO 6944-1985.
   a. General Installation Instructions for Single Layer Installations: FireMaster or Pyroscat blankets are cut to a length that will fit around the duct and overlap itself no less than 3 in. (152 mm). Adjacent blankets overlap each other a minimum of 3 in. (152 mm), or they can be fitted together with a tight butt joint and covered with a 6 in. (305 mm) wide collar centered over the butt joint. Cut edges of the blanket are taped with aluminum foil tape. During installation the blankets are temporarily held in place with filament tape until the wrap is mechanically attached with steel bands or steel insulation pins.

4. Install one layer of Thermal Ceramics PlenumWrap+ on plastic pipe or plastic jacketed electrical cables per Intertek listing reports and testing to NFPA 262 and UL1887.
   a. Cut plenum blanket to a length that will fit around the pipe or cable and overlap itself no less than 1 in. (25 mm). Adjacent blankets overlap each other a minimum of 1 in. (25 mm). Plenum blanket is secured using either 1/2 in. (12 mm) steel banding or 16 gauge carbon or stainless steel tie wire on maximum 11-1/2 in. (292 mm) spacing.

5. Mechanical Fastening of Enclosure Material to Ductwork:
   a. Banding - Carbon steel or stainless steel banding is used to hold the outer layer of the blanket enclosure in place. Banding is minimum 1/2 in. (12.7 mm) wide, and is placed around the entire perimeter of the duct on maximum 10-1/2 in. (267 mm) centers and 1-1/2 in. (38 mm) from each blanket or collar edge.
   b. Pinning - To prevent blanket sag on duct spans wider than 24 in. (610 mm), minimum 12-gauge steel insulation pins are welded to the duct along bottom horizontal and outside vertical runs in columns spaced 12 in. (305 mm) apart, 6 to 12 in. (152 to 305 mm) apart, 6 to 12 in. (152 to 305 mm) apart, and 10-1/2 in. (267 mm) centers. Pins are locked in place with 1-1/2 in. (38 mm) diameter or 1-1/2 in. (38 mm) square galvanized steel speed clips or cup head pins. Pins are turned down or the excess cut off to eliminate sharp edges.

6. Grease Duct Access Door Installation:
   a. Install Thermal Ceramics FastDoor XL per manufacturers' instructions, and applicable building code reports and laboratory design listings.
7. Through-Penetration Firestop System:
   a. When the duct penetrates a concrete or dry wall fire rated floor, ceiling, or wall an approved firestop system shall be employed. FireMaster or Pyroscat insulation shall be installed directly to the duct through the penetration, or terminated on both sides of the penetration depending on the annular space allowance between the duct and the duct opening. When the FireMaster or Pyroscat enclosure system is terminated on both sides of the through penetration, the duct wrap material is mechanically attached to the duct at the termination points using either steel banding or steel pins.
   b. To fire stop the through penetration void area, fill the annular space between the wrapped duct or bare duct and the periphery of the opening with scrap FireMaster or Pyroscat insulation firmly packed into the opening. Compress scrap blanket to percentage stated in the firestop listing for a minimum depth as specified in the firestop listing. Recess packing material below surface on both sides of walls or top side only for floors to the depth stated in the firestop listing. Seal over the packing material using an approved firestop sealant to a depth as stated in the firestop listing, flush with top side of a floor assembly and both sides of a wall assembly.

D. Repair Procedures
   1. Repair damaged FireMaster FastWrap XL or Pyroscat Duct Wrap XL in accordance with manufacturer's instructions.
   2. Remove damaged section by cutting the bands and removing the anchor clips holding it in place. Apply a new section of the same dimension ensuring the same overlap and installation method that existed previously. Cut edges and tears in the foil must be taped with aluminum tape to prevent the insulation from wicking moisture or grease.

E. Protection
   1. Protect installed products until completion of project.
   2. Touch-up, repair or replace damaged products before Substantial Completion.

3.08 INSTALLATION OF REFRIGERANT PIPING AND ACCESSORIES

A. Vibration Control and Seismic Restraint: Refer to section 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS.1.

B. Piping Installations:
   1. Locations and Arrangements: Drawings indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, and other design consideration.
   2. Install pipe sleeves at all wall and floor penetrations.
   3. Install escutcheons at all exposed pipe wall penetrations.
3.09 INSTALLATION OF STEAM AND CONDENSATE SPECIALTIES

A. Inspection:

1. General: Examine areas and conditions under which steam and condensate specialties are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

B. Installation:

1. General: Install steam and condensate specialties as indicated, and in accessible locations to permit service. When located behind heating enclosures, center steam and condensate specialties on access door. Install in neat and workmanlike manner. Use only wrenches having square flat jaws, or non-metallic strap wrenches on brass specialties, wrench marks will not be permitted.

3.10 INSTALLATION OF STEAM AND CONDENSATE PIPING

A. Inspection:

1. General: Examine areas and conditions under which steam and condensate piping materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Installation:

1. Steam Piping:
   a. Where possible, install piping with 1/16” per foot (1/2%) downward slope in direction of steam flow. Otherwise, install with 1/32” per foot (1/4%) downward slope.
   b. Install low-pressure drip legs as required, and at 100' intervals in low-pressure steam piping.

2. Condensate Piping:
   a. Install condensate piping to return steam condensate collection. Comply with applicable steam-piping installation requirements, except install piping with 1/32” per foot (1/4%) downward slope in direction of flow.

C. Fabrication and Installation of Piping Components:

1. General: Fabricate and install piping components in accordance with applicable requirements of Division-23 sections, ASME B31.9, and, where not otherwise indicated, comply with recognized industry practices to ensure that components serve intended function.
2. Bypass Piping: Except as otherwise indicated, fabricate and install bypass piping using same materials and in same plane as connected piping, but one pipe size smaller. Include valve in bypass piping.

3. Drip-Legs: Except as otherwise indicated, fabricate drip-legs from 2" pipe. Install to direct steam vertically downward; include Tee-fitting in vertical pipe; and install dirt-leg pipe at 180 deg. outlet of Tee-fitting. At 90 deg. outlet of Tee-Fitting connect valve, strainer, trap, and second valve. Provide trap with continuous flow capacity of 1.5 lbs./hr. of condensate per sq. ft. of surface of drained-pipe. Install bypass piping around strainer and trap. Install drip-legs at both ends of steam headers, at low points and at vertical offsets in piping runs where low points do not drain by natural flow, and elsewhere as indicated.
   a. Low-Pressure: Close dirt-leg pipe with cap or coupling and plug.
   b. Take-off for trap assembly shall be at least 6 in. above the bottom of the dirt-leg and 18 in. below the bottom of the steam pipe.

4. Flash-Legs: Fabricate flash-legs from oversize pipe; cap pipe ends and mount on pipe stand. Include safety valve.

D. Adjusting and Cleaning:
   1. Cleaning, Flushing and Inspection: Clean, flush, and inspect steam and condensate piping systems.

3.11 INSTALLATION OF STEAM BOILERS

A. Vibration Control and Seismic Restraint: Refer to section 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS.1.

B. General: Install boilers in accordance with manufacturer's installation instructions, in accordance with State and Local Code requirements. Install units plumb and level, to tolerance of 1/8 in. in 10 ft. - 0 in. in both directions. Maintain manufacturer's recommended clearances around and over boilers.

C. Support: Install boilers on 4 in. thick concrete pad, 4 in. larger on each side than base of unit. Provide supplemental structural steel supports (minimum 8 in. high) to elevate boiler to allow proper condensate drainage.

D. Electrical Work: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
   1. Verify that electrical work installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until electrical work is acceptable to equipment Installer.

E. Gas Piping: Connect gas piping to boiler, full size of boiler gas train inlet, provide union with sufficient clearance for burner removal and service.
F. Steam & Condensate Piping: Connect supply and return boiler tappings, with shutoff valve and union or flange at each connection.

G. Regulator Vents: Provide 3/4 in. vent from each main and pilot regulator. Each vent shall terminate outdoors per code requirements.

H. Breeching: Connect breeching to boiler outlet, full size of outlet. Coordinate breeching routing and sizing with Boiler Manufacturer and vent system manufacturer.

I. Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.

J. Hydrostatically test assembled boiler and piping in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.

K. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boiler piping, observation of hydrostatic testing, and for certification of completed boiler units.

L. Start-up boilers, in accordance with manufacturer's start-up instructions, and in presence of boiler manufacturer's start-up representative. Test controls, and demonstrate compliance with requirements. Adjust burner for maximum burning efficiency. Replace damaged or malfunctioning controls and equipment.

M. Owner's Instructions: Provide services of manufacturer's technical representative for 4-hour day to instruct Owner's personnel in operation and maintenance of boilers.

1. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

3.12 INSTALLATION OF TERMINAL HEATING UNITS (STEAM)

A. Vibration Control and Seismic Restraint: Refer to section 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS.1.

B. Installation of Finned Tube Radiation: (Hydronic)

1. General: Install finned tube radiation as indicated, and in accordance with manufacturer's installation instructions.

2. Locate finned tube radiation as indicated, run cover wall-to-wall unless otherwise indicated. Provide butt caps, splice joints, "Z" bends etc. for a complete installation.

3. Install access panels centered in front of each shutoff valve, balancing cock, steam trap, or temperature control valve.
C. Installation of Cabinet Unit Heaters: (Hydronic)
   1. General: Install cabinet heaters as indicated, and in accordance with manufacturer's installation instructions.
   2. Coordinate with other trades to assure correct recess size for recessed units.
   3. Install piping as indicated.
   4. Protect units with protective covers during balance of construction.

D. Adjusting and Cleaning:
   1. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
   2. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
   3. Install new filter units for terminals requiring same.

3.13 INSTALLATION OF POWER AND GRAVITY VENTILATORS

A. Vibration Control and Seismic Restraint: Refer to section 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS.1.

B. General: Except as otherwise indicated or specified, install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that products serve the intended function.

C. Coordinate ventilator work with work of roofing, walls and ceilings, as necessary for proper interfacing.

D. Ductwork: Connect ducts to ventilators in accordance with manufacturer's installation instruction, and details on drawings.

E. Roof Curbs: Furnish roof curbs to roofing Installer for installation.

F. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
   1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

G. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

H. Testing: After installation of ventilators has been completed, test each ventilator to possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.
I. Cleaning: Clean factory-finished surface. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

J. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven power ventilator.

3.14 INSTALLATION OF KITCHEN FIRED MAKE-UP AIR UNITS (MAU)

A. Vibration Control and Seismic Restraint: Refer to section 23 05 48 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 23 05 48 and drawing VS.1.

B. General: Install units where indicated, in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

C. Coordination: Coordinate with other work, including ductwork, floor construction, roof decking, and piping, as necessary to interface installation of units with other work.

D. Access: Provide access space around units for service as indicated, but in no case less than that recommended by manufacturer.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
   1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Section 26 00 00. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.

F. Duct Connections: Provide ductwork, accessories, and flexible connections as indicated.

G. Grounding: Provide positive equipment ground for unit components.

H. Testing: Upon completion of installation of units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

I. Provide two complete extra set of filters for each unit as part of project close-out. In addition, install new filters at completion of system work, and again after completion of testing, adjusting, and balancing work in accordance with MA-CHPs requirements. Provide spare set of filters. Obtain receipt from Owner that new filters have been installed.

J. Provide one spare set of belts for each belt-driven unit, obtain receipt from Owner that belts have been received. Provide one spare set of belts for each belt-driven air handling unit, obtain receipt from Owner that belts have been received.
K. Provide the services of a factory-authorized service representative to start-up rooftop units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

L. Operating and Maintenance Training:
   1. Provide services of manufacturer's service representative (2 hours minimum) to instruct Owner's personnel in operation and maintenance of rooftop units. Training shall include start-up and shut-down, servicing and preventative maintenance schedule and procedures, and trouble-shooting procedures plus procedures for obtaining repair parts and technical assistance.
   2. Schedule training with Owner, provide at least 7-day prior notice to the Architect/Engineer.

3.15 INSTALLATION OF METAL DUCTWORK

A. Installation of Metal Ductwork:
   1. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5 percent leakage for systems rated 3 in. and under; 1 percent for systems rated over 3 in.) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately with internal surface smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
      a. Exposed ductwork shall be supported by air craft cable. Cable shall be sized to match the anticipated weight of the ductwork. Install per manufactures recommendations. Recommend manufacture are Gripple, Rize or approved equal.
   2. Sealing: All ductwork joints and seams shall be sealed with flexible duct sealer to assure an airtight installation.
   3. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 in. Fasten to duct and substrate.
      a. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.
   4. Coordination: Coordinate duct installation with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
   5. Installation: Install metal ductwork in accordance with "SMACNA HVAC Duct Construction Standards".

B. Installation of Duct Liners:
   1. General Install duct liners in accordance with SMACNA "HVAC Duct Construction Standards".

C. Installation of Flexible Ducts:
   1. Maximum Length: For any duct run using flexible ductwork, do not exceed 4 ft.-0 in. extended length.
2. Installation: Install in accordance with Section II of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

D. Field Quality Control:
1. Leakage Tests: After each duct system, test for duct leakage in accordance with SMACNA "HVAC Air Duct Leakage Test Manual". Repair leaks and repeat tests until total leakage is less than that specified in 3.22.A.1.

E. Equipment Connections:
1. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery.

F. Adjusting and Cleaning:
1. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

2. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until final connections are to be completed.

3. Balancing: Refer to Division 23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork. Seal any leaks in ductwork that become apparent in balancing process.

G. Construction IAQ Management:
1. Follow the SMACNA guidelines for “Duct Cleanliness for New Construction Guidelines” according to advanced levels of cleanliness. Including but not limited to:
   a. Ductwork shall be sealed when transported to the construction site and film shall not be removed until ductwork connections are completed.
   b. Store ductwork in clean, dry conditions and keep sealed while it is stored.
   c. Wipe down internal surfaces of ductwork immediately prior to installation to remove dust.
   d. Seal open ends on completed ductwork and overnight work-in-progress.
   e. During installation, protect ductwork waiting to be installed with surface wrapping.
   f. During construction, seal HVAC supply and return openings to protect them from dust infiltration.

3.16 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
B. Install turning vanes in square or rectangular 90 degree elbows in supply, return, and exhaust air systems, and elsewhere as indicated.

C. Install volume and/or splitter damper with adjusting rod in each supply branch. Install according to detail on drawings.

D. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

E. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

F. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

G. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

H. Furnish extra fusible links to owner, one link for every 10 installed of each temperature range; obtain receipt.

3.17 INSTALLATION OF ACOUSTIC DUCT LINING

A. Installation: All portions of duct designed to receive duct liner shall be completely covered. The smooth, black coated surfaces shall face the airstream. All liners shall be cut to assure tight, overlapped corner joints. The top pieces shall be supported by the side pieces. The liner shall be adhered to the sheet metal with full coverage of an approved adhesive that conforms to ASTM C 916, and all exposed leading edges and transverse joints shall be coated with Permacote factory-applied or field-applied edge coating and shall be neatly butted without gaps. Shop or field cuts shall be liberally coated with "Schuller SuperSeal Edge Treatment" or approved adhesive. The liner shall be additionally secured with mechanical fasteners. The pin length should be such as to hold the material firmly in place with minimum compression of the material.

3.18 INSTALLATION OF DUPLEX CONDENSATE RECEIVER

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

B. Installation of Equipment

1. General: Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

2. Comply with installation requirements of local and state boiler codes, and applicable provisions of NFPA and ASME Boiler Code Standards.

3. Support: Install equipment on 4" high concrete pad, where indicated.

4. Accessories: Install equipment accessories not installed at factory.
5. Connections: Connect as indicated, piping, vents, and drains.

6. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.
   a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

C. Field Quality Control

1. General: Start-up equipment, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Closeout Procedures

1. Training: Provide services of manufacturer's technical representative for one 4-hour day to instruct Owner's personnel in operation and maintenance of equipment.
   a. Schedule training with owner, provide at least 7-day notice to Contractor and Engineer of training date.

3.19 INSTALLATION OF AIR OUTLETS AND INLETS

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.20 INSTALLATION OF DUCTLESS COOLING UNIT SYSTEMS

A. Vibration Control And Seismic Restraint: Refer to section 230548 and drawing VS.1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS.1.

B. General:
   1. Verify all dimensions by field measurements. Verify roof structure, mounting supports, wall structure, and membrane installations are completed to the proper point to allow installation of wall mounted and roof mounted units. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation. Do not proceed until unsatisfactory conditions have been corrected.
2. Install equipment in accordance with manufacturer’s installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Field Quality Control:
   1. Provide the services, to include a written report, of a factory authorized service representative to examine the field assembly of the components, installation, and piping and electrical connections.
   2. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

D. Demonstration:
   1. Provide the services of a factory authorized service representative to provide start-up service and to demonstrate and train the Owner’s maintenance personnel as specified below.
   2. Start-up service: Place units into operation and adjust controls and safeties. Replace damaged or malfunctioning components and controls.

E. Training:
   1. Train the Owner's maintenance personnel on start-up and shut-down procedures, troubleshooting procedures, and servicing and preventative maintenance schedules and procedures.
   2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice. Measure sound levels in field under full load conditions and included in start-up report.

3.21 INSTALLATION OF CONDENSATE DISCHARGE PUMPS

A. Examine areas and conditions under which pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

B. Installation Of Equipment
   1. General: Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in drain pans and locations indicated, and maintain manufacturer's recommended clearances.
   2. Accessories: Install equipment accessories not installed at factory.
   3. Connections: Connect discharge piping as indicated and terminate where indicated on the contract documents.
   4. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.
      a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
C. Field Quality Control
   1. General: Start-up equipment, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Closeout Procedures
   1. Training: Instruct Owner's personnel in operation and maintenance of condensate discharge pumps.

3.22 INSTALLATION OF HEATED AIR CURTAIN

A. Examination
   1. Verify that door frame and adjacent construction are installed correctly and are ready to receive work of this Section.
   2. Verify that utilities are in correct location and are of correct capacities for specified products.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation
   1. Install air curtains where indicated on Drawings and accordance with [shop drawings and] manufacturer’s instructions. Provide clearance to permit servicing and maintenance.
   2. Securely install air curtains plumb, level, and as close as practical to top of opening and face of wall.
   3. Install switches where indicated on Drawings.

C. Connections
   1. Connect air curtain to utilities as specified in Division 23 and Division 26 section.

D. Field Quality Control
   1. Provide a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
   2. Test and operate air curtain to be sure that it performs as intended.

E. Adjusting
   1. Adjust fan speed to prepare installed products to perform properly.
   2. Adjust discharge nozzles to deflect air outward.

F. Cleaning
   1. Clean air curtain prior to commissioning.
   2. Repair or repaint damage to finishes on exposed-to-view surfaces.
G. System Startup
   1. Test and operate air curtains to ensure that they perform as intended. Adjust discharge nozzles to deflect air outward.

H. Demonstration
   1. Demonstrate for Owner’s maintenance personnel how to adjust, operate, and maintain air curtains.

3.23 INSTALLATION OF FIRESTOP SYSTEMS
A. General: Install firestop/smoke seal systems at all fire and/or smoke rated construction where penetrated by the Work of this Section.
B. Refer to Section 078400 - Firestopping, for all installation requirements for maintaining integrity of fire and/or smoke rated construction at penetrations.

3.24 INSTALLATION OF WALL AND CEILING ACCESS DOORS
A. General: Install access doors in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
B. All access doors shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that the item or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 in. X 16 in.). Furnish access doors to permit thorough inspection. When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.

3.25 AUTOMATIC TEMPERATURE CONTROLS (DDC)
A. Installation Of Automatic Temperature Controls (DDC):
   1. Installation of Control Systems:
      a. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.
      b. Control Wiring: Install control wiring, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code.
         1) Install circuits over 25-volt with color-coded No. 12 wire in electric metallic tubing.
         2) Install circuits under 25-volt with color-code No. 18 wire with 0.031 in. high temperature 105 degrees F. (41 degrees C) plastic insulation on each conductor and plastic sheath over all.
         3) Install electronic circuits with color-coded No. 22 wire with 0.023 in. polyethylene insulation on each conductor with plastic-jacketed copper shield over all.
4) Install low voltage circuits, located in concrete slabs, masonry walls, or in mechanical areas, in electrical conduit. Where exposed in occupied areas install all wiring in wiremold.
5) Power sources from lighting circuits and wall outlets shall not be used to power DDC controllers.

**c. Controllers and safety devices:**

1) All safety devices such as freezestats, duct mounted heat detectors, and smoke detectors shall be hard wired to shut down the fans independently. Provide audible alarm with silence switch as well as DDC indication.
2) Humidifier controls shall be hard wired through fan proof flow differential switch and starter auxiliary contacts to disable humidifier system on fan shutdown. Provide DDC indication.
3) All supply, return and exhaust fans shall be provided with pressure differential switches. Current sensing devices, starter auxiliary contacts, and relay contacts are unacceptable proof of fan operation.
4) Primary and standby pumps shall be selectable through the DDC control system. Provide local pilot light to indicate selected pump as well as alarm and silence switch for failed pump. Provide differential pressure switch to prove flow.

2. **Adjusting and Cleaning:**

a. **Start-Up:** Start-up, test, and adjust DDC control systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

b. **Cleaning:** Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

c. **Final Adjustment:** After completion of installation, adjust thermostats, control valves, motor and similar equipment provided as work of this section.

1) Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

3. **Closeout Procedures:**

a. **Owner's Instructions:** Provide services of manufacturer's technical representative for 40 hours of onsite instruction and training on operating, running and basic troubleshooting of DDC control system.

b. **Validation:** The automatic temperature control sub-subcontractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequence of operation submitted.

1) Witnessed validation demonstration shall consist of:
   a) Execute digital and analog commands in English and graphic mode.
   b) Demonstrate all specified diagnostics.
   c) Demonstrate scan, update, and alarm responsiveness.

2) Comply with SECTION 019113 – COMMISSIONING REQUIREMENTS and SECTION 017855 – LEED SYSTEMS MANUAL.

c. **Training:**

1) All training shall be by the automatic temperature control sub-subcontractor and shall utilize specified manuals and as-built documentation.

HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) 230000 - 117
2) Operator training shall include:
   a) Sequence of Operation review.
   b) Sign on-Sign off.
   c) Modifying warning limits, alarm limits and start-stop times.
   d) System initialization.
   e) Use of Portable Operators Terminal.
   f) Troubleshooting of sensors (determining bad sensors).
   g) Point disable/enable.
   h) Software review of Sequence of Operation programs.
   i) Modification of control programs.
   j) Add/Delete/Modify data points.
   k) Use of diagnostics.
   l) Review of initialization.

3) Training shall be for Owner-designated personnel at the subject site, and shall be scheduled by the Owner with two week notice.

4) All training sessions shall be videotaped.

5) Seasonal Site Visits:
   a) In addition to the one year warranty period against component or workmanship defects, 40 hours of training and 40 hours of extra programming as it relates to the control system and as indicated in section 230000 paragraph 2.27 and 3.27, the ATC sub-subcontractor shall provide a seasonal site visit to confirm, verify and modify as required the sequence and/or programming of each piece of equipment to ensure the system is functioning as required and per the sequence of operations. The ATC sub-subcontractor shall provide 16 labor hours per season (four times within a year, total of 64 hours). During each visit they shall, for each piece of equipment confirm operation and functionality, modify and/or repair any control related issues and/or programming and provide training as requested by the owner. This requirement will ensure the equipment/building is operating properly and efficiently as it cycles through each season. These site visits shall begin the following season after substantial completion of the project is issued. Upon substantial completion the engineer of record shall issue four dates to the ATC sub-subcontractor and owner. Signatures and time logs will be kept by both parties to ensure these visits occur.

B. Perform Indoor Air Quality Management Building flush out procedures and adhere to IAQ Management Procedures referenced in Section 018119 – INDOOR AIR QUALITY REQUIREMENTS.
3.26 TESTING, ADJUSTING, AND BALANCING

A. REQUIREMENTS:
   1. Requirements include verification of HVAC system operation, measurement of all system
capacity, and establishment of the quantities of the mechanical systems as required to meet
specifications, and recording and reporting the results.
   2. Commission, test, adjust and balance the following mechanical systems:
      a. Supply air systems.
      b. Return air systems.
      c. Exhaust air systems.
      d. Outside air systems.
      e. Steam heating systems.
      f. Verify temperature control system operation.
   3. Do not include:
      a. Testing boilers and pressure vessels for compliance with safety code.
      b. Installation of adjusting and balancing devices. If devices must be added to achieve
proper adjusting and balancing. Contact Mechanical Contractor and the Engineer
for direction.
   4. Comply with Commissioning Test Requirements in Section 019113 and 017855.

B. REPORT:
   1. Format: Report forms shall be those standard forms prepared by the referenced standard
for each respective item and system to be tested, adjusted, and balanced. Bind report
forms complete with schematic systems diagrams and other data in reinforced, vinyl,
three-ring binders. Provide binding edge labels with the project identification and a title
descriptive of the contents. Forms providing test measurements shall indicate piece of
equipment, room number, and terminal outlet. In the case of multiple outlets in room,
cross-reference on plan as part of TAB submittal. Divide the contents of the binder into
the below listed divisions, separated by divider tabs:
      a. General Information and Summary.
      b. Air Systems.
      c. Hydronic heating and cooling systems.
      d. Temperature Control Systems.
   2. Contents: Provide the following minimum information, forms and data:
      a. General Information and Summary: Inside cover sheet to identify testing, adjusting,
and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include
addresses, and contact names and telephone numbers. Also include a
certification sheet containing the seal and name address, telephone number, and
signature of the Certified Test and Balance Engineer. Include in this division a
listing of the instrumentation used for the procedures along with the proof of
 calibration.
b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC for each respective item and system.

c. Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

C. QUALITY ASSURANCE:

1. An independent testing, adjusting, and balancing agency certified by the AABC or NEBB as a Test and Balance Engineer in those testing and balancing disciplines required for this project.

2. Codes and Standards:
   a. AABC: "National Standards For Total System Balance".

3. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and Mechanical Contractor. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

4. System Operation: Systems shall be fully operational prior to beginning procedures. All new automatic temperature controls shall be fully operational. Test, adjust and balance the air systems before refrigerant systems. Test, adjust and balance air conditioning systems during summer season, and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg F. wet bulb temperature of maximum summer design condition, and within 10 deg F. dry bulb temperature of minimum winter design condition. Take final temperature reading during seasonal operation.

D. PRELIMINARY PROCEDURES:

1. Air Systems:
   a. Obtain drawings and become thoroughly acquainted with the systems.
   b. Compare drawings to installed equipment and field installations.
   c. Walk the system from the system air handling equipment to terminal units to determine variations in installation.
   d. Check filters for cleanliness.
   e. Check all dampers (volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
   f. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a cross check with required fan volumes.
   g. Determine best locations in main and branch ductwork for most accurate duct traverses. Traverses shall be performed in each supply and return duct main and sub-mains for each AHU and return air fan.
   h. Place outlet dampers in the full open position.
   i. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
   j. Verify lubrication of all motors and bearings.
   k. Check fan belt tension.
1. Check fan rotation.

2. Measurements:
   a. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerance specified in the referenced standards. Instruments shall be properly maintained and protected against damage.
   b. Provide instruments meeting the specifications of the referenced standards.
   c. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
   d. Apply instrument as recommended by the manufacturer.
   e. Use instruments with minimum scale and maximum subdivisions and with scaled ranges proper for the value being measured.
   f. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.
   g. Take all reading with the eye at the level of the indicated value to prevent parallax.
   h. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
   i. Take measurements in the system where best suited to the task.

E. Performing Testing, Adjusting, and Balancing:

1. Test, adjust and balance all noted systems according to SMACNA standards and as follows:
   a. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
   b. Cut insulation and ductwork for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
   c. Patch insulation, ductwork, and housings, using materials identical to those removed.
   d. Seal ducts and test for and repair leaks.
   e. Seal insulation to re-establish integrity of the vapor barrier.
   f. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
   g. Retest, adjust and balance system subsequent to significant system modifications, and resubmit test results.

2. System Deficiencies:
   a. The Balancing Contractor shall advise the Mechanical Contractor and the Engineer of all system deficiencies in writing. Report all motors not running, missing dampers, inoperative valves and controls, lack of access.
   b. Upon completion of system deficiencies, Balancing Contractor shall balance and record data.
F. MANUFACTURER'S REPRESENTATIVE AND COMMISSIONING OF SYSTEMS:

1. Each Contractor shall provide, at appropriate time or as directed by the Architect, the onsite services of a competent factory trained Engineer or authorized representative of particular manufacturer of equipment provided under his contract, such as for the ductless cooling units, boilers, condensate handling systems, automatic temperature controls, building automation system (BAS), Boiler Plant Controller, condensate & feedwater pumps, make-up air unit and exhaust fans as provided under this Contract, to instruct the Owner, inspect, adjust and place in proper operating condition any item provided by him, as applicable. The equipment manufacturer will be part of the official equipment startup and the scheduled functional performance test with the commissioning authority. The contractor is to carry this allowance in his cost at no additional expense to the Owner.

2. The HVAC Subcontractor, as applicable, shall commission and set in operating condition all major equipment and systems, such as the steam heating system and all ductless heating/cooling systems, in the presence of the applicable equipment manufacturer's representatives, and the Owner and Architect's representatives. In no case will major systems and equipment be commissioned by any of the Contractor's forces alone, without the assistance or presence of the equipment manufacturers.

3. A written report shall be issued by the particular equipment manufacturer and the Mechanical Contractor summarizing the results of the commissioning and performance of each system for the Architect's record. No additional compensation will be allowed for any Contractor for such services.

4. The Contractor shall prepare and submit to the Architect for acceptance, a schedule of anticipated system commissioning. No system shall be commissioned without prior acceptance of the schedule by the Architect and Owner. No systems shall be commissioned prior to submittal and acceptance of a formal System Readiness form signed by the appropriate sub-contractors.

5. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the installer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.

6. Provide any recommendation for system modification in writing to Owner. Do not make any system modification, including operating parameters and control settings, without prior approval of Owner.

G. Subject to compliance with the above requirements and certifications, provide the services of independent air and water testing and balancing contractor:

1. Thomas Young – Marion, MA
2. The THB Company – Reading, MA
3. American Testing And Balancing – South Brookline, MA
4. Air Balance Inc. – Woburn, MA
5. Regional Air Balance Co. – Norwood, MA

END OF SECTION 230000
SECTION 23 05 48

VIBRATION CONTROL AND SEISMIC RESTRAINT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
1.02 DESCRIPTION
1.03 SUBMITTAL DATA REQUIREMENTS
1.04 CODE AND STANDARDS REQUIREMENTS
1.05 MANUFACTURER’S RESPONSIBILITY
1.06 RELATED WORK
1.07 DESIGN REQUIREMENTS
1.08 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.01 INTENT
2.02 PRODUCT DESCRIPTIONS

PART 3 - EXECUTION

3.01 GENERAL
3.02 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF PIPING, DUCTWORK, AND CONDUIT
3.03 SEISMIC RESTRAINT EXCLUSIONS
3.04 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

END OF INDEX 230548
SECTION 230548
VIBRATION CONTROL AND SEISMIC RESTRAINT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION

A. General: The work noted within Section 230548 is referenced by Divisions 210000, 220000, 230000, and 260000. Provide all necessary labor & material in each division as required herein.

B. Intent:
   1. All mechanical, plumbing, fire protection & electrical equipment, piping, conduits and ductwork shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
   2. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
   3. It is the intent of the seismic portion of this specification to keep all mechanical, plumbing, fire protection and electrical building system components in place during a seismic event.
   4. All such systems must be installed in strict accordance with seismic codes, component manufacturer's, and building construction standards. Whenever a conflict occurs between the manufacturer's or construction standards, the most stringent shall apply.
   5. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).
   6. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.
C. The work in this section includes, but is not limited to the following:

1. Vibration isolation for piping, conduits, ductwork and equipment.
2. Equipment isolation bases.
3. Flexible piping connections.
4. Seismic restraints for isolated equipment.
5. Seismic restraints for non-isolated equipment.
6. Certification of seismic restraint designs and installation supervision.
7. Certification of seismic attachment of housekeeping pads.
8. All mechanical, plumbing, fire protection and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical. (Equipment not listed is still included in this specification).

<table>
<thead>
<tr>
<th>AC Units</th>
<th>Generators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Cooled Condensing Units</td>
<td>Heat Exchangers</td>
</tr>
<tr>
<td>Air Handling Units</td>
<td>Light Fixtures</td>
</tr>
<tr>
<td>Air Separators</td>
<td>Motor Control Ctrs</td>
</tr>
<tr>
<td>Battery Racks</td>
<td>Piping</td>
</tr>
<tr>
<td>Boilers</td>
<td>Pumps (all types)</td>
</tr>
<tr>
<td>Bus Ducts</td>
<td>Rooftop Units</td>
</tr>
<tr>
<td>Cable Trays</td>
<td>Switching Gear</td>
</tr>
<tr>
<td>Chillers</td>
<td>Tanks (all types)</td>
</tr>
<tr>
<td>Comp. Room Units</td>
<td>Transformers</td>
</tr>
<tr>
<td>Conduit</td>
<td>Unit Heaters</td>
</tr>
<tr>
<td>Cooling Towers</td>
<td>Unit Substations</td>
</tr>
<tr>
<td>Ductwork</td>
<td>Var. Freq. Drives</td>
</tr>
<tr>
<td>Electrical Panels</td>
<td>VAV Boxes</td>
</tr>
<tr>
<td>Fans (all types)</td>
<td>Water Heaters</td>
</tr>
</tbody>
</table>

D. Definitions:

1. Life Safety Systems
   a. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
   b. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers, and all flowpaths to fire protection and/or emergency lighting systems.
   c. All medical and life support systems.
   d. Fresh air & relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.
2. Positive Attachment
   a. A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a
double sided beam clamp loaded perpendicular to a beam, or a welded or bolted
connection to structure. Single sided "C" type beam clamps for support rods of
overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable
trays, etc. are not acceptable as seismic anchor points.

3. Transverse Bracing
   a. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe,
duct or conduit.

4. Longitudinal Bracing
   a. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or
conduit.

1.03 SUBMITTAL DATA REQUIREMENTS

A. In addition to requirements of Section 013300, the manufacturer of vibration isolation and
seismic restraints shall provide submittals for products as follows:

1. Descriptive Data
   a. Catalog cuts or data sheets on vibration isolators and specific restraints detailing
compliance with the specification.
   b. Detailed schedules of flexible and rigidly mounted equipment, showing vibration
isolators and seismic restraints by referencing numbered descriptive drawings.

2. Shop Drawings
   a. Submit fabrication details for equipment bases including dimensions, structural
member sizes and support point locations.
   b. Provide all details of suspension and support for ceiling hung equipment.
   c. Where walls, floors, slabs or supplementary steel work are used for seismic
restraint locations, details of acceptable attachment methods for ducts, conduit and
pipe must be included and approved before the condition is accepted for
installation. Restraint manufacturers' submittals must include spacing, static loads
and seismic loads at all attachment and support points.
   d. Provide specific details of seismic restraints and anchors; include number, size and
locations for each piece of equipment.

3. Seismic Certification and Analysis
   a. Seismic restraint calculations must be provided for all connections of equipment
to the structure. Calculations must be stamped by a registered professional
engineer with at least five years of seismic design experience, licensed in the state
of the job location.
b. All restraining devices shall have a pre-approval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 450 to the weakest mode.

c. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embodiment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces required acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

1.04 CODE AND STANDARDS REQUIREMENTS

A. Typical Applicable Codes, Standards, and Categories:
   1. International Building Code 2009 with an effective peak acceleration coefficient of 0.15.
   3. Seismic hazard exposure group of I, II, III and seismic performance category of C, D.

1.05 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
   1. Determine vibration isolation and seismic restraint sizes and locations.
   2. Provide vibration isolation and seismic restraints.
   3. Provide calculations and materials if required for restraint of unisolated equipment.
   4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

1.06 RELATED WORK

A. Housekeeping Pads:
   1. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embodiment.

B. Supplementary Support Steel:
   1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment.

VIBRATION CONTROL AND SEISMIC RESTRAINT
230548 - 4
C. Attachments:
   1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

1.07 DESIGN REQUIREMENTS

A. Design isolators for equipment installed outdoors to provide adequate restraint to withstand the force of a 100 mph wind applied to any exposed surface of the isolated equipment. Isolators for outdoor equipment shall have bolt holes for attachment to equipment and to supports. The vibration isolation Vendor shall submit verifying shear and overturning calculations, for their product and equipment installation arrangement, stamped by a licensed Professional Engineer. The design and supply of miscellaneous support steel above and below isolators will not be the responsibility of the vibration isolation manufacturer.

1.08 QUALITY ASSURANCE

A. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.

B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.

C. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet the requirements stated herein, even if not expressly specified or shown on the drawings, without claim for additional payment.

D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.

E. Should any rotating equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

PART 2 - PRODUCTS

2.01 INTENT

A. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer. Mason Industry's products are the basis of these specifications; products of other manufacturers are acceptable provided their systems strictly comply with the specification.
B. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8 inch and/or horizontal permanent deformation greater that 1/4 inch.

2.02 PRODUCT DESCRIPTIONS

A. Vibration Isolators and Seismic Restraints.

GENERAL:
2. Isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.
3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not degrade the isolation performance of the isolators.
4. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

SPECIFICATION:
1. Two layers of 3/4" thick neoprene pad consisting of 2" square waffle modules separated horizontally by a 16-gauge galvanized shim. Load distribution plates shall be used as required. Pads shall be Type Super "W" as manufactured by Mason Industries, Inc.
2. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2" and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be Type BR as manufactured by Mason Industries, Inc.
3. Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality. Bushing assemblies shall be type PB as manufactured by Mason Industries, Inc.
4. A one (1) piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact. Neoprene bushings shall be type HG as manufactured by Mason Industries, Inc.

5. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be Type SLF as manufactured by Mason Industries, Inc.

6. Restrained spring mountings shall have an SLF mounting as described in Specification 5, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces. Mountings shall have Anchorage Pre-approval "R" Number from OSHPD in the state of California certifying the maximum certified horizontal and vertical load ratings. Mountings shall be SLR as manufactured by Mason Industries, Inc.

7. Spring mountings as in specification 5 built into ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 1/4 inch travel in all directions before contacting the resilient snubbing collars. Mountings shall have an Anchorage Pre-approval "R" number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be SSLFH as manufactured by Mason Industries, Inc.

8. Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three leveling valves to maintain leveling within plus or minus 1/8". Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician. Air Springs shall be Type MT and leveling valves Type LV as manufactured by Mason Industries, Inc.

9. Restrained air spring mountings shall have an MT air spring as described in Specification 8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces. Mountings shall be SLR-MT as manufactured by Mason Industries, Inc.

VIBRATION CONTROL AND SEISMIC RESTRAINT
230548 - 7
10. Hangers shall consist of rigid steel frames containing minimum 1 1/4" thick neoprene elements at the top and a steel spring with general characteristics as in specification 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability, the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30° capability. Hangers shall be type 30° as manufactured by Mason Industries, Inc.

11. Hangers shall be as described in specifications 10, but they shall be pre-compressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc.

12. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all directional restraint. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California verifying the maximum certified load ratings. Cable assemblies shall be Type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam all as manufactured by Mason Industries, Inc.

13. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage pre-approval "R" number from OSHPD in the state of California verifying the maximum certified load ratings. Solid seismic brace assemblies shall be type SSB as manufactured by Mason Industries, Inc.

Note: Specifications 12 - 14 apply to trapeze as well as clevis hanger locations. At trapeze anchor locations piping must be shackled to the trapeze. Specifications apply to hanging equipment as well.

14. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California. Rod clamp assemblies shall be Type SRC as manufactured by Mason Industries, Inc.

15. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose performed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California. Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.
16. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 inch thick. Rated loading shall not exceed 1,000 psi. A minimum air gap of 1/8 inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated. Snubbers shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Snubber shall be Type Z-1 225 as manufactured by Mason Industries, Inc.

17. All directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4" thick. Rated loadings shall not exceed 1,000 psi. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" nor more that 1/4". Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8" deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable "G" force. Submittals shall include the load deflection curves up to 1/2" deflection in the x, y and z planes. Snubbers shall have an anchorage pre-approval "R" number from OSHPD in the state of California verifying the maximum certified horizontal and vertical load ratings. Snubbers shall be series Z-101 1 as manufactured by Mason Industries, Inc.

18. Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is "rolled up" to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads. Drill-in stud wedge anchors shall be type SAS as manufactured by Mason Industries, Inc.

19. Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying to its allowable loads. Drill-in female wedge anchors shall be type SAB as manufactured by Mason Industries, Inc.

20. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14' provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1 " . Bases shall be type WF as manufactured by Mason Industries, Inc.
21. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/1 2 of the longest dimension of the base but not less than 6". The base depth need not exceed 1 2" unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" bars welded in place on 6" centers running both ways in a layer 1 1/2" above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1 " clearance below the base. Wooden formed bases leaving a concrete rather than a steel finish are not acceptable. Base shall be type BMK or K as manufactured by Mason Industries, Inc.

22. Roof Curb (by HVAC Contractor)
   a. Curb mounted rooftop equipment shall be mounted on structural spring isolation curbs that bear directly on the roof support structure, and are flashed and waterproofed into the roof's membrane waterproofing system. All spring locations shall have removable waterproof covers to allow for spring adjustment and/or removal. Springs shall be Type A.
   b. Unit shall be provided with wood nailer and flashing.
   c. Curbs shall meet all NRCA Standards.
   d. Curbs shall be similar to Novia Associates VibCurb III or equal having a minimum 3" rated static deflection and be 18" high.
   e. Vibration control: The spring roof curb shall have the top isolated or floating rail attached in a manner to the fixed lower portion of the curb without short circuiting or bridging between the two. Restraining bolt(s) or threaded rod shall be of sufficient size to withstand the applied wind & or seismic forces at each spring pack location.
   f. An alignment bolt shall be installed before connecting the floating to non-floating parts to guarantee perfect centering of the restraining bolts.
   g. Weather proofing & air seal: The spring curb must keep the weather (air and water) out and any airflow from the RTU in. The weather seal must not have the ability to fail and allow water or air into the building.
   h. The use of exposed exterior neoprene or some other elastomer material to seal the top floating rail from the base of the curb in not acceptable.
   i. Vibration Mountings: Provide a rubber gasket covered by formed galvanized sheet metal top flashing that overhangs the top wood nailer and galvanized bottom flashing. The overlapping shall effectively cover the rubber gasket so it is protected from the elements.
   j. The top flashing / support rail shall be 14 ga. G60–Zc steel formed with 90 bends that extend down to the wood nailer. Provide a counter flashing member with a sponge gasket attached that presses up against the horizontal bend. The seal shall be replaceable, protected from the elements and easy to install.
   k. Curb side material: Provide 12 Ga. G60 galvanized steel for curb side construction. All side and end seam between sheets shall be continuously welded, corner joints to be caulked and bolted.
I. Structural Capability:

1) Curbs shall be installed on metal decking/concrete slab. Air handling unit load shall be properly distributed. Coordinate curb construction with pitch of roof. Curbs shall be built to match the roof pitch in accordance with all requirements of this project. Positive attachment of the curb to the structure is imperative. Pitch correction shall be fabricated from 12-gauge galvanized material and be continuous on all sides and ends. Field fabricated and installed tube steel stub-ups are not acceptable. HVAC contractor shall provide detailed information to the curb manufacturer regarding pitch correction.

2) Plenum Sections: The side material must be capable of handling the static pressure developed by the fans and not ‘oil can’. Provide spanning bar joists as required to support plenum installation (even when the spring pockets are center span).

3) Provide a continuous bottom tube steel member or side material of sufficient strength. Mechanical contractor shall coordinate and verify all dimensions, weights, roof penetrations, etc. with the Structural Engineer prior to installation.

4) Curb Insulation: Provide spring curbs with a space between the floating and non-floating parts for the installation of insulation. Curb manufacturer shall provide factory installed insulation adhered to roof curb. Curbs shall be externally factory insulated with a 1.7” thick R-12 foam insulation, FM Class 1 and UL Class A Ratings, with bonded fiber reinforced facer.

m. Protection: Curbs shall be completely shrink-wrapped during shipping.

n. Mechanical contractor shall provide all necessary materials to completely weather proof and sound proof the curb installation.

o. Additional features:

1) Sound barrier: Provide a sound barrier package, consisting of G60 galvanized back-to-back angles. Sound barrier package shall be capable of supporting two layers of 1/2” concrete board with a maximum deflection over the width of the curb of L/360. Cement board furnished and installed by the HVAC Contractor. Overlap all joints, caulk all seams and edges. Transmission Loss & STC shall be as shown as follows. Sound Transmission Loss at Frequency (Cycles per second) of (125)=20, (250)=27, (500)=30, (1000)=32, (2000)=30, (4000)=38, (STC)=31.

2) Provide with framed Supply & Return air duct openings. Openings shall match duct sizes and have 1” galvanized steel flanges.
3) Plenum sections: Where indicated on the drawings, provide in the interior of the curb, double wall acoustical floor, walls and plenum divider. All insulation shall be 2" thick fiber glass acoustical duct liner with reinforced coating system. Insulation acoustical performance shall be as follows. Liner shall not support microbial growth and shall be EPA registered and pass ASTM C 1071 & ASTM G21 bacterial tests conducted in accordance with ASTM G22. Floors up to 90" curb I.D. width shall be constructed of 22 Ga., 20 Ga. thereafter, solid G60 galvanized bottom panels and 22 Ga. galvanized perforated 22.7% open area top panel. Floor shall be attached to walls and plenum divider to provide an airtight plenum. Walls shall have 22 Ga. galvanized perforated 22.7% open area inside panels. Plenum divider shall be double wall 22 Ga. perforated galvanized 22.7% open area panel on the supply side with a 14 gauge solid panel opposite. Sound Absorption Coefficient at Frequency (Cycles per second) of (125)=.23, (250)=.64, (500)=.99, (1000)=1.05, (2000)=1.00, (4000)=.98, (NRC)=.90.

23. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Dacron tire cord friction ring. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" and larger shall have two spheres reinforced with a ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16' to 24" may be single sphere. Sizes 3/4" to 1 1/2" may have threaded bolted flange assemblies, one sphere and cable retention. 14" and smaller connectors shall be rated at 250 psi up to 190°F with a uniform drop in allowable pressure to 190 psi at 250°F. 16" and larger connectors are rated 180 psi at 190°F and 135 psi at 250°F. Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5-minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods, as control rods are not desirable in seismic work. If control rods are used, they must have 1/2" thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi maximum on the washer area. Expansion joints shall be installed on the equipment side of the shut off valves.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be SAFE FLEX SFDEJ, SFEJ, SFDSC or SFU and Control Rods CR as manufactured by Mason Industries, Inc.
24. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3” and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:

<table>
<thead>
<tr>
<th>Flanged</th>
<th>Male Nipples</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 x 14</td>
<td>10 x 26</td>
</tr>
<tr>
<td>4 x 15</td>
<td>12 x 28</td>
</tr>
<tr>
<td>5 x 19</td>
<td>14 x 30</td>
</tr>
<tr>
<td>6 x 20</td>
<td>16 x 32</td>
</tr>
<tr>
<td>8 x 22</td>
<td>1-1/4 x 12</td>
</tr>
<tr>
<td>1/2 x 9</td>
<td>2 x 14</td>
</tr>
<tr>
<td>3/4 x 10</td>
<td>2-1/2 x 18</td>
</tr>
</tbody>
</table>

Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be type BSS as manufactured by Mason Industries, Inc.

25. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be type ADA as manufactured by Mason Industries, Inc.

26. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of + 1 5/8" motion, or to meet location requirements. Pipe guides shall be type VSG as manufactured by Mason Industries, Inc.

27. Split Wall Seals consist of two bolted pipe halves with minimum 3/4" thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1” past either face of the wall. Where temperatures exceed 240°F., 10# density fiberglass may be used in lieu of the sponge. Seals shall be Type SWS as manufactured by Mason Industries, Inc.

28. The horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup as described in specification 5 with the same deflection as specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the duct work or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit. Horizontal thrust restraints shall be type WBI/WBD as manufactured by Mason Industries, Inc.
PART 3 - EXECUTION

3.01 GENERAL

A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturer's written instructions and all certified submittal data. At the completion of all construction work the vibration and seismic device supplier shall inspect all installations and provided a written report of installation compliance to the engineer of record. A copy of this written certification shall also be provided in the operations manual provided to the owner.

B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineer's attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor’s expense.

G. Bring to the architects/engineer’s attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor’s expense.

H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractor’s expense.

I. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
   1. Flanges of structural beams.
   2. Upper truss cords in bar joist construction.
   3. Cast in place inserts or wedge type drill-in concrete anchors.

J. Specification 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.

K. Specification 12 cable assemblies are installed taut on non-isolated systems. Specification 13 seismic solid braces may be used in place of cables on rigidly attached systems only.
L. At locations where specification 12 or 13 restraints are located, the support rods must be braced when necessary to accept compressive loads with specification 14 braces.

M. At all locations where specification 12 or 13 restraints are attached to pipe clevis's, the clevis cross bolt must be reinforced with specification type 15 braces.

N. Drill-in concrete anchors for ceiling and wall installation shall be specification type 18, and specification type 19 female wedge type for floor mounted equipment.

O. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.

P. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24" or specified movements exceed specification 23 capabilities.

Q. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide specification 27 wall seals.

R. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be specification type 28.

S. Locate isolation hangers as near to the overhead support structure as possible.

3.02 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF PIPING, DUCTWORK, AND CONDUIT

A. Where piping connects to rotating or vibrating mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.

B. Seismic Restraint of Piping:
   1. Seismically restrain all piping listed as a, b or c below. Use specification 12 cables.
      a. Fuel oil piping, gas piping, medical gas piping, and compressed air piping.
      b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1 1/4" I.D. and larger.
      c. All other piping 2 1/2" diameter and larger.
   2. Transverse piping restraints shall be at 40' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
   3. Longitudinal restraints shall be at 80' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
   4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
   5. For fuel oil and all gas piping transverse restraints must be at 20' maximum and longitudinal restraints at 40' maximum spacing.
6. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" of the elbow or TEE or combined stresses are within allowable limits at longer distances.

7. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.

8. Branch lines may not be used to restrain main lines.

C. Pipe Isolation

1. All chilled water, condenser water, hot water, steam, refrigerant, drain and engine exhaust piping that is connected to vibration-isolated equipment shall be isolated from the building structure within the following limits:
   - Within mechanical rooms;
   - Within 50' total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.);
   - At every support point for piping that is greater than 4 inches in diameter.

2. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.

3. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2", Type FSN or HSN isolators shall be used. When the required static deflection is less than or equal to 1/2", Type FN or HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or HN achieving at least 1/4" static deflection.

4. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.

5. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

6. Provide flexible pipe connections as called for under Major Equipment above and wherever shown on the drawings.

D. Seismic restraint of ductwork:

1. Seismically restrain all duct work with specification 12 or 13 restraints as listed below:
   a. Restrain rectangular ducts with cross sectional area of 6 sq. ft. or larger.
   b. Restrain round ducts with diameters of 28" or larger.
   c. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
      1) Transverse restraints shall occur at 30' intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
2) Longitudinal restraints shall occur at 60' intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.

3) The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.

4) A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.

5) Walls, including gypsum board nonbearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

E. Duct Isolation:
1. All sheet metal ducts and air plenums that are within mechanical rooms or within a distance of 50' total duct length of connected vibration-isolated equipment (whichever is longer) shall be isolated from the building structure by Type FN, PCF or HN isolators. All isolators shall achieve 0.1" minimum static deflection.

2. Ducts within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

3. Flexible duct connections shall be provided as called for above under Major Equipment and wherever shown on the drawings.

F. Seismic Restraint of Electrical Services:
1. All electrical conduit 2-1/2" in diameter and larger shall be restrained with specification type 12 seismic cable restraints or specification type 13 for seismic solid brace restraints.

2. All electrical bus ducts, cable trays and ladder trays shall be restrained with specification type 12, seismic cable restraints or specification 13 seismic solid brace restraints.

3. Transverse restraints shall occur at 30' intervals or both ends if the electrical run is less than the specified interval. Transverse restraints shall be installed at each electrical services turn and at each end of the electric run.

4. Longitudinal restraints shall occur at 60' intervals with at least one restraint per electric run. Transverse restraints for one electric section may also act as a longitudinal restraint for a duct for an electric section connected perpendicular to it if the restraints are installed within 4' of the intersection of the electric run and if the restraints are sized for the larger electric run.

5. All rigid floor mounted equipment must have a resilient media between the equipment mounting hole and the anchor bolt. Neoprene bushings shall be specification type 4 and anchor bolts shall be specification type 18 or 19.
6. Wall mounted panels shall be mounted with specification type 3 bushings. Floor mounted panels shall be mounted on specification type 4 bushings. Anchor bolts shall be specification type 18 or 19.

G. All fire protection piping shall be braced in accordance with NFPA 13 and 14.

H. All mechanical equipment shall be vibration isolated and seismically restrained.
   1. All fire protection equipment is considered life safety equipment and shall be seismically restrained.

3.03 SEISMIC RESTRAINT EXCLUSIONS

A. Piping:
   1. All piping less than 2 1/2” except for gas and fire protection piping.
   2. All piping in boiler and mechanical equipment rooms less than 1 1/4” I.D.
   3. All clevis or trapeze supported piping suspended from hanger rods where the point of attachment is less than the 12” in length from the structure to the structural connection of the clevis or trapeze.
      a. All PVC and fiberglass suspended waste or vent pipe 6” in diameter and smaller.

B. Ductwork:
   1. Rectangular, square or oval ducts less than 6 sq.ft. in cross sectional area.
   2. Round duct less than 28” in diameter.
   3. Duct supported by hanger rods where the point of attachment is less than 12” in length from the structure to the structural connection of the duct work.

C. Electrical:
   1. All conduit less than 2 1/2” diameter suspended by individual hanger rods.
   2. All clevis or trapeze supported conduits suspended by hanger rods where the point of attachment is less than 1 2” in length from the structure to the structural connection of the clevis or trapeze.

3.04 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General
   1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.
   2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators
   1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.
2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.

3. Locate isolators to provide stable support for equipment, without excess rocking.

4. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.

5. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.

6. Hanger rods for vibration-isolated support shall be connected to major structural members, not the floor slab between major structural members. Provide suitable intermediate support members as necessary.

7. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.

8. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and unisolated pipes on the same trapeze.
   a. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.
   b. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.
   c. The installed and operating heights of equipment supported by Type FSNTL isolators or with Type RC-2 isolation bases shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4" clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.
   d. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.

2. Unless otherwise indicated, there is to be a minimum operating clearance of 1" between steel rails, steel frame bases or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.
3. Isolation bases shall be installed in strict accordance with the manufacturer’s instructions.

D. Flexible Duct Connections:
   1. Prior to installation of the flexible connection, sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section, and the gap between connected parts shall be uniform. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections:
   1. Install flexible pipe connections in strict accordance with the manufacturer's instructions.

F. Thrust Restraints:
   1. Thrust restraints shall be attached on each side of the fan parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Grommets:
   1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

H. Resilient Penetration Sleeve/Seals:
   1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

END OF SECTION 230548
PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. The work of this Section consists of a COMMERCIAL KITCHEN EXHAUST HOOD where shown on the Drawing Numbered K-01 and as specified under this Section.

B. Carefully examine all of the Contract Documents for requirements which affect the work of this Section. The exact scope of work of this Section cannot be determined without a thorough review of all specification sections and other Contract Documents.

1.2 DEFINITIONS

A. Commercial kitchen exhaust hood, kitchen hood, exhaust hood, ventilator, hood and hood canopy: for the purpose of this specification Section, these terms shall have the same definition.

1.3 WORK INCLUDED

A. Provide all labor, materials, equipment, services and transportation required to install complete and ready for continuous operation all food service equipment as shown on Drawings, as specified herein, or both.

B. Furnish and install all equipment, complete, ready for connections by the appropriate Electrical, Plumbing, or Mechanical Subcontractors. All equipment shall be complete with standard fittings, valves, switches and accessories specified or normally required for standard operation.

C. See Drawings for locations and details.

D. This COMMERCIAL KITCHEN EXHAUST HOOD SUB-CONTRACTOR shall cooperate and coordinate with others engaged in the work in order that work will progress on schedule.

E. This COMMERCIAL KITCHEN EXHAUST HOOD SUB-CONTRACTOR is required to install all materials furnished by him under this Section of the Specification. All such installation work shall be performed by workmen compatible with those existent on the project site. All equipment shall be of the latest design, new and unused, complete with all standard parts for normal operations and including such accessories or materials as may be required to comply with these Specifications.

F. This Specification is to further describe and supplement the applicable Drawings. What is called for by either the Drawings and/or these Specifications shall be furnished and installed as part of this work. Any questions relative to discrepancies or omissions shall be submitted to the Architect for correction by Addenda.
G. Work in this Section of the Specifications shall include but shall not be limited to the following:

1. Catalog items of equipment.
2. Fabricated equipment other than catalog items.
3. Plumbing trim and mechanical system components as required for standard operation of equipment items such as faucets and waste outlets. Vacuum breakers shall be furnished for all equipment where water is introduced less than 2” above flood level.
4. Electrical equipment forming an integral part of equipment items such as electric motors, heating elements, controls, switches, starters, temperature regulators, and internal wiring to a control panel or switch, if mounted on the equipment.

H. All openings or cut-outs required to accommodate the switches and receptacles in the specified work and the wiring in conduit from terminal blocks to junction boxes shall be performed under this section.

1.4 RELATED WORK UNDER OTHER SECTIONS

A. Finished floor and walls, structural supports for all ceiling supported equipment, acoustical ceilings and related building work.

B. Rough-in for sanitary waste, domestic water, floor drains and plumbing fixtures except those provided under this Section, and related mechanical work as set forth under the PLUMBING Section. All connecting piping, waste lines, traps and vent piping, complete with shut-off valves to all the equipment, shall be furnished and installed under the PLUMBING Section.

C. Exhaust hood systems complete with ductwork, hangers, access panels, balancing dampers and insulation between the exhaust ventilator, exhaust and supply collars and the exhaust fans shall be furnished and installed under the HEATING AND VENTILATING Section.

D. All external wiring, connecting conduit, and external connections to Exhaust Hood and Fire suppression system shall be under the ELECTRICAL Section.

E. All seismic restraint requirements for non-structural components. Comply with applicable guidelines for seismic restraint of kitchen exhaust hood and/or all other kitchen equipment contained in SMACNA’s “Kitchen Ventilation Systems and Food Service Equipment Guidelines,” Appendix A.

1.5 SUBMITTALS

A. Prepare and submit Shop Drawings in accordance with requirements of Division 1 General Requirements and in the manner described herein.

B. Shop Drawings shall indicate layout of equipment, installation drawings with dimensions, method of assembly, details of installation, adjoining construction, coordination with service utilities, other work required for a complete installation, correct sizes and location of all floor curbs or depressions, and the stub-up locations of all services in the floors or walls, for the
use of other contractors. Provide dimensioned locations for all floor drains and indirect wastes that relate to the equipment being furnished. Fabrication Drawings shall be furnished for non-catalog items, showing construction details, erection and connections. Stub-up drawings shall be to the scale of 1/2"=1'-0" or larger; fabrication Drawings, 1"=1'-0" or larger.

C. Standard items of equipment, not built-in or part of other assemblies, may be submitted for approval in the form of bound catalog cuts with descriptions. Items submitted shall include all necessary connection data or such data shall be shown on the overall plan, and a listing of all accessories. Catalog cuts shall be clearly marked by Item Number and quantity required.

D. Operating Instructions covering operation of all components, maintenance procedures covering proper cleaning and necessary lubrication or adjustments to controls.

E. Field Tests Reports: Indicate dates and times of tests and certify test results.

1.6 SAMPLES
A. Submit samples of all materials requested by the Architect.
B. Samples shall be prepared and submitted in accordance with requirements of the SUBMITTALS Section.

1.7 APPLICABLE PERMITS, LAWS, PUBLICATIONS, ORDINANCES AND CODES
A. Comply with laws, publications, ordinances, rules and regulations of all local, state and federal authorities having jurisdiction, the rules and regulations of the National Board of Fire Underwriters and the local electric code.

B. The publications listed below form a part of this specification SECTION. The publications are referenced in the text by basic designation only. All equipment specified herein shall be fabricated to conform to the standards and requirements of:
2. ASTM International: A666-03, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.


D. NSF - National Sanitation Foundation Sanitary Standards" for the construction and installation of "Food Service Equipment" prepared by the Committee on Food Service Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan. Any differences of opinion on sanitation shall be referred to the State Department of Health for a ruling. All equipment shall be installed in accordance with the manufacturer's
instructions and the best practices of the Food Service Industry, with careful attention to eliminating all cracks, crevices, and concealed spaces in wet areas that would be difficult to clean or keep free of vermin and soil.


1.8 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

A. Instruct to the Owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the equipment and their parts.

B. Maintenance manuals and list of local authorized service agents shall be delivered in a labeled hard-cover binder. Provide two (2) complete binders.

C. For maintenance purposes, provide Shop Drawings, parts lists, Specifications and manufacturer's maintenance bulletins for each piece of equipment.

D. Provide at least one factory-authorized service agency for equipment covered under this SECTION, listing the name, address and telephone number of the manufacturer's representative and service company for each piece of equipment, so that service or spare part can be readily obtained.

1.9 WARRANTY

A. Attention is directed to the provisions of the GENERAL CONDITIONS regarding guarantees and warrantees for the work under this contract.

B. All equipment shall be unconditionally guaranteed for a period of not less than one (1) calendar year from the date of substantial completion of approved installation, except self-contained refrigeration units for reach-in refrigerators, freezers and ice machines which shall carry a five-year replacement warranty for the sealed unit from the date of completed installation.

C. In addition to the guarantee called for under the CONDITIONS OF THE CONTRACT, this KITCHEN EXHAUST HOOD SUB-CONTRACTOR shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, he shall have available and "on call" competent service personnel to make the necessary repairs or replacements promptly of specified work. He further agrees that should he fail to make the necessary repairs or replacements within six (6) hours, the Owner may employ such personnel as are available to him to make the necessary repairs and back charge the costs to this KITCHEN EXHAUST HOOD SUB-CONTRACTOR.

D. Furnish manufacturer's warranties for each item of standard equipment and a warranty on fabricated equipment.
1.10 ELECTRICAL EQUIPMENT AND WIRING

A. Under this Section, items of equipment having electrical motors, electrical heating units, lighting fixtures, receptacles and the like shall be wired as specified herein, terminating at a junction box mounted on the equipment.

B. The Electrical Subcontractor shall furnish and install switches and receptacles not integral with the specified equipment and not called for under Item Specifications, and shall furnish and connect all wiring and conduit from the junction box mounted on the items of equipment to the building electrical distribution system.

C. The Electrical Subcontractor shall mount and wire all motor starters and other electrical devices furnished under this Section, that are not an integral part of the items of equipment furnished.

D. Internal wiring of specified equipment having electrical components, such as between controllers, control stations, and the electric power consuming units in the equipment, shall be either factory wired or wired under this Section, and brought to junction boxes mounted on the equipment ready for connection to the building electrical distribution system by the Electrical Subcontractor.

E. This KITCHEN EXHAUST HOOD SUB-CONTRACTOR shall furnish wiring diagrams for all his equipment as requested by the Architect or Electrical Subcontractor.

F. All openings or cut-outs required to accommodate the switches and receptacles in the specified work, and the wiring in conduit from terminal blocks in junction boxes shall be done under this Section.

G. All Electrically operated equipment shall be listed by Underwriter's Laboratories, Inc.

PART 2 – PRODUCTS

2.1 EXHAUST HOOD

A. GENERAL

1. Exhaust hood shall be single-sided wall-mounted canopy type fabricated in one section; and shall be designed specifically for the cooking equipment being covered. Exhaust hood shall include UL listed and NSF certified grease extractor type, high efficiency cartridge style baffle filters of adequate number and sizes to ensure optimum performance in accordance with manufacturer’s published information.

B. MATERIALS

1. All stainless steel shall be non-magnetic, corrosion resistant chromium-nickel 18 Gauge Type 304, polished to a Number 4 finish where exposed, unless otherwise noted.

2. Metals shall be free from defects impairing strength, durability of appearance, made of new materials with structural properties to withstand strains and stresses to which normally subjected.
3. Stock materials, patterns, products and methods of fabrication shall be approved provided that they conform to the requirements specified under Item Specifications.

4. Metal gauges for steel, galvanized steel and stainless steel shall be manufacturer's standard Gauge, (USS Gauge Revised); and for aluminum, B & S Gauge. Minimum gauges shall be as specified under Item Specifications.

C. WELDING

1. The words "weld," "welded," or "welding" as used in this Section of the Specification shall mean that metal joints shall be continuously welded and the exposed parts ground smooth and polished to match adjoining surfaces as specified below.

2. Where spot welding is specified, the welds shall be a maximum spacing of 3" O.C.

3. Where tack welding is specified, the pieces welded shall have 1/2" minimum lengths of welding material at 4" O.C. maximum spacing.

D. FINISHES

1. All exposed welding joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken-in by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if necessary, again welded and ground to low spots. All ground surfaces shall be polished or buffed to a degree consistent with good workmanship.

2. Care shall be exercised in all grinding operations to avoid excessive heating of metal and discoloration. Abrasives, wheels, and belts used in grinding shall be iron free and shall have not been used on carbon steel. The texture of the final polishing operation shall be uniform and smooth.

3. The general finish of all equipment shall be consistent throughout the job. Brake ends shall be free of open texture or orange peel appearance, and where brake work mars the uniform finish of the material, the marks shall be removed by grinding and polishing, and finishing. Sheared edges shall be free of burrs, projections or fins to eliminate all danger of laceration. An exposed surface shall include an inside surface which is exposed to view when a swing or sliding door is opened. Underside of shelves need not be finished unless otherwise specified.

E. DESCRIPTION

1. Hood shall be constructed using the standing seam method for optimum strength. The seams on the canopy shall be welded liquidtight, and all exposed external welds shall be ground and polished to match the original finish of the metal. Lighter material gauges, alternate material types and finishes (400 series stainless steel, cold rolled steel, etc.) and non-liquidtight welding (tack weld, spot weld, etc.) will not be acceptable. Control of wiring for fan motors and lights shall be by the Electrical Subcontractor. The exhaust hood shall achieve its low air flow rates without the use of...
internal motors, plenums, or jets. The exhaust hood shall also include a capture lip on the front panel for enhancement of smoke and grease capture. The exhaust hood shall include a static pressure port in each section to be used in balancing the static pressure.

2. Construction shall include corrosion-resistant steel framing members for strength. Short circuit style hoods will not be allowed. The filter housing shall terminate in a pitched, full-length stationary sloped grease trough, which shall drain into a removable built-in 0.5 gallon stainless steel grease drawer. The sloped grease trough shall be concealed by an apron, extending the full-length of the exhaust hood. Hood shall be provided with one (1) filter removal tool.

3. Exhaust hood shall be equipped with UL listed, recessed fluorescent, vapor proof light fixtures with bulbs. Light fixtures shall be factory pre-wired to a single junction box situated at the top of the exhaust hood. Ventilators built in multiple sections shall be furnished with coiled flex conduit for interconnecting sections. Wiring shall conform to the requirements of the National Electric Code (NEC 70) Final connection shall be by the Electrical Sub-Contractor.

4. Provide hood with a stationary grease collecting gutter at bottom of the grease extraction device, sloped to drain at one end to a 0.5 gallon built-in stainless steel grease drawer. The sloped gutter shall be concealed by an apron which extends the full length of the hood. Hood shall contain super high efficiency filtration extractor utilizing the “capture and drain” principle. The hood shall achieve low air flow rates without the use of internal motors, plenums or jets, and feature a capture lip at the front panel for enhancement of smoke and grease capture.

5. The ventilator shall include a static pressure port in each section to be used in balancing the static pressure. Continuous front and rear mounting brackets shall be provided to facilitate mounting to the wall and hanging from the overhead building structure. The ventilator shall be equipped with an opposed blade balancing damper. The damper shall be manually adjustable and accessible from below. The ventilator shall be listed under the category “Exhaust Hood without Exhaust Damper.” Damper shall be reviewed with HVAC Contractor prior to fabrication.

Hood ventilator shall be hung by hood installer from structural ceiling with appropriate methods for hanging and attaching to concrete ceilings.

6. The exhaust hood shall be listed to UL Standard 710 and NSF. The ventilator shall comply with all requirements of NFPA-96, IMC, UMC, BOCA, and SBCCI mechanical codes.

7. Fresh air make-up system shall be incorporated into front face of hood and balanced for optimum function of exhaust hood.

2.2 FIRE SUPPRESSION SYSTEM

A. Provide an automatic stored pressure wet chemical system sized to meet all City Codes and N.F.P.A. Codes. System shop drawings shall be submitted by this Equipment Subcontractor for review and approval of Local Code Enforcement Officer. System shall be designed to provide complete area protection of the entire hood area. Such shop drawings shall be certified and stamped by Registered Engineer, prior to submittal. System shall provide surface protection for
cooking equipment, hoods and the exhaust ductwork, if required. Tanks shall be mounted 6'-6" A.F.F. on wall per plan, and all piping shall run above ceiling wherever possible. All pipes and fittings used to convey the chemical shall be hot dipped galvanized and scale free steel, 40 weight, with the exception of the exposed piping located inside the exhaust ventilator which shall be chrome plated brass or stainless steel pipe. Detection shall be by fusible links rated per codes, and system shall rely on no outside source of power. The cylinder(s) shall be provided with a pressure gauge to indicate tank condition, and a control head with indicator to indicate system status. Control head shall also include two integral micro switches, each offering "normally open" and "normally closed" terminals for use by the Electrical Sub-contractor for the shut down of equipment and the sounding of alarms. Provide and install a remote pull station per plan and codes, complete with cables, conduit and pulleys. Provide a properly sized mechanically operated gas shut off valve for mounting by the Plumbing Subcontractor at a point in the gas supply that will shut off fuel to all gas fired equipment.

cartridge style baffle filters of adequate number and sizes to ensure optimum performance in accordance with manufacturer's published information.

PART 3 - EXECUTION

3.1 EXAMINATION AND ACCEPTANCE

A. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of work shall be construed as acceptance of space conditions.

B. This Commercial Kitchen Exhaust Hood Sub-Contractor shall obtain and verify all measurements and conditions on the job, and shall assume all responsibility in respect to same.

3.2 INSTALLATION

A. Install Exhaust Hood level and plumb with access clearances required for operation, maintenance and cleaning and in accordance with the manufacturer's published documentation.

B. Coordinate installation Exhaust Hood with overhead structure and supports. Refer to Structural and Architectural Drawings and Specifications.

3.3 FIELD TESTING

A. Field testing General: Following Installation test Exhaust Hood for compliance with specified requirements and those of Authority having jurisdiction. Perform testing after air-handling units have been balanced and adjusted.

B. Smoke Test:
   1. Test Conditions:
      a. Perform tests with cooking equipment served by exhaust turned off.
      b. Perform tests with supply and exhaust fans serving the food service kitchen area turned on.
2. Test Procedure: Move a smoke bomb around the perimeter of cooking equipment the top surface.

3. Test – Performance Requirements: No visible smoke shall escape from the exhaust hood canopy into the room.

C. Demand Exhaust Hood Control test:
   1. Test Conditions:
      a. Perform tests with cooking equipment served by exhaust hood turned off.
      b. Perform tests with air-handling units serving food service kitchen turned on.
   2. Test Procedure: Turn equipment on and measure speed of exhaust fan(s) as cooking equipment heats up. Move smoke bomb around the perimeter of the cooking cooking equipment at the top surface and continue to measure speed of exhaust fan(s).
   3. Test – Performance Requirements: Speed of fan(s) should increase/decrease with the severity of the heat and/or smoke.

D. Wet Chemical Fire Extinguishing system: Test system to verify that equipment operation complies with NFPA 96 and NFPA 17A.

3.4 PROTECTION OF WORK

A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.

B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the Contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.

C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by and to the satisfaction of the Architect.

3.5 CLEAN-UP

A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.

B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the Contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.

C. All debris and surplus materials resulting from installation work shall be removed promptly as work progresses by this Kitchen Exhaust Hood Subcontractor, to a location indicated by the General Contractor.

D. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer’s instructions, and leave specified work free of imperfections.

End of Section
SECTION 260000

ELECTRICAL

(Filed Sub-Bid Required)

PART 1 - GENERAL ........................................................................................................................................... ii

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS .............................................1
1.02 RELATED DOCUMENTS ..........................................................................................................................1
1.03 DESCRIPTION OF WORK ......................................................................................................................1
1.04 COMMISSIONING ....................................................................................................................................2
1.05 DEFINITIONS ..........................................................................................................................................3
1.06 ITEMS TO BE FURNISHED ONLY .......................................................................................................3
1.07 ITEMS TO BE WIRED ONLY ................................................................................................................3
1.08 RELATED WORK .....................................................................................................................................3
1.09 CONTRACT COST BREAKDOWN ............................................................................................................3
1.10 INSPECTION OF SITE ............................................................................................................................4
1.11 SUBCONTRACTOR’S REPRESENTATIVE ....................................................................................................4
1.12 COOPERATION ......................................................................................................................................4
1.13 CODES, ORDINANCES, AND PERMITS .................................................................................................4
1.14 GUARANTEE ..........................................................................................................................................5
1.15 INSPECTIONS AND TESTS ......................................................................................................................5
1.16 ELECTRICAL ROOMS OR SPACES .........................................................................................................5
1.17 ALTERNATES .........................................................................................................................................5
1.18 PHASING, DEMOLITION AND MAINTAINING EXISTING SERVICES ..................................................6

PART 2 - PRODUCTS ..........................................................................................................................................7

2.01 GENERAL .............................................................................................................................................7
2.02 RACEWAYS AND FITTINGS ..................................................................................................................7
2.03 CONDUCTORS ......................................................................................................................................10
2.04 ACCESS PANELS ..................................................................................................................................11
2.05 SLEEVES, INSERTS, AND OPENINGS .................................................................................................12
2.06 WIRING DEVICES ................................................................................................................................13
2.07 LIGHTING FIXTURES .............................................................................................................................14
2.08 ELECTRICAL POWER EQUIPMENT .....................................................................................................18
2.09 ELECTRICAL SYSTEM CONTROLS AND INSTRUMENTS .....................................................................19
2.10 GROUNDING SYSTEM ..........................................................................................................................20
2.11 PANELBOARDS ....................................................................................................................................20
2.12 SEALS ...................................................................................................................................................22
2.13 FIRE ALARM AND DETECTION SYSTEM (Voice evacuation required) ..............................................22
2.14 SURGE PROTECTION ............................................................................................................................38
2.15 FIRESTOPPING AND SEALANTS ..........................................................................................................43
2.16 EMERGENCY BATTERY SYSTEM .........................................................................................................46

PART 3 - EXECUTION ......................................................................................................................................46

3.01 WORK COORDINATION AND JOB OPERATIONS ...............................................................................46
3.02 DRAWINGS AND SPECIFICATIONS ......................................................................................................47
3.03 IDENTIFICATION ..................................................................................................................................47
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

3.04 PROTECTION AND CLEANUP ................................................................. 48
3.05 PORTABLE OR DETACHABLE PARTS ....................................................... 48
3.06 SAFETY PRECAUTIONS ........................................................................... 49
3.07 MOUNTING HEIGHTS .............................................................................. 49
3.08 WORKMANSHIP AND INSTALLATION METHODS .................................. 49
3.09 FEEDER CIRCUITS .................................................................................. 53
3.10 BRANCH CIRCUITS ................................................................................ 54
3.11 FIREPROOFING AND WATERPROOFING ........................................... 54
3.12 CUTTING AND PATCHING ...................................................................... 54
3.13 MECHANICAL SYSTEM COORDINATION ............................................. 54
3.14 DISTRIBUTION EQUIPMENT FIELD TESTING ....................................... 55
3.15 DEMOLITION, REMOVAL AND RELOCATION WORK .......................... 57
3.16 STORAGE AND INSTALLATION OF EQUIPMENT ................................. 57
3.17 FAULT CURRENT, ARC FLASH AND COORDINATION STUDY .............. 57

END OF INDEX
SECTION 260000

ELECTRICAL
(Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 TIME, MANNER, AND REQUIREMENTS FOR SUBMITTING SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter Ed) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place for submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority must be accompanied by BID BOND, or CASH, or CERTIFIED CHECK, or TREASURER'S CHECK or CASHIER'S CHECK, issued by a responsible bank or trust company, payable to the CITY OF NEW BEDFORD in the amount of five-percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid, submitted for the work of this SECTION, shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. Work to be done under this SECTION is shown on Drawings numbered: G1.1, G1.2, C0.1, C1.1, D1.1, D2.1, D3.1, A1.1, A2.1, A2.2, A3.1, A5.1, A8.1, A8.2, A8.3, K-01, P0.1, P1.1, P2.1, MD-1, M-1 through M-4 inclusive, ED-0, E-0, E-1, E-2, E-3.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.03 DESCRIPTION OF WORK

A. Work described herein shall be interpreted as work to be done by the Electrical Subcontractor. Work to be performed by other trades will be referenced to a particular Subcontractor.
B. Provide all labor, materials, tools, and equipment, including scaffolding, to complete the installation of the electrical system. Install, equip, adjust, and put into operation the respective portions of the installation specified, and so interconnect various items or sections of work in order to form a complete and operating whole. Systems may be referenced in singular or plural terms, also refer to drawings to confirm quantities. The work shall consist of, but shall not necessarily be limited to the following:

1. New distribution panel, panelboards, starters, feeders and subfeeders.
2. New fire alarm system with voice evacuation.
3. Disconnection and reconnection of panelboards, boilers, pumps and controls.
4. Lighting systems, including lamps, fixtures and controls.
5. Power connections to new kitchen hood and kitchen equipment.
6. All raceway systems, including boxes, couplings, and fittings.
7. All branch circuit wiring systems, including wiring devices, and plates.
8. Connections for all building equipment, including mechanical, plumbing, Owner’s and the like.
9. All testing of equipment installed.
10. Any other item of work hereinafter specified or indicated on electrical drawings.
11. Drilling, coring, cutting and patching of holes (where the largest dimension thereof does not exceed 12 inches) for electrical conduit systems, and equipment. Cutting and patching shall be in accordance with Section 024119 – SELECTIVE DEMOLITION.
13. Provide Vibration Control and Seismic Restraints for all Electrical Systems conforming to the requirements of Massachusetts State Building Code.
14. Phasing and demolition.
15. Firestopping of penetrations through fire rated walls, slabs and partitions.
16. Sealing of all penetrations through walls, slabs, partitions, which are not fire rated.
17. Furnish access doors and frames in accordance with section 081113.
18. Telephone wiring, outlets and final connections.

1.04 COMMISSIONING

A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 01 91 13 –Commissioning Requirements.

B. Complete installation and startup checks and functional tests according to Section 01 91 13 –Commissioning Requirements and manufacturers written instructions.

C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the start up procedure.

D. Verify that equipment is installed and commissioned as per requirements of Section 01 91 13 and manufacturers written instructions/requirements.
1.05 DEFINITIONS

A. Most terms used within the documents are industry standard. Certain words or phrases shall be understood to have specific meanings as follows:

1. Provide: Furnish and install completely connected up and in operable condition.
2. Furnish: Purchase and deliver to a specific location within the building or site.
3. Install: With respect to equipment furnished by others, install means to receive, unpack, move into position, mount and connect, including removal of packaging materials.
4. Conduit: Raceways of the metallic type which are not flexible. Specific types as specified.
5. Connect: To wire up, including all branch circuitry, control and disconnection devices so item is complete and ready for operation.
6. Subject to Mechanical Damage: Equipment and raceways installed exposed and less than eight feet above finished floor in mechanical rooms or other areas where heavy equipment may be in use or moved.
7. Finish Space: Any space where public/students have access including but not limited to corridors, classrooms, offices, toilets, cafeteria, gym, auditorium, etc.

1.06 ITEMS TO BE FURNISHED ONLY

A. Furnish the following items for installation under designated sections.

1. None.

1.07 ITEMS TO BE WIRED ONLY

A. Install the following items furnished under designated sections.


1.08 RELATED WORK

A. The following related work is to be performed under designated sections.

1. Temp. Controls – SECTION 01 50 00 – CONSTRUCTION FACILITIES. AND TEMPORARY CONTROLS.
2. Payment for energy for temporary light and power, refer to Section 01 50 00.
3. Automatic Temperature Controls: SECTION 23 00 00 – HVAC
5. Door Hardware: Section 08 71 00
6. Penetration Firetopping: Section 078400

1.09 CONTRACT COST BREAKDOWN

A. Submit a breakdown of contract price to aid Architect in determining value of work installed as job progresses.
1.10 INSPECTION OF SITE

A. Electrical bidders will be permitted to inspect site. Failure to inspect existing conditions or to fully understand work which is required shall not excuse Electrical Subcontractor from his obligations to supply and install work in accordance with specifications and the drawings and under all site conditions as they exist.

1.11 SUBCONTRACTOR'S REPRESENTATIVE

A. Retain a competent representative on the project.

1.12 COOPERATION

A. Work shall be carried on under usual construction conditions, in conjunction with the contractors work. Cooperate with other Subcontractors, coordinate work and proceed in a manner as not to delay progress.

B. Before proceeding, examine all construction drawings and consult other Subcontractors to coordinate installation and avoid interference.

C. In case of dispute, the Architect will render a decision in accordance with General and Supplementary General Conditions.

1.13 CODES, ORDINANCES, AND PERMITS

A. Codes and Ordinances:

1. All material and work provided shall be in accordance with all applicable codes including the following codes and standards as most recently amended:
   - Commonwealth of Massachusetts Building Code
   - State Department of Public Safety
   - NFPA 101 "Life Safety Code"
   - NFPA Standards
   - Standards of the Underwriters Laboratories (UL)
   - Occupational Safety and Health Act (OSHA)
   - Americans with Disabilities Act (ADA)
   - City of New Bedford

2. Where contract documents indicate more stringent requirements than codes, the contract documents shall take precedence.

B. Permits: Be responsible for filing documents, and securing of inspection and approvals. Pay permit fees.
1.14 GUARANTEE

A. All parts of the work shall be guaranteed for a period of one year from the date of acceptance of the job by Owner. If during that period of general guaranty, any part of the work fails, becomes unsatisfactory, or does not function properly due to any fault in material or workmanship whether or not manufactured or job built, the Owner shall upon notice from owner promptly proceed to repair or replace such faulty material or workmanship without expense to owner, including cutting, patching, and painting, or other work involved, and including repair or restoration of any damaged sections of the premises resulting from such faults.

B. In the event that a repetition of any one defect occurs indicating the probability of further failure and which can be traced to faulty design, material, or workmanship, then repair or replacement shall not continue to be made but the fault shall be remedied by a complete replacement of the entire defective unit.

C. Refer to Section 01 78 36 – Warranties for additional requirements.

D. In addition to the general guaranty, obtain and transmit to owner any guaranties or warranties from manufacturers of specialties, but only as supplementary to the general guaranty which will not be invalidated by same.

1.15 INSPECTIONS AND TESTS

A. Inspection: If inspection of materials installed shows defects, such defective work, materials, and/or equipment shall be replaced and inspection and tests repeated.

B. Tests: Make reasonable tests and prove integrity of work and leave electrical installation in correct adjustment and ready to operate. All panels shall have phases balanced as near as practical. A consistent phase orientation shall be adhered to at all terminations.

1.16 ELECTRICAL ROOMS OR SPACES

A. Be responsible for ensuring that the dedicated space and clearances required in the NEC, Sections 110-16 and 110-26 are maintained for all electrical equipment.

B. Call other contractors' attention to the requirements contained in the above mentioned code sections, prior to the installation of equipment by other contractors, in order to ensure no violations.

1.17 ALTERNATES

A. Refer to Section 012300 for Alternates affecting this section.
1.18 PHASING, DEMOLITION AND MAINTAINING EXISTING SERVICES

A. During the execution of the work, required relocation, rerouting, etc., of existing equipment and systems in the existing building areas where new work is to be installed or new connections are scheduled to be made, shall be performed by the Electrical Subcontractor, as required by job conditions and as determined by the Architect in the field, to facilitate the installation of the new system, while demolition, relocation work or new tie-ins will be performed. Outages required for construction purposes shall be scheduled for the shortest practical periods of time, in coordination with the Owner’s designated representative, for specified, mutually agreeable periods of time, after each of which the interruption shall cease and the service shall be restored. This procedure shall be repeated to suit the Owner’s working schedule, as many times as required until all work is complete. Any outages of service shall be approved by the Owner, prior to commencing the work. No outages or shutdowns of service shall occur without the written authorization of the Owner prior to commencing the work. Give notice of any scheduled shutdowns, a minimum of (2) weeks in advance. Owner shall make their best effort to meet this request without adversely affecting the electric service to the existing building.

B. Prior to any deactivation and relocation or demolition work, consult the drawings and arrange a conference with the Owner’s representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect all equipment designated to be relocated and reused or to remain in operation and be integrated with the new systems.

C. Where existing outlets are to be reused and are cut off by the remodeling, they shall be reconnected to existing circuits as required by field conditions. Each bidder shall, before submitting his bid, visit the site and make a thorough examination of the conditions in the existing building in order to determine the extent of the work to be done.

D. All deactivation, relocation and temporary tie-ins of electrical systems and equipment shall be provided by the Electrical Subcontractor. All demolition and removal of electrical systems and equipment designated to be demolished shall be by the Electrical Subcontractor.

E. The Owner reserves the right to inspect the material scheduled for removal and salvage any items he deems usable as spare parts.

F. Phasing
1. The Electrical Subcontractor shall construct the subject in phases as directed by the Architect to suit the project progress schedule, as well as the completion date of the project.
2. Refer to Section 024119 – SELECTIVE DEMOLITION
PART 2 - PRODUCTS

2.01 GENERAL

A. Product specifications are written in such a manner so as to specify what materials may be used in a particular location or application and therefore do not indicate what is not acceptable or suitable for a particular location or application. As an example: non-metallic sheathed cable is not specified; therefore, it is not acceptable.

B. For purpose of establishing a standard of quality and not for purpose of limiting competition, the basis of this Specification is upon specified models and types of equipment and materials, as manufactured by specified manufacturers.

C. In all cases, standard cataloged materials and systems have been selected. Materials such as lighting fixtures specially manufactured for this particular project and not part of a manufacturers' standard product line will not be acceptable. In the case of systems, the system components shall be from a single source regularly engaged in supplying such systems. A proposed system made up of a collection of various manufacturers' products will be unacceptable.

D. Where Specifications list manufacturers' names and/or "as approved" or "equal approved by Architect", other manufacturers' equipment will be considered if equipment meets Specification requirements and has all features of the specified items as are considered essential by Architect.

E. All material shall be new and shall be UL listed.

2.02 RACEWAYS AND FITTINGS

A. Raceways - General:

1. No raceway shall be used smaller than 3/4" diameter and shall have no more than four (4) 90° bends in any one run, and where necessary, pull boxes shall be provided. Only rigid metal conduit or intermediate metal conduit is allowed for slab work. Cable systems, if allowed to be used by other sections of this specification, shall not be used exposed or in slabs, whether listed by "UL" for such use or not.

2. Rigid metal conduit conforming to, and installed in accordance with, Article 344 shall be heavy wall zinc coated steel conforming to American Standard Specification C80-1 and may be used for service work, exterior work, slab work, and below grade level slab, wet locations, and in penthouse for drops down to equipment from elevations below eight feet and also where raceway may be subject to mechanical damage.

3. Intermediate metal conduit conforming to, and installed in accordance with, Article 342, may be used for all applications where rigid metal conduit is allowed by these specifications.
4. Electrical Metallic Tubing (EMT), conforming to, and installed in accordance with, Article 358 shall be zinc coated steel, conforming to industry standards, may be used in masonry block walls, stud partitions, above furred ceilings, where exposed but not subject to mechanical damage in unfinished spaces, and may be used for fire alarm work where concealed or exposed in unfinished spaces.

5. Flexible metal conduit shall be used for final connections to recessed lighting fixtures from above ceiling junction boxes and for final flexible connections to motors and other rotating or vibrating equipment. Liquid tight flexible metal conduit shall be used for the above connections which are located in moist locations. Moist locations shall include mechanical rooms, penthouses and exterior locations with mechanical equipment. All flexible connections shall include an insulated grounding conductor.

6. Acceptable manufacturers:
   a. Pittsburgh Standard Conduit Company
   b. Republic Steel and Tube
   c. Youngstown Sheet and Tube Company
   d. Carlon
   e. Or equal

7. Fittings:
   a. Provide insulated bushings on all raceways 1 inch diameter or larger.
   b. Manufacturer's standard fittings shall be used for raceway supports.
   c. Expansion Fittings: Expansion fittings shall be used where structural and concrete expansion joints occur and shall include a ground strap.
   d. Couplings for rigid metal and intermediate metal conduit shall be threaded type.
   e. Threadless fittings for EMT shall be watertight compression type or set-screw type (dry-locations). All fittings shall be concrete tight. No diecast fittings allowed except for raceways larger than 1 inch diameter.
   f. Cable supports in vertical raceways shall be of the split wedge type. Armored cable supports for vertical runs to be of wire mesh basket design.
   g. Wall entrance seals shall be equal to O.Z. Gedney type "WSK".
   h. Couplings, elbows and other fittings used with rigid nonmetallic conduit shall be of the solvent cemented type to secure a waterproof installation.
   i. Acceptable manufacturers:
      (1) O.Z.
      (2) Crouse Hinds
      (3) Appleton
      (4) EFCOR
      (5) Steel City
      (6) Or equal
B. Outlets, Pull and Junction Boxes:

1. Outlets:
   a. Each outlet in wiring or raceway systems shall be provided with an outlet box to suit conditions encountered. Boxes installed in normally wet locations or surface mounted shall be of the cast-metal type having hubs. Concealed boxes shall be cadmium plated or zinc coated sheet metal type. Old work boxes with Madison clamps not allowed in new construction.
   
b. Each box shall have sufficient volume to accommodate number of conductors in accordance with requirements of Code. Boxes shall not be less than 1-1/2" deep unless shallower boxes are required by structural conditions and are specifically approved by Architect. Ceiling and bracket outlet boxes shall not be less than 4” octagonal except that smaller boxes may be used where required by particular fixture to be installed. Flush or recessed fixtures shall be provided with separate junction boxes when required by fixture terminal temperature requirements. Switch and receptacle boxes shall be 4” square or of comparable volume.
   
c. Far side box supports shall be Caddy J-1A.
   
d. Acceptable manufacturers:
      (1) Appleton
      (2) Crouse Hinds
      (3) Steel City
      (4) RACO
      (5) Or equal

2. Pull and Junction Boxes: Where indicated on drawings, and where necessary to terminate, tap off, or redirect multiple raceway runs or to facilitate conductor installation, furnish, and install appropriately designed boxes. Boxes shall be fabricated from code gauge steel assembled with corrosion resistant machine screws. Box size shall be as required by Code.

3. Boxes in moist or wet areas shall be galvanized type. Boxes larger than 4-11/16 inches square shall have hinged covers. Boxes larger than 12 inches in one dimension will be allowed to have screw fastened covers, if a hinged cover would not be capable of being opened a full 90 degrees due to installation location.

   a. Acceptable Manufacturers:
      (1) Brasch
      (2) Hoffman
      (3) Keystone
      (4) Lee Products Co.
      (5) McKinstry Inc.
      (6) Eldon Inc.
      (7) Or equal
2.03 CONDUCTORS

A. All conductors shall be a minimum size of #12 AWG except for control wiring and fire alarm wiring where #14 AWG may be used. For all exit sign circuits, emergency only circuits, exterior lighting circuits, and also where distance from panelboard to first outlet exceeds 100' at 120 volts, #10 AWG shall be minimum size wire allowed. All feeder and branch circuit conductor shall be color coded as follows:

1. 208Y/120V Phase A Black
2. 208Y/120V Phase B Red
3. 208Y/120V Phase C Blue
4. Grounded Conductor 120/208 White
5. Equipment Ground 120/208 Green
6. Isolated Ground 120/208 Green with Orange Trace

B. All conductors not installed in accordance with color scheme shall be replaced. All conductors larger than #6 AWG must be identified with colored tape.

C. Connections throughout the entire job shall be made with solderless type devices.
1. For #10 AWG and smaller: spring type.
2. For #8 AWG and larger: circumferential compression type.
3. Acceptable manufacturers:
   a. 3M "Scotchlock"
   b. IDEAL "Wingnut"
   c. BURNDY
   d. MAC
   e. Or equal
4. Any splices made up in ground mounted pull boxes shall be resin cast waterproof type or waterproof pressure type.

D. Conductors shall be copper, soft drawn, and annealed of 98% conductivity. Conductors larger than #10 AWG shall be stranded; #10 AWG and smaller shall be solid. Conductors shall be insulated for 600 volts and be of following types:
1. All conductors shall have heat/moisture resistant thermoplastic insulation type THHN/THWN (75°C) except as follows:
   a. In sizes #1 AWG and larger: Crosslinked polyethylene insulation type XHHW (75°C - 90°C) may be used.
   b. Fire alarm system conductors shall be #14 AWG, type THHN, solid. Color coding of fire alarm conductors shall be in accordance with fire codes.
   c. Fixture whips #16AWG type "SF".

E. Stranded conductors for all wiring systems except fire alarm will be allowed if installed and terminated as specified under Execution Section.
F. **Mineral-Insulated Metal-Sheathed Fire-Resistive Cables (Type MI)** - Cables shall consist of a factory assembly of one or more solid copper conductors insulated with highly-compressed magnesium oxide and enclosed in a seamless, liquid-and-gas-tight continuous copper sheath. Cables shall be rated for 600 volts and less. Cables shall comply with Article 332 of the National Electrical Code. Cables shall be classified by Underwriters Laboratories, Inc. as having a 2-hour fire resistive rating. Cable terminations shall be made with UL listed mineral-insulated cable fittings.

G. **Type MC Cable** may be used for concealed branch circuits in hollow spaces where allowed by code if installed and terminated as specified under Execution Section. Armor to be galvanized steel and shall be UL listed for 2 hour fire wall penetration. Aluminum armor is not acceptable.

H. **Type MC Cable** may be used for fire alarm where concealed and allowed by Code, armor shall be red.

I. **Acceptable manufacturers:**
   1. AFC Cable Systems
   2. American Wire & Cable
   3. Cerro
   4. Cornish
   5. Cresent
   6. General Cable
   7. Okonite
   8. Or equal

2.04 **ACCESS PANELS**

A. **Provide access panels** for access to concealed junction boxes and to other concealed parts of system that require accessibility for operation and maintenance. In general, electrical work shall be laid out so access panels are not required.

B. **Access panels** shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that junction can be easily reached and size shall be sufficient for purpose (minimum size 12" x 12"). When access panels are required in corridors, lobbies, or other habitable areas, they shall be located as directed.

C. **Access panels** shall be prime painted and equipped with screwdriver operated cam locks.

D. **Acceptable manufacturers:**
   Inland Steel Products Company - Milcor
   Miami Carey
   Walsh-Hannon-Gladwin, Inc. - Way Locator
   Specific types:
   Or equal
   1. Acoustical Tile Ceiling "Milcor Type AT"
2. Plastered Surfaces  "Milcor Type K"
3. Masonry Construction  "Milcor Type M"
4. Drywall Construction  "Milcor Type DW"

E. Furnish access panel shop drawings.

2.05 SLEEVES, INSERTS, AND OPENINGS

A. Sleeves: Provide sleeves of proper sizes for all openings required in concrete floors and walls. Sleeves passing through floors shall be set with top of sleeve 1" above finished floor. Core drilling will also be acceptable if in accordance with any structural standards. Any unsleeved openings shall be waterproofed.

B. Inserts: Provide inserts or other anchoring devices in concrete and masonry construction as required to support raceways and equipment.

C. Openings: Where an opening is required in concrete slabs to allow passage of a multitude of raceways, give adequate notice to General Contractor so he may box out opening in form work.

D. Sleeves or openings through slabs for passage of future cables shall be located within 6 inches of walls and shall be in a single row and shall be proofed whether used or not.

E. Any openings through fire rated surfaces shall be closed off with fireproofing materials providing the same rating as the surface penetrated.

F. Acceptable Manufacturers:
   Specified Technologies Inc.
   Thomas & Betts
   International Protective Coatings Corp.
   3M Fire Protection Products
   Dow Corning
   Or equal
2.06 WIRING DEVICES

A. ELE Receptacles: Receptacles shall be flush mounted. All standard 20 ampere devices to be of same manufacturer.

1. Acceptable Manufacturers:

   Twenty (20) ampere duplex grounding type NEMA 5-20R, provide tamper resistant receptacles where shown on drawings.
   Cooper 5362-V
   Hubbell 5362I
   Pas and Seymour 5362I
   Leviton 5362I
   Or equal

   Thirty (30) ampere, 250 volt NEMA 14-30R complete with plate,
   Cooper 1257,
   General Electric 1439-3,
   Hubbell 9430-A,
   Pass and Seymour 3864,
   Or equal

   Fifty (50) ampere, 250 volt NEMA 14-50R complete with plate,
   Cooper 1258,
   General Electric 4181-3,
   Hubbell 9450A,
   Pass and Seymour 3894,
   Switches: 20 ampere,
   Or equal

   Cooper CWD 2221,
   General Electric 5951,
   Hubbell 1221,
   Pass and Seymour 20AC-2,
   Leviton 1221.
   Or equal
   Prewired devices with pigtails acceptable

B. Composition material of wiring devices to be nylon with ivory finish. Outlets intended for computer use (shown shaded on plans) shall be gray.

C. Coverplates: Finish shall be 302 stainless steel.

D. Provide gaskets on all wiring device plates where devices are on walls separating conditioned and non-conditioned spaces.
E. Dimmer Controls
   1. All devices shall be UL listed specifically for the required loads (i.e., incandescent, fluorescent, magnetic low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers are not acceptable.
   2. All dimmers and switches shall incorporate an air gap switch. The air gap switch shall be capable of meeting all applicable requirements of UL 20 for air gap switches on incandescent dimmers.
   3. All dimmers and switches shall provide power- failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.
   4. Dimmers and switches shall met ANSI/IEEE Std. C62.41-1980, tested to withstand voltage surges of up to 6000V and current surges of up to 200A without damage.
   5. Dimmers and switches shall meet the UL 20 limited short circuit test requirement for snap switches.
   6. Dimmers shall provide a smooth and continuous Square Law dimming curve.
   7. Dimmers shall be voltage regulated so that +10 percent variation in line voltage shall cause not more than + 5 percent variation in load voltage when dimmer is operating at 40V (5 percent light output).
   8. Dimmers, where ganged, shall be derated in accordance with manufacturer's instructions. Ratings in watts listed on the drawings are the derated ratings. Minimum size dimmer shall be 1500 watts.
   9. Dimmers shall be Lutron, Lightoler, Leviton or equal.

2.07 LIGHTING FIXTURES

A. General

1. Submit the following in accordance with project submittal procedures:
   a. Catalog Data: Submit catalog data describing luminaires, lamps, and ballasts. Include data substantiating that materials comply with specified requirements. Arrange data for luminaires in the order of fixture designation.
   b. Performance Curves/Data:
      (1) Submit certified photometric data for each type of luminaire.
      (2) Submit supply-air, return-air, heat-removal, and sound performance data for air handling luminaires.
   c. Drawings: Submit shop drawings for non-standard luminaires.
   d. Calculations: Submit as requested to support equal product proposals.
   e. Warranty: Submit warranties for luminaires and for electronic ballasts.

2. All lamps, ballasts, led sources, drivers, and controls shall meet the latest utility company incentive requirements. Refer to the latest program requirements documentation and coordinate with the utility company to ensure compliance.
ELIZABETH CARTER BROOKS SCHOOL  
WINDOW, DOOR & BOILER REPLACEMENT  
New Bedford, Massachusetts

B. Quality Assurance

1. Comply with the National Electrical Code (NEC) and the State Building Code (MBC) for components and installation.
2. Provide luminaires listed and labeled by a nationally recognized testing laboratory (NRTL) for the application, installation condition, and the environments in which installed.
3. Use manufacturers that are experienced in manufacturing luminaires, lamps and ballasts similar to those indicated for this Project and have a record of successful in-service performance.
4. Coordinate luminaires, mounting hardware and trim with the ceiling system.

C. LED Assemblies

1. LED luminaires shall conform to UL 1598 and to UL 8250 – Safety Standard for Light-Emitting Diode (LED) Light Sources for Use in Lighting Products.
2. Products shall be lead and mercury free.
3. Photometric characteristics shall be established using IESNA LM-79-08, IESNA Approved Method for the Electrical and Photometric Measurement of Solid-State Lighting Products.
4. Color characteristics of LED luminaires shall be as follows in accordance with ANSI C78.377 – Specifications for the Chromaticity of Solid State Lighting Products.
5. LED and driver cooling system shall be passive and shall resist the buildup of debris.
6. LED luminaire output after 50,000 hours of operation shall be not less than 70 percent of the initial lumen output when determined in accordance with IESNA LM-80-08 – IESNA approved Method for Measuring Lumen Maintenance of LED Lighting Sources.
7. LED source package electrical characteristics:
   a. Supply voltage: 120 V, 208 V, 240 V, 277 V, or 480 V as indicated on the Drawings. Provide step-down transformers if required to match driver input voltage rating.
   b. Total harmonic distortion (current): Not more than 10 percent
   c. Power factor: Not less than 90 percent
   d. RF interference: Meet FCC 47 CFR Part 15/18
   e. Transient protection: IEEE C62.41 Class A.

D. Extra Materials

1. Furnish the following extra materials matching products installed. Package with protective covering for storage and identify with labels describing contents.
   a. Five (ten percent of quantity of fluorescent lamps of each type, but no fewer than two lamps of each type).
   b. Five (five percent of quantity of LED source packages of each type, but no fewer than two of each type).
   c. One (two percent of quantity of louvers and lenses of each type, but not less than one of each type).
d. One (two percent of quantity of ballasts of each type, but not less than one of each type).
e. One (two percent of quantity of LED drivers of each type, but not less than one of each type).

E. Interior General:

1. Furnish interior luminaries that comply with requirements specified below, indicated on the Drawings, and as required to meet conditions of installation.
2. Metal parts shall be free from burrs and sharp corners and edges.
3. Metal components shall be formed and supported to prevent sagging and warping.
4. Steel parts shall be finished with manufacturer's standard finish applied over a corrosion-resistant primer. Finish shall be free from runs, streaks, stains, holidays or defects.
5. Doors and frames shall be smooth operating and free from light leakage under operating conditions. Relamping shall be possible without the use of tools. Doors, frames, lenses and diffusers shall be designed to prevent accidental falling during relamping and when secured in the operating position.
6. Luminaires shall have minimum reflecting surface reflectance as follows unless specified otherwise on the Drawings:
   a. White Surfaces: 85 percent
   b. Specular Surfaces: 83 percent
   c. Diffusing Specular Surfaces: 75 percent
7. Lenses, diffusers, covers and globes shall be 100 percent virgin acrylic unless specified otherwise on the Drawings. Lenses shall have 0.125 inches minimum thickness. Lenses for fluorescent troffers shall be injection molded.
8. Luminaires shall conform to UL 1598 - Luminaires. Provide product with damp location listing or wet location listing as required by installation location.

F. Interior Accessories

1. Provide stud supports, mounting brackets, frames, plaster rings and other accessories required for luminaire installation.
2. Furnish hangers as specified below and as required by conditions of installation:
   a. Stem hangers shall be made of 1/2-inch steel tubing with 45 degrees swivel ball hanger fitting and ceiling canopy. Finish the same as the luminaire.
   b. Rod hangers shall be made of 1/4 inch threaded zinc-plated steel rod.
   c. For HID luminaires provide hook hangers that are integrated assemblies matched to the luminaire and line voltage; equip with threaded attachment, power cord and locking type plug. Provide a safety chain or cable for each luminaire that will attach to the building structure, the ballast housing, and to the reflector/diffuser assembly.
3. Use NRTL-listed T-bar safety clips for lay-in luminaires.
4. Where indicated on the Drawings or where lamp breakage is detrimental, such as above food counters, provide open fluorescent luminaires with:

   a. Self-locking sockets or lamp retainers, two per lamp, and clear polycarbonate protective lamp sleeves with end caps over each lamp. Sleeve shall have a light transmission of 95 percent and shall be rated for the thermal profile of the lamp and ballast.

G. Interior Installation

1. Install interior lighting system in accordance with the NEC, manufacturer's installation instructions, approved shop drawings, and NECA National Electrical Installation Standards.
2. Have the manufacturer’s installation instructions available at the Project site.
3. Mounting heights specified or indicated on the Drawings are to the bottom of the luminaire for ceiling-mounted fixtures and to the center of the luminaire for wall-mounted fixtures.
4. Where the ceiling forms the protective membrane of a fire resistive assembly, install protective coverings over luminaires in accordance with NRTL requirements.
5. Install slack safety wires as described below for luminaires in or on suspended ceilings.
   a. Wire shall be minimum 12 gage galvanized soft annealed steel wire conforming to ASTM A641.
   b. Attach wire to the building structure directly above the attachment point on the box or luminaire; make trapezes of framing channel material as required to span obstacles
   c. Secure wire(s) at each end with not less than three tight turns in 1-1/2 inches.
6. Support pendant-mounted or cable-supported luminaires directly from the structure above using a 9 gage wire or an approved alternate support without using the ceiling suspension system for direct support.
   a. Install seismic restraints for pendant-mounted and cable-supported luminaires.
   b. Pendants, rods, cables, or chains 4 ft or longer shall be braced to prevent swaying using three cables at 120 degrees separation.
7. Connect luminaires in suspended ceilings using 6 ft. lengths of flexible wiring method arranged accommodate not less than 4 inches of differential seismic movement in any direction.

H. Interior Quality Control

1. Make electrical connections, clean interiors and exteriors of luminaires, install lamps, energize and test luminaires, inspect interior lighting system, and deliver spare parts in accordance with manufacturer's instructions and NECA National Electrical Installation Standards:

   ELECTRICAL
   260000 - 17
2. Test electronic dimming ballasts for full range dimming capability.
   a. Burn-in dimmer controlled fluorescent lamps at full output for not less than 100 hours before dimming.
   b. Check for visually detectable flicker over the full dimming range.

3. Prior to turnover to Owner, replace lamps that were installed and used during construction if more than 15 percent of their rated lamp life has been used.

2.08 ELECTRICAL POWER EQUIPMENT

A. Motor Controls - Manual and Magnetic:
   1. Individually-mounted magnetic starters shall be NEMA rated across-the-line type with thermal overload on each phase, single-speed, two-speed, or reduced voltage start as indicated.
   2. Motor Starters shall be furnished by Electrical Subcontractor unless part of package mechanical equipment such as rooftop units.
   3. Starters shall be of maintained contact type, of size and type required for particular motor horsepower and voltage. Minimum size starter to be size 1 FVNR, unless noted otherwise.
      a. Starters shall have OL reset button, green push-to-test type pilot light to indicate "ON", and "HAND-OFF-AUTO" switch in cover.
      b. Starters to have 120 volt control transformers with fused output being provided for those units operating on 277/480 volt system.
      c. Provide Class 20 fixed heater overloads with auto/manual reset.
      d. Provide four (4) sets of auxiliary contacts of convertible type N.O. to N.C. for each starter.
      e. Motor starters shall have NEMA I enclosures. Those in wet locations shall be NEMA 3R.
      f. Acceptable Manufacturers:
         (1) Westinghouse/Cutler-Hammer
         (2) Square D/Groupe Schneider
         (3) Siemens
         (4) Allen Bradley
         (5) GE
         (6) Or equal.

   4. Manual motor starters shall have pilot lights and shall be furnished with thermal overloads on each phase.

B. Motors: Each motor shall have disconnect switch and starter provided under this section. Starters which are a part of "factory assembled" control panel will be provided under section supplying equipment to be controlled but connected under this section.

C. Provide motor terminal boxes for each motor not furnished with same.
D. Disconnect Switches:

1. Disconnect (safety) switches shall conform to industrial standards of NEMA, be UL listed and shall be heavy duty type, quick-make, quick-break type with interlocking cover mechanism and provisions for padlocking switch handle in "OFF" position. Three pole toggle switches are not acceptable as substitute for disconnect switches.

2. Disconnect switches shall be of fused or unfused type as indicated with number of disconnecting poles indicated. The grounded conductor shall not be switched. Switches for use with current limiting fuses shall be rejection type and those used in conjunction with motors shall be horsepower rated. Provide oversize termination lugs if required by conductor size.

3. Enclosures shall be of proper NEMA type for intended location and shall be phosphate coated or equivalent code gauge galvanized sheet steel with ANSI #24 dark gray baked enamel finish.

4. Acceptable Manufacturers:
   a. Westinghouse/Culter-Hammer
   b. Square D/Groupe Schneider
   c. Siemens
   d. Allen Bradley
   e. Or equal

E. Fuses:

1. Provide a complete set of fuses for each item of fusible type equipment. Fusible equipment furnished by other Subcontractors will be complete with fuses, unless noted otherwise on Electrical Drawings.

2. Turn over to authorized representative of Owner upon completion a spare set of fuses of each different type and ampere rating installed. These spares shall be bound with twine and tagged.

3. Secondary system fuses, rated at 600 volts or less, shall be UL listed and constructed in conformance with the applicable standards set forth by NEMA and ANSI. All fuses of a particular class shall be of same manufacturer.

4. All fuses in distribution panelboards and switchboards shall be class "L" above 600 amperes and class "RK1" for 600 amperes and below.

5. Acceptable Manufacturers:
   a. Bussmann, Division of McGraw
   b. Gould/Shawmut
   c. GEC-ALSTHOM
   d. Or equal

2.09 ELECTRICAL SYSTEM CONTROLS AND INSTRUMENTS

A. Provide a complete power system consisting of branch circuits, motor disconnect switches, pushbutton stations, motor starters, and other devices to connect up and leave in operating condition each piece of electrically operated equipment provided either under this section or other Divisions.
B. All control wiring, not indicated in the Electrical Specifications or not shown on Electrical Drawings, will be provided by Temperature Control Subcontractor.

2.10 GROUNDING SYSTEM

A. All equipment and systems shall be grounded.

B. The grounded conductor shall be supplemented by an equipment grounding system.

C. The equipment grounding system shall be installed so all conductive items in close proximity to electrical circuits operate continuously at ground potential and provide a low impedance path for ground fault currents.

D. Grounding conductors shall be so installed as to permit shortest and most direct path to ground.

E. Equipment grounding conductors and straps shall be sized in compliance with Code Table 250.

F. Grounding conductors shall be insulated with green color. Grounding conductors for use on isolated ground receptacles shall be green with trace color to differentiate between normal ground conductors.

G. Branch circuits shall consist of phase, grounded and grounding conductor installed in common metallic raceway. The raceway system may not serve as the grounding conductor only. All circuits shall have a separate insulated grounding conductor installed. Any flexible cable system or non-metallic raceway system shall have an insulated grounding conductor. Any cable system for use on isolated ground circuits shall have both an isolated ground conductor as well as an equipment ground conductor, both of which shall be insulated.

H. Each electrical expansion fitting shall be furnished with a bonding jumper. Provide grounding bushings and ground connections for all raceways terminating below equipment where there is no metal-to-metal continuity.

I. Continuity between all metallic and non-metallic raceway systems and equipment shall be maintained.

J. Outdoor lighting fixtures shall be grounded and bonded in common with building system via a separate grounding conductor.

2.11 PANELBOARDS

A. Panelboards shall be dead-front, door in door safety type equipped with single or multi-pole circuit breakers suitable for 120/208 volt, 3 phase, 4 wire operation.
B. Buses shall be copper. Panelboards shall have a circuit directory card mounted in a frame with plastic cover on inside of door. Panelboards to have a copper ground bus with terminals for each circuit. Panelboards serving isolated ground receptacles shall have a separate ground bus for terminations of the isolated grounds. The isolated ground bus shall be mounted to the panel tub via non-conducting means with a separate grounding conductor run to the normal panel ground bus. Provide oversize lugs for any termination requiring same due to oversize conductors. Cabinets shall be minimum of 20 inches wide and be made of code gauge steel. Surface type shall be ordered without knockouts.

C. Trims shall be made of code gauge steel, surface or flush as indicated. Panelboards shall be keyed alike. Trims shall be provided with full length piano hinge on one side, and secured to tub with sufficient quantity of latches opposite the hinge side to allow trim to fit flush with tub and when released, allow full access to wiring gutters. Inner door shall allow access to circuit breakers only.

D. Panelboards shall be of the following types with minimum circuit breaker frame sizes listed below. Refer to schedules for larger circuit breaker frame sizes due to fault current availability.

1. 120/208 volt, three phase, four wire. Symmetrical interrupting capacity 42,000 AIC.

<table>
<thead>
<tr>
<th>Style</th>
<th>Breakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutler-Hammer type PRL-1</td>
<td>BAB Breakers</td>
</tr>
<tr>
<td>Square D type NQOD</td>
<td>QOB Breakers</td>
</tr>
<tr>
<td>Siemens type CDP-7</td>
<td>BQ Breakers</td>
</tr>
<tr>
<td>General Electric Type AQ</td>
<td>HHQB Breakers</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
</tr>
</tbody>
</table>

2. Distribution Panels:

   a. Where scheduled as circuit breaker type, symmetrical interrupting capacity 42,000 AIC.

<table>
<thead>
<tr>
<th>Type</th>
<th>Breakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westinghouse type PRL-3</td>
<td>FD Breakers</td>
</tr>
<tr>
<td>Square D I-Line type</td>
<td>FA Breakers</td>
</tr>
<tr>
<td>Siemens SPP</td>
<td>FXD6 Breakers</td>
</tr>
<tr>
<td>General Electric Spectra</td>
<td>THED Breakers</td>
</tr>
<tr>
<td>Or equal</td>
<td></td>
</tr>
</tbody>
</table>

E. Panelboards and distribution panels shall be of same manufacturer as main distribution panel. Refer to drawings where higher interrupting is required.

F. Panels may have integral surge protection within panel board. Remote surge protection is acceptable when fed with 60A/3P breaker.
2.12 SEALS

A. Environmental Seals

1. Provide seals on raceways exposed to widely different temperatures, as in refrigerating or cold storage areas. Install seal to prevent circulation of air from warmer to colder sections through the raceway.

B. Smoke and Fire Stopping Seals

1. Provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion shall not be substantially increased.

2. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings shall be firestopped using approved methods and NRTL listed products to maintain the fire resistance rating.

3. Fire stopping in sleeves or in areas that may require the addition or modification of installed cables or raceways shall be a soft, pliable, non-hardening fire stop putty. Putty shall be water resistant and intumescent. Provide for all sleeves and raceways.

4. Firestopping in locations not likely to require frequent modification shall be NRTL listed putty, caulk or mortar to meet the required fire resistant rating.

5. Box penetrations into a fire rated wall or shaft shall have a fire stopping pad installed on the back of the box.

6. Firestopping of cable trays or busways through walls shall be with a non-hardening putty or with seal bags.

7. Firestopping materials shall be NRTL listed to UL 1479 (ASTM E814). Installation methods shall conform to a UL firestopping system. Submit specifications and installation drawings for the type of material to be used. Firestopping materials shall be as manufactured by 3M, International Protective Coatings Corp., RayChem or approved equal.

2.13 FIRE ALARM AND DETECTION SYSTEM (Voice evacuation required)

A. Description:

1. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

2. The fire alarm system shall comply with requirements of latest NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

3. The fire alarm manufacturer shall be of the highest caliber and insist on the highest quality. The system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
4. The FACP and peripheral devices shall be manufactured 100 percent by a single U.S. manufacturer (or division thereof).

5. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and shall be in compliance with the UL listing.

6. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication.

7. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

B. Scope:

1. An intelligent reporting, microprocessor controlled fire detection and system shall be installed in accordance with the specifications and drawings.

2. Basic Performance:
   a. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto NFPA Style 7 (Class A) Signaling Line Circuits (SLC).
   b. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).
   c. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z).
   d. Digitized electronic signals shall employ check digits or multiple polling.
   e. Power for initiating devices and notification appliances must be from the main fire alarm control panel, the transponder to which they are connected or to a Field Charging Power Supply (FCPS).
   f. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
   g. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

3. Basic System Functional Operation: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
   a. The FACP alarm LED on the FACP shall flash.
   b. A local piezo-electric signal in the FACP control panel shall sound.
   c. The 80-character LCD display on the local FACP node and on the intelligent network display shall indicate all information associated with the fire alarm condition, including the type of alarm point, and its location within the protected premises. This information shall also be displayed on the network reporting terminal.
   d. Printing and history storage equipment shall log the information associated with the fire alarm control panel condition, along with the time and date of occurrence.
e. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated on either local outputs or points located on other network nodes.

4. Software Modifications:
   a. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
   b. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm network on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-downtime of the system or loss of system fire protection while modifications are being made.

5. Certifications:
   a. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer and trained on network applications. Include names and addresses in the certification.

C. Applicable Publications:

The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only.

1. National Fire Protection Association (NFPA) - USA:
   No. 72 National Fire Alarm Code
   No. 70 National Electric Code
   No. 101 Life Safety Code
2. Underwriters Laboratories Inc. (UL) - USA:
   No. 50  Cabinets and Boxes
   No. 268  Smoke Detectors for Fire
     Protective Signaling Systems
   No. 864  Control Units for Fire Protective
     Signaling Systems
   No. 268A  Smoke Detectors for Duct Applications
   No. 521  Heat Detectors for Fire Protective
     Signaling Systems
   No. 228  Door Closers-Holders for
     Fire Protective Signaling Systems
   No. 464  Audible Signaling Appliances
   No. 38  Manually Actuated Signaling Boxes
   No. 346  Waterflow Indicators for
     Fire Protective Signaling Systems
   No. 1481  Power supplies for Fire
     Protective Signaling Systems
   No. 1076  Control Units for Burglar Alarm
     Proprietary Protective Signaling Systems
   No. 1971  Visual Notification Appliances

3. Local and State Building Codes.
4. All requirements of the Authority Having Jurisdiction (AHJ).

D. Approvals:

1. The system must have proper listing and/or approval from the following nationally
   recognized agencies:
   UL  Underwriters Laboratories Inc.
   FM  Factory Mutual
   MEA  Material Equipment Acceptance (NYC)
   CSFM  California State Fire Marshal

2. The fire alarm control panel shall meet the modular labeling requirements of
   Underwriters Laboratories, Inc. Each subassembly, including all printed circuits,
   shall include the appropriate UL modular label. Systems which do not include
   modular labels which may require return to the manufacturer for system upgrades,
   and are not acceptable.
E. Equipment and Material - General:

1. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

2. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, and physical equipment sizes before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.

3. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

F. Conduit and Wire:

1. Conduit:
   a. Conduit shall be in accordance with the National Electrical Code (NEC), local and state requirements.
   b. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
   c. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
   d. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
   e. Conduit shall not enter any FACP, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
   f. Conduit shall be 3/4 inch (19.1 mm) minimum.

2. Wire:
   a. All fire alarm system wiring must be new, unless specified herein.
   b. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 16 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.32 mm) for notification appliance circuits.
   c. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
d. Wiring used for the SLC multiplex communication loop shall be twisted and shielded unless specifically accepted by the fire alarm equipment manufacturer.
e. All field wiring shall be completely supervised.

3. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for the intended purpose.
4. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
5. The FACP shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution Panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The FACP cabinet shall be grounded securely to either a cold water pipe or grounding rod.

G. Fire Alarm Control Panel and Fire Command Center:

1. Fire alarm control panel shall be NOTIFIER Model No. NFS3030, Edward EST3, Simplex 4100ES, Autocall 4100ES or Siemens XLS, or equal. Each shall contain a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, transponders, local and remote operator terminals, printers, annunciators, and other system controlled devices.

2. Node Capacity and General Operation:
   a. Each node shall provide, or be capable of, expansion to 198 intelligent addressable devices per loop plus 2048 annunciation points per system. FACP shall support a minimum of 10 intelligent loops.
   b. Each FACP node shall include a full featured operator interface control and annunciation panel which shall include a backlit Liquid Crystal Display (LCD), individual, color coded system status LEDs, and an alphanumeric keypad for field programming and control of the node.
   c. All programming or editing of the existing programming the system shall be achieved without special equipment or interrupting the alarm monitoring functions of the fire alarm control panel.
   d. The system shall include emergency voice communications utilizing distributed amplification and intelligence such that loss of operation by the main FACP will not result in the loss of evacuation signal throughout the balance of the building.
Each FACP node shall provide the following features:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Acknowledge</td>
<td>Printer Interface</td>
</tr>
<tr>
<td>Charger rate Control</td>
<td>CRT Display Interface</td>
</tr>
<tr>
<td>Control-by-Time</td>
<td>Non-Alarm Module Reporting</td>
</tr>
<tr>
<td>Day/Night Sensitivity</td>
<td>Periodic Detector Test</td>
</tr>
<tr>
<td>Device Blink Control</td>
<td>Remote Page</td>
</tr>
<tr>
<td>Drift Compensation</td>
<td>Trouble Reminder</td>
</tr>
<tr>
<td>NFPA 72, Sensitivity Test</td>
<td>Upload/Download to PC computer</td>
</tr>
<tr>
<td>System Status Reports</td>
<td>Verification</td>
</tr>
<tr>
<td>Security Monitor Points</td>
<td>Walk Test</td>
</tr>
<tr>
<td>Alarm Verification</td>
<td>Maintenance Alert</td>
</tr>
</tbody>
</table>

3. Loop Interface Board (LIB):
   a. Loop interface boards shall be provided to monitor and control each of the Signaling Line Circuit (SLC) loops in the network node. The loop interface board shall contain its own microprocessor and shall be capable of operating in local mode in the case of a failure in the main CPU of the control panel. In local mode, the loop interface board shall detect alarms and activate output devices on its own SLC loop.
   b. The LIB shall not require any jumper cuts or address switch settings to initialize SLC Loop operations.
   c. The loop interface board shall provide power to, and communicate with, all of the intelligent detectors and addressable modules connected to its SLC Loop over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7.
   d. The LIB shall be able to drive two Style 4 SLC loops, each up to 10,000 feet in length, for an effective loop span of 20,000 feet.
   e. The loop interface board shall receive analog information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The loop interface board software shall include software to automatically adjust and compensate for dust accumulation to maintain detector performance as it is affected by environmental factors. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
   f. The LIB shall communicate with each intelligent addressable detector and addressable module on its SLC loop and verify proper device function and status. Communication with up to 198 intelligent devices shall be performed every 6 seconds or less.
4. Enclosures:
   a. Control panels shall be housed in UL listed cabinets suitable for semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and the manufacturer's standard finish.
   b. The back box and door shall be constructed of .060 steel with provisions for electrical conduit connections into the sides and top.
   c. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
   d. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

5. FACP nodes shall be designed so that it permits continued local operation of remote transponders under both normal and abnormal network communication loop conditions. This shall be obtained by having transponders operate as local control panels upon loss of network communication.

6. FACP nodes shall be modular in construction to allow ease of servicing. Each CPU and transponder shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems, which require use of external programmers or change of EPROM’s are not acceptable.

7. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients including RFI and EMI.

8. FACP Power Supplies:
   a. Main power supplies shall operate on 120 VAC, 60Hz, and shall provide all necessary power for the FACP.
   b. Each main supply shall provide 3.0 amps of usable notification appliance power, using a switching 24 VDC regulator.
   c. The main power supply shall be expandable for additional notification appliance power in 3.0 ampere steps.
   d. Each main power supply shall provide a battery charger for 60 hours of standby using dual-rate charging techniques for fast battery recharge. It shall charge 55 Amp hour batteries with-in a 48 hour period.
   e. The supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.
   f. It shall provide meters to indicate battery voltage and charging current.
   g. The main power supply shall be power-limited per 1995 UL864 requirements.

9. System Circuit Supervision:
   a. Each FACP node shall supervise all circuits to intelligent devices, transponders, annunciators and peripheral equipment and annunciate loss of communications with these devices. The FACP CPU shall continuously scan the above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information on the printer.
   b. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.
10. Field Wiring Terminal Blocks: For ease of service, all wiring terminal blocks shall be the plug-in type and have sufficient capacity for 18 to 12 AWG wire. Fixed terminal blocks are not acceptable.

11. Operators Terminal: Provide the following functions in addition to any other functions required for the system.
   a. Acknowledge (ACK/STEP) Switch:
      (1) Activation of the control panel Acknowledge switch in response to a single new Alarm and/or trouble condition shall silence the local panel piezo electric signal and change the system alarm or trouble LED from flashing mode to steady-ON mode. If additional new alarm or trouble conditions exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
      (2) Depressing the acknowledge switch shall also silence all remote annunciator piezo sounders.
   b. Signal Silence Switch: Activation of the signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm activation. The selection of notification circuits and relays which are silence able by this switch shall be fully field programmable within the confines of all applicable standards.
   c. System Reset Switch: Activation of the system reset switch shall cause all local electronically-latched initiating devices, software zones, output devices and circuits, to return to their normal condition.
   d. If an alarm condition(s) still exists, or if they reoccur in the system after system reset switch activation, the system shall then resound the alarm conditions.
   e. System Test Switch: Activation of the system test switch shall initiate an automatic test of all intelligent/addressable detectors in the local system. The system test shall activate the electronics in each intelligent sensor, simulating an alarm condition and causing the transmission of the alarm condition from that sensor to the fire alarm control panel. The fire alarm control panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the system LCD and on any CRTs or printers in the system.
   f. Lamp Test Switch: Activation of the lamp test switch shall sequentially turn on all LED indicators, system liquid crystal display and local piezo signal, and then automatically return the fire alarm control panel to the previous condition.

12. Field Programming:
   a. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
   b. All local FACP node programming shall be accomplished through the FACP keyboard or through the video display terminal.
   c. All field defined programs shall be stored in non-volatile memory.
d. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.

13. Specific System Operations:
   a. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent detectors in the FACP node from each system keypad or from the keyboard of the video terminal. Sensitivity range shall be within allowed UL limits.
   b. Alarm Verification: Each of the intelligent addressable detectors in the system may be independently selected and enabled for alarm verification. Each FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
   c. System Point Operations:
      (1) All devices in the FACP node may be enabled or disabled through the local keypad or video terminal.
      (2) Any FACP node output point may be turned on or off from the local system keypad or the video terminal.
   d. Point Read: The FACP node shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point will be annunciated for the parameters listed:
      (1) Device Status
      (2) Device Type
      (3) Custom Device Label
      (4) Software Zone Label
      (5) Device Zone Assignments
      (6) Detector Analog Value
      (7) All Program Parameters
   e. System Status Reports: Upon command from a password-authorized operator of the system, a status report will be generated, and printed, listing all local FACP system status.
   f. System History Recording and Reporting: Each FACP node shall contain a history buffer that shall be capable of storing a minimum of 400 system events. Each local activation will be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and or printed.
   g. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
h. Automatic Detector Maintenance Alert: Each FACP node shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular intelligent detector will be annunciated on the system display, network display and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

H. Addressable Devices – General:

1. Addressable devices shall use simple to install and maintain decade (numbered 1 to 10) type address switches.
2. Addressable devices which use a binary address setting method, such as a Dip switch, are difficult to install and subject to installation error. This type of device is not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the FACP signaling line circuit.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. Smoke detector sensitivity shall be set in the fire alarm control panel and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Class A applications.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

11. A magnetic test switch shall be provided to test each detector for 100 percent obscuration, reported to the FACP.

12. Addressable devices shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.

13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100 percent of the alarm threshold.

I. Addressable Pull Box (manual station):

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key. Manual pull stations shall be of the double action type.

2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.

4. Stations shall be suitable for surface mounting or semiflush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

J. Intelligent Photoelectric Smoke Detector:

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

K. Intelligent Thermal Detectors:

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit. Up to 99 intelligent heat detectors may connect to one SLC loop.
L. Intelligent Duct Smoke Detector:

1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

M. Addressable Dry Contact Monitor Module:

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. The IDC zone may be wired for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch x 1-1/4 inch x 1/2 inch. This version need not include Style D or an LED.

N. Two Wire Detector Monitor Module:

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.
3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

O. Addressable Control Module:

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100 percent of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.

5. The control module shall be suitable for pilot duty applications and rated for a minimum of .6 amps at 30 VDC.

P. Isolator Module:

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.

2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

Q. LCD Alphanumeric Display Annunciator:

1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of 80 characters for alarm annunciation in clear English text.

2. The LCD annunciator shall display all alarm and trouble conditions from either the network node or complete network, via the INA.

3. Up to 32 LCD annunciators may be connected to a specific (terminal mode) EIA 485 interface. LCD annunciators shall not reduce the annunciation capacity of the system. Each LCD shall include vital system wide functions such as, system acknowledge, silence and reset.

4. LCD display annunciators shall mimic the local control panel 80 character display or network annunciator and shall not require special programming.

R. Batteries and External Charger:

1. Battery:
   a. Batteries shall be 12 volt, Gell-Cell type.
   b. The battery shall have sufficient capacity to power the fire alarm system for not less than 60 hours plus 15 minutes of alarm upon a normal AC power failure.
   c. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills and leakage shall not be required.
S. Speaker/Strobe Units:

1. One-way Tone/Voice Communication:
   a. The evacuation alarm and alert signals shall be capable of being initiated automatically from the fire alarm control panel (FACP) and transmitted to any speaker circuit, selected speaker circuits or all speaker circuits.
   b. The alarm signal, alert signal and live voice announcements shall be capable of manual transmission from the FACP to any speaker circuit, selected speaker circuits or all speaker circuits by manual selection of the associated speaker circuit control switches.
   c. Live voice announcements, via the hand-held microphone or patched in warden phone, by use of speaker control switches, shall take priority over all previously activated alarm inputs. In addition to NFPA 72 requirements, the system shall be capable of priority live voice announcements over subsequent alarm conditions. In no case shall subsequent alarms disrupt emergency live voice announcements.
   d. Alarm speaker amplification equipment shall be sized, as a minimum, to provide the following wattage levels for each location type of alarm speaker:
      (1) Each floor alarm speaker: Provide one watt of input power.
      (2) Each toilet alarm speaker: Provide one-half (1/2) watt of input power.
      (3) Each mechanical room alarm speaker: Provide two watts of input power.
      (4) Each stairwell alarm speaker: Provide one-half (1/2) watt of input power.
      (5) Each elevator cab alarm speaker: Provide one-quarter (1/4) watt of input power.
   e. As a minimum, alarm speaker amplification equipment shall be sized to provide the above indicated wattage of input power to each location type of alarm speaker shown on the Drawings, plus twenty-five percent (25 percent) spare capacity to permit the addition of future alarm speakers.
   f. Alarm speaker amplifiers shall be paired to provide 100 percent redundancy. One back-up alarm speaker amplifier shall be provided for each primary alarm speaker amplifier. If any primary alarm speaker amplifier fails, its function shall be taken over by its backup amplifier. Provide dedicated power amplifiers for each speaker circuit (4 min.) with one dedicated backup.
   g. Alarm tone and alert tone oscillators and pre-amplifiers shall be paired to provide 100 percent redundancy.
   h. As a minimum, each stairwell shall be provided with a dedicated notification appliance circuit.
   i. As a minimum, the system shall be configured as a two channel voice system.
   j. Within the individual assembly occupancies in this project, an alarm received during a program occupancy shall sound an alert alarm at a constantly attended location and perform the following actions:
      (1) Deliver a field programmable, digitized custom evacuation message to the occupants, detailing evacuation instructions.
(2) A simultaneous message shall be delivered via all alarm speakers installed in remainder of the building directing evacuation using exits other than the assembly occupancy exit path.

(3) Perform all control functions as detailed elsewhere in this specification.

(4) An automatic announcement or tone evacuation signal shall be capable of interruption by the operation of the system microphone to give voice evacuation instructions overriding the pre-programmed sequences.

k. Visual Unit (Xenon Strobe):
   (1) Combination speaker strobe units - Provide Truealert Non-Addressable 75 Cd, Red Sync. 2-Wire. Comprised of a 24 VDC Xenon Flash Tube entirely solid state. The unit shall require a sync. Control module. Provide True 75 Cd from all axis.
   
   (2) Combination speaker strobe units - Provide Truealert Non-Addressable 110 Cd, Red Sync. 2-Wire. Comprised of a 24 VDC Xenon Flash Tube entirely solid state. The unit shall require a sync. Control module. Provide True 110 Cd from all axis.

   (3) Visual only – Provide Truealert Non-Addressable 15 Cd, Red Sync. 2-Wire comprised of a 24 VDC Xenon flash tube entirely solid state.

T. Provide UL Listed digital communicator with Contact ID to transmit signals by Point ID to “UL Listed” central station in accordance with Fire Department requirements.

U. Exterior Strobe-unit:
   1. Provide wall mounted, 24 VDL strobe, color red with WRR wall bracket.

V. Tamper resistant covers:
   1. Provide clear plastic covers with local audible alarm for all pull stations.

W. Magnetic Door Holders:
   1. Provide Semi-Flush Wall Mounted, or Floor Mounted, 24 V.D.C. with catch plate.

X. Key Repository Box:
   1. Provide key repository box(es) in accordance with fire department requirements.

Y. Provide radio master box, Sigcom 16 zone in accordance with local fire department requirements with exterior antenna. Program zones per Fire Department requirements.

Z. Field Quality Control
   1. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
2. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
   a. Factory trained and certified.
   b. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
   c. International Municipal Signal Association (IMSA) fire alarm certified.
   d. Certified by a state or local authority.
   e. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

3. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

4. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

5. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

6. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.


8. Final Test, Certificate of Completion, and Certificate of Occupancy:
   a. Test the entire system 100 percent devices as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

9. Provide 8 hours of customer training.

2.14 SURGE PROTECTION

A. Scope

1. This section describes the materials and installation requirements for surge protective devices (SPD) for the protection of all main service and panelboards.

B. Submittals

1. Submit shop drawings and product information for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by customer name, customer location, and customer order number.

2. Submittals shall include UL 1449 3rd Edition Listing documentation verifiable by visiting www.UL.com, clicking “Certifications” link, searching using UL Category Code: VZCA and VZCA2:
   a. Short Circuit Current Rating (SCCR)
   b. Voltage Protection Ratings (VPRs) for all modes
   c. Maximum Continuous Operating Voltage rating (MCOV)
d. I-nominal rating (I-n)
e. SPD shall be UL listed and labeled as Type 1 or Type 4 intended for Type 1 or Type 2 applications

3. Upon request, an unencapsulated but complete SPD formally known as TVSS shall be presented for visual inspection.

4. Minimum of ten year warranty

C. Related Standards

1. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,
2. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,
5. UL 1283 - Electromagnetic Interference Filters

D. Quality Assurance

1. Manufacturer Qualifications: Engage a firm with at least 5 years experience in manufacturing transient voltage surge suppressors.
2. Manufacturer shall be ISO 9001 or 9002 certified.
3. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
4. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

E. Delivery, Storage And Handling

1. Handle and store equipment in accordance with manufacturer’s Installation and Maintenance Manuals. One copy of this document to be provided with the equipment at time of shipment.

F. Manufacturers

1. Provide an internally mounted Surge Protective Devices (SPD) formerly called Transient Voltage Suppressor (TVSS) by:
   a. Siemens Industry.
   b. Current Technology
   c. LEA
   d. Liebert
   e. APT
   f. Or equal
G. Electrical Distribution Equipment

1. Service Entrance

a. SPD shall be UL 1449 labeled as Type 1 or Type 2 intended for Type 1 or Type 2 applications, verifiable at UL.com, without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

b. SPD shall be factory installed integral to electrical distribution equipment.

c. SPD shall be UL labeled with 20kA I-nominal (I-n).

d. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR).

e. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

f. True 10 Mode Protection paths: SPD shall provide “directly connected protection elements” between all possible modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

g. SPD shall be connected external of the distribution equipment with an appropriately sized 200kA SCCR rated disconnect.

h. SPD shall meet or exceed the following criteria:

2. Maximum 7-Mode surge current capability shall be [300kA] per phase.

3. Maximum 10-Mode surge current capability shall be [300kA] per phase.

4. UL 1449 - Third Edition Revision; effective September 29, 2009 Voltage Protection Ratings shall not exceed the following:

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>L-N</th>
<th>L-G</th>
<th>N-G</th>
<th>L-L</th>
<th>MCOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120</td>
<td>800V</td>
<td>800V</td>
<td>800V</td>
<td>1200V</td>
<td>150V</td>
</tr>
</tbody>
</table>

a. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>Allowable System Voltage Fluctuation (%)</th>
<th>MCOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120</td>
<td>25%</td>
<td>150V</td>
</tr>
</tbody>
</table>

b. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of -50dB at 100 kHz.

c. Suppression components shall be heavy duty ‘large block’ MOVs, each exceeding 30mm diameter.

d. SPD shall include a serviceable, replaceable module.

e. SPD shall be equipped with the following diagnostics:

(1) Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
Audible alarm with on/off silence function and diagnostic test function (excluding branch).

Form C dry contacts

Optional – Surge Counter

No other test equipment shall be required for SPD monitoring or testing before or after installation.

SPD shall have a response time no greater than 1/2 nanosecond.

SPD shall have a 10 year warranty.

5. Distribution Panel

a. SPD shall be UL 1449 labeled as Type 4 intended for Type 1 or Type 2 applications, verifiable at UL.com, without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

b. SPD shall be factory installed integral to electrical distribution equipment.

c. SPD shall be UL labeled with 20kA I-nominal (I-n)

d. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR).

e. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

f. SPD shall be connected to the buss of the distribution equipment with an appropriately sized 200kA SCCR rated disconnect.

g. SPD shall meet or exceed the following criteria:

(1) Maximum 7-Mode surge current capability shall be 100kA per phase.

(2) Maximum 10-Mode surge current capability shall be 150kA per phase.

6. UL 1449 - Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>L-N</th>
<th>L-G</th>
<th>N-G</th>
<th>L-L</th>
<th>MCOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120</td>
<td>800V</td>
<td>800V</td>
<td>800V</td>
<td>1200V</td>
<td>150V</td>
</tr>
</tbody>
</table>

a. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

```
<table>
<thead>
<tr>
<th>System Voltage</th>
<th>Allowable System Voltage Fluctuation (%)</th>
<th>MCOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120</td>
<td>25%</td>
<td>150V</td>
</tr>
</tbody>
</table>
```

b. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of -50dB at 100 kHz.
c. Suppression components shall be heavy duty ‘large block’ MOVs, each exceeding 30mm diameter.
d. SPD shall include a serviceable, replaceable module.
e. SPD shall be equipped with the following diagnostics:

1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
2. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
3. Form C dry contacts
4. Optional – Surge Counter

No other test equipment shall be required for SPD monitoring or testing before or after installation.

f. SPD shall have a response time no greater than 1/2 nanosecond.
g. SPD shall have a 10 year warranty.

7. Branch Panels

a. The panelboard shall be UL 67 Listed and the SPD shall be UL 1449 labeled as Type 1 or as Type 4 intended for Type 1 or Type 2 applications.
b. The unit shall be top or bottom feed according to requirements. A circuit directory shall be located inside the door.
c. SPD shall meet or exceed the following criteria:

1. Maximum 7-Mode surge current capability shall be 100kA per phase.
2. Maximum 10-Mode surge current capability shall be 150kA per phase.
3. UL 1449 - Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>L-N</th>
<th>L-G</th>
<th>N-G</th>
<th>L-L</th>
<th>MCOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120</td>
<td>800V</td>
<td>800V</td>
<td>800V</td>
<td>1200V</td>
<td>150V</td>
</tr>
</tbody>
</table>

d. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>Allowable System Voltage Fluctuation (%)</th>
<th>MCOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120</td>
<td>25%</td>
<td>150V</td>
</tr>
</tbody>
</table>

e. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz.
f. Suppression components shall be heavy duty ‘large block’ MOVs, each exceeding 30mm diameter.
g. SPD shall include a serviceable, replaceable module.
h. SPD shall be equipped with the following diagnostics:

1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
(2) Audible alarm with on/off silence function and diagnostic test function (excluding branch).
(3) Form C dry contacts
(4) Optional – Surge Counter

i. No other test equipment shall be required for SPD monitoring or testing before or after installation.

j. SPD shall have a response time no greater than 1/2 nanosecond.

k. SPD shall have a 10 year warranty.

l. The unit shall have removable interior.

m. The main bus shall be [copper] [aluminum] and rated for the load current required.

n. The unit shall include a 200 percent rated neutral assembly with copper neutral bus.

o. The unit shall be provided with a safety ground bus.

p. The field connections to the panelboard shall be main lug or main breaker.

q. The unit shall be constructed with flush or surface mounted trim and shall be in a NEMA Type 1 enclosure.

H. Installation

1. Install per manufacturer’s recommendations and contract documents.

I. Adjustments And Cleaning

1. Remove debris from installation site and wipe dust and dirt from all components.
2. Repaint marred and scratched surfaces with touch up paint to match original finish.

J. Testing

1. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture’s recommendations.
2. Check all installed panels for proper grounding, fastening and alignment.

K. Warranty

1. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.

2.15 FIRESTOPPING AND SEALANTS

A. General

1. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed. For applications where combustible penetrants are involved, i.e. insulated and plastic pipe, a suitable intumescent material must be used.
2. This section specifically addresses pipe, duct, cable, and wiring penetrations of fire wall firestops and smoke stops for all bearing and non-bearing walls and floors assemblies.

B. References
   a. ASTM E 814: Standard Test method For Fire Tests of Through-Penetration Firestops
   b. ASTM E84: Standard Test Method For Surface Burning Characteristics of Building Materials
2. Underwriters Laboratories Inc.:
3. UL 1479 Fire Tests of Through-Penetration Firestops
   1) UL 723 Surface Burning Characteristics of Building Materials
   b. UL Fire Resistance Directory:
      1) Through Penetration Firestop Device (XHJI)
      2) Fire Resistive Ratings (BXUV)
      3) Through Penetration Firestop Systems (XHEZ)
      4) Fill, Void, or Cavity Material (XHHW)

C. Definitions
1. Firestopping: The use of a material or combination of materials in a fire-rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on that wall or floor.
2. System: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a "System".
3. Barrier: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.
4. Through-Penetration: Any penetration of a fire-rated wall or floor that completely breaches the barrier.
5. Membrane-Penetration: Any penetration in a fire-rated wall that breaches only one side of the barrier.
6. Construction Gaps: Any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall to wall applications, edge to edge floor configurations; floor to exterior wall; or any linear breach in a rated barrier. Where movement is required, the firestopping system must comply with UL2079 for dynamic joints.

D. Quality Assurance
1. Firestopping systems (materials and design):
   a. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
   b. The F rating must be a minimum of one (10 hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). the fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
   c. For joints, must be tested to UL2079 with movement capabilities equal to those of the anticipated conditions.
2. Firestopping materials and systems must be capable of closing or filling through openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).

3. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

4. Firestopping sealants must be flexible, allowing for normal pipe movement.

5. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

6. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

7. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).

8. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestop manufacturer.

9. Material used shall be in accordance with the manufacturer's written installation instructions.

E. Materials

1. Intumescent Firestop Sealants and Caulks:
   a. STI SpecSeal S100 and S500 Sealant
   b. 3M Fire Barrier Caulk CP25WB+

2. Latex Firestop Sealant:
   a. STI SpecSeal LC150 Sealant

3. Silicone Firestop Sealants and Caulks:
   a. STI SpecSeal Pensil 100 and 300
   b. 3M Fire Barrier Silicone Sealants

4. Firestop Putty:
   a. STI SpecSeal Firestop Putty Bars and Pads
   b. 3M Fire Barrier Moldable Putty

5. Firestop Collars:
   a. STI SpecSeal Firestop Collars
   b. 3M Fire Barrier PPD's

6. Wrap Strips:
   a. SpecSeal Wrap Strip
   b. 3M Fire Barrier FS195 Wrap Strip

7. 2-Part Silicone Firestop Foam:
   a. STI SpecSeal Pensil 200
   b. 3M Fire Barrier 2001 Silicone Foam

8. Firestop Mortar:
   a. STI SpecSeal Mortar

9. Composite Board:
   a. 3M Barrier Sheet Material

10. Accessories:
    a. Forming/Damming Materials: Mineral Fiberboard or other type as per manufacturer recommendation.
2.16 EMERGENCY BATTERY SYSTEM

A. Provide a 12 Volt emergency battery system constructed in accordance with UL Standard 924 and installed in accordance with Article 700 of the Electrical Code in locations indicated on the Drawings.

B. Battery units and remote heads shall be as manufactured by Emergi-Lite, Inc., Chloride, Inc., Dual Light or approved equal and shall be of the voltage, capacity and model indicated on the Drawings. Provide units of capacities as required to meet the number of lighting fixtures connected to each unit. Batteries shall be NRTL listed for carrying rated load for 90 minutes.

C. Battery unit shall be arranged for 60 cycle input with AC voltage as indicated on the Drawings, including heavy gauge sheet cabinet with fully automatic solid-state controlled charger. Unit shall be fully restorable in 12 hours or less and shall include Trickle charger, heavy duty two contact AC supervisory relay, voltmeter, ammeter, protection fuse, ready pilot light, charging pilot light, test switch, knockouts provided in housing for both AC input and DC output to remote heads. Unit shall be provided with wall-mounting hardware.

D. Provide 5 minute time delay relay to maintain emergency lighting in HID source lighted areas for three minutes after return of normal power.

E. Remote heads shall be of the voltage, wattage and type indicated on the Drawings and shall be housed in an aluminum cylinder with fully adjustable swivel-mounted on a single gang stainless switch plate unless indicated otherwise on Contract Drawings.

F. All remote heads shall be aimed after final installation of all furnishings to ensure code compliant coverage of paths of egress. Provide a minimum of one onsite review of lighting coverage and footcandle levels for the entire facility with local AHJ and provide record of acceptance.

PART 3 - EJECUTION

3.01 WORK COORDINATION AND JOB OPERATIONS

A. Equipment shall not be installed in congested and possible problem areas without first coordinating installation of same with other trades. Relocate electrical equipment installed in congested or problem areas should it interfere with the proper installation of equipment to be installed by other trades.

B. Particular attention shall be directed to coordination of lighting fixtures and other electrically operated equipment requiring access which is to be installed in ceiling areas. Coordinate with other trades, the elevations of equipment in hung ceiling areas to insure adequate space for installation of recessed fixtures before said equipment is installed. Conflicts in mounting heights and clearances above hung ceilings for installation of recessed lighting fixtures or other electrically operated equipment requiring access shall be brought to the attention of Architect for a decision prior to equipment installation.
C. Furnish to Construction Manager and other subcontractors information relative to portions of electrical installation that will affect other trades sufficiently in advance so that they may plan their work and installation.

D. Obtain from other trades information relative to electrical work which he, the Electrical Subcontractor, is to execute in conjunction with installation of other trades’ equipment.

E. Lighting fixtures in mechanical spaces or utility/storage rooms shall only be installed after all mechanical equipment is in place.

3.02 DRAWINGS AND SPECIFICATIONS

A. Drawings:

1. Plans showing layout of electrical systems indicate approximate location of raceways, outlets, and apparatus. Runs of feeders and branch circuits are schematic and are not intended to show exact routing. Final determination as to routing shall be governed by structural conditions and as indicated on the approved coordination Drawings.

B. Specifications:

1. Specifications supplement Drawings and provide specifics pertaining to methods and material to be used.

3.03 IDENTIFICATION

A. Equipment shall be marked for ease of identification as follows:

1. Provide screw-on nameplates on switchboards, panelboards, F.A. terminal cabinets, starters, and disconnect switches. Nameplates to be of black phenolic with white engraving. For starters and disconnect switches lettering shall be minimum of 1/4 in. high. Nameplates on panelboards shall have the following information.
   a. Line 1 - Panel designation in 1/2 in. high letters.
   b. Line 2 - Utilization voltage in 3/8 in. high letters.
   c. Line 3 - Distribution source "Fed from      " in 1/4 in. high letters.

2. Neatly typed directory cards listing circuit designations shall be fastened inside the cover of panelboards. Spare circuits shall be penciled.

3. Color coding schedules. If there is more than a single system voltage, different voltages shall have separate color codes, as previously specified. A copy of the color code schedule shall be affixed to each secondary switchboard and distribution panel and shall be of the phenolic nameplate type as previously specified. A typewritten color code schedule shall also be affixed, under plastic, inside each panelboard door.

4. Outlet boxes both concealed and exposed shall be identified as to panel origination and circuit number by means of fibre pen on the inside of coverplate.
5. Special system outlet boxes concealed above hung ceilings shall be identified as to system by spray painting during roughing. The following systems shall be identified.
   a. Fire Alarm - red.
   d. Sound - green.

6. Wiring device plates on devices connected to normal-emergency circuits shall be red in color.
7. All conductors in boxes larger than standard outlet boxes, in all wireways and trench headers shall be grouped logically and be identified.
8. Grounding conductors and neutrals shall be labeled in panels and wireways as to circuits associated with.

3.04 PROTECTION AND CLEANUP

A. Protection:
   1. Materials and equipment shall be suitably stored and protected from weather.
   2. During progress of work, pipe and equipment openings shall be temporarily closed so as to prevent obstruction and damage.
   3. Be responsible for maintenance and protection of material and equipment until final acceptance.

B. Cleanup:
   1. Keep job site free from accumulation of waste material and rubbish. Remove all rubbish, construction equipment, and surplus materials from site and leave premises in a clean condition.
   2. At completion, equipment with factory finished surfaces shall be cleaned and damaged spots touched up with the same type paint applied at factory.
   3. Particular attention is called to Section 110-12(c) of the NEC, which requires that internal parts of electrical equipment not be contaminated by construction operations.

3.05 PORTABLE OR DETACHABLE PARTS

A. Retain possession of and be responsible for spare parts, portable and detachable parts, and other removable portions of installation including fuses, keys, locks, blocking clips, inserts, lamps, instructions, drawings, and other devices or materials that are relative to and necessary for proper operation and maintenance of the system until final acceptance, at which time such parts shall be installed or turned over to the Owner, as the case may be.
3.06 SAFETY PRECAUTIONS

A. Provide proper guards, signage, and other necessary construction required for prevention of accidents and to insure safety of life and property. Remove any temporary safety precautions at completion.

3.07 MOUNTING HEIGHTS

A. All electrical equipment shall be mounted at the following heights unless noted or detailed otherwise on drawings. Notes on architectural drawings shall supersede those noted below or detailed on the electrical drawings. If mounting height of an electrical component is questionable, obtain clarification from Architect before installation.

1. Duplex convenience outlets, microphone outlets, and telephone outlets - 18 inches.
2. Light switches, pushbutton stations, HOA switches, and all other toggle or control switches for the operation of heating, ventilating, and air conditioning, plumbing, and general service - 48 inches.
3. Fire alarm pull stations - 48 inches.
4. Fire alarm audio visual signals - 80 inches or 6 inches below ceiling, whichever is lower.
5. Panelboards for lighting, power, telephone, and other auxiliary systems – 68 in. to top.
6. Equipment located in lobbies shall be located as detailed on architectural drawings or as directed by Architect.
7. All receptacles, light switches, and fire alarm signals sharing a common location shall be symmetrically arranged.
8. Exterior and interior wall brackets shall be as detailed on architectural drawings or as directed by Architect.

B. Mounting heights given are from finished floor to centerline. In the case of a raised floor, surface of raised floor is the finished floor.

3.08 WORKMANSHIP AND INSTALLATION METHODS

A. Work shall be installed in first-class manner consistent with best current trade practices. Equipment shall be securely installed plumb and/or level. Flush-mounted outlet boxes shall have front edge flush with finished wall surface. No electrical equipment shall be supported by work of other trades.

B. Supports:

1. Support work in accordance with best industry practice and by use of standard fittings.
2. In general, walls and partitions will not be suitable for supporting weight of panelboards, dry type transformers and the like. Provide supporting frames or racks extending from floor slab to structure above.
3. Provide supporting frames or racks for equipment, intended for vertical surface mounting in free standing position where no walls exist.
4. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of equipment.

5. Provide 3/4" thick painted plywood mounting surfaces in all electric and telephone areas and for all equipment on free standing racks. All plywood shall be fire retardant and painted both sides and edges with 2 coats of white paint.

6. No work for exposed installations in damp locations shall be mounted directly on any building surface. In such locations, flat bar members or spacers shall be used to create a minimum of 1/4" air space between building surfaces and work.

7. Nothing (including outlet, pull and junction boxes and fittings) shall depend on electric raceways or cables for support. All outlet, pull, and junction boxes shall be independently supported.

8. Nothing shall rest on, or depend for support on, suspended ceiling or its mounting members.

9. Support surface or pendant mounted lighting fixtures:
   a. From outlet box by means of an interposed metal strap, where weight is less than five pounds.
   b. From outlet box by means of a hickey or other direct threaded connection, where weight is from five to fifty pounds.
   c. Directly from structural slab, deck or framing member, where weight exceeds fifty pounds.
   d. Pendant lighting fixtures shall be supported by threaded rods in non-public areas and by manufacturer’s standard tube hangers with swivel aligner and canopy in public areas. Provide non-standard pendant lengths where required to mount fixtures at elevations either called for on Drawings or as shown in architectural elevations.

10. Support recessed lighting fixtures directly from structural slabs, decks or framing members, by means of jack chain or air craft cable, one at each end of fixture at opposite corners.

11. Where support members must of necessity penetrate air ducts, provide airtight sealing provisions which allow for a relative movement between the support members and the duct walls.

12. Provide channel sills or skids for leveling and support of all floor mounted electrical equipment.

13. Where permitted loading is exceeded by direct application of electrical equipment to a slab or deck, provide proper dunnage as required to distribute the weight in a safe manner.

14. Support metallic raceways by either running within steel frame or hung from the building frame. Anything hung from building frame shall be attached with metallic fasteners.

C. Fastenings:

1. Fasten electric work to building structure in accordance with the best industry practice.

2. Where weight applied to attachment points is 100 pounds or less, fasten to building elements of:
   a. Wood -- with wood screws.
   b. Concrete and solid masonry -- with bolts and expansion shields.
   c. Hollow construction -- with toggle bolts.
d. Solid metal -- with machine screws in tapped holes or with welded studs.

3. Where weight applied to attachment points exceeds 100 pounds, fasten as follows:
   a. At field poured concrete slabs, provide inserts with 18" minimum length slip-through steel rods, set transverse to reinforcing steel.
   b. Where building is steel framed, utilize suitable auxiliary channel or angle iron bridging between structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.

4. Floor mounted equipment shall not be held in place solely by its own dead weight. Provide floor anchor fastenings. Floor mounted equipment over 72 inches in height shall also be braced to nearest wall or overhead structural elements.

5. For items which are shown as being mounted at locations where fastenings to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging to building structural elements.

6. Fastenings for metallic raceways using the fastening as support shall be of the metallic type. Fastenings to hold raceways or cables in place may be via tyraps.

D. General Raceway Installation:

1. Install the various types of raceways in permitted locations as previously specified. All raceways shall be run concealed. Consult Architect for instruction for raceways which must be exposed in public spaces.
2. Raceways for normal-emergency or emergency only wiring cannot contain other conductors.
3. Raceways shall be properly aligned, grouped, and supported in accordance with code. Exposed raceways shall be installed at right angles to or parallel with structural members. Concealed raceways may take most direct route between outlets.
4. Raceways run on trapeze hangers shall be secured to the trapeze.
5. Raceways shall be continuous and shall enter and be secured to all boxes in such a manner that each system shall be electrically continuous from service to all outlets. Provide grounding bushings and bonding jumpers where raceways attach to painted enclosures or terminate below equipment.
6. Where raceways enter boxes, cabinets, tap boxes, other than those having threaded hubs, a standard locknut shall be used on the outside and locknut and bushing on the inside.
7. Where raceways terminate below equipment and there is no direct metal to metal continuity, provide grounding bushings on raceways and interconnect with equipment grounding conductor.
8. All empty raceways shall be provided with a pull wire.
9. All raceway sleeves, stub-ups, or stub-outs, where not connected to a box or cabinet, shall be terminated with a bushing.
10. All raceway joints shall be made up tight and no running threads will be permitted.
11. Where raceways are cut, the inside edge shall be reamed smooth to prevent injury to conductors.
12. All vertical raceways passing through floor slabs shall be supported.
13. Raceways shall not be installed in concrete slabs above grade or below waterproofed slabs.

14. Electric raceways and/or sleeves passing through floors or walls shall be of such size and in such location as not to impair strength of construction. Where raceways alter structural strength or the installation is questionable, the structural engineer shall be contacted for approval.

15. Raceways shall not run directly above or below heat producing apparatus such as boilers, nor shall raceways run parallel within 6 inches of heated pipes. Raceways crossing heated pipes shall maintain at least a 1 inch space from them.

16. Raceways shall be installed in such a manner as to prevent collection of trapped condensates, and all runs shall be arranged to drain.

17. Raceways passing between refrigerated and non-refrigerated spaces and those penetrating enclosures with air movement shall be provided with seals.

18. Raceways feeding fire and jockey pumps shall be rigid metal conduit either run below slab or inside 2 hour rated enclosure. Final connections to motors shall be liquidtight flexible conduit.

19. Where two alternate wiring methods interconnect such as EMT to flexible metal conduit, an outlet box shall be provided.

20. All empty raceways entering building and all sleeves or core drilled openings through floors shall be sealed.

21. Rigid non-metallic raceways where allowed and run as a ductbank encased in concrete shall be installed with plastic spacers to ensure a separation of 3 inches between raceways.

22. Elbows and extensions of rigid non-metallic raceway systems which penetrate slabs shall be rigid or intermediate metal conduit.

23. Raceways used for transformer connections shall be flexible type and shall contain a grounding conductor.

24. Raceways entering building through foundation wall into a basement area shall be provided with wall entrance seals or with other acceptable waterproofing method.

E. General Outlet Box Installation:

1. Boxes shall be set flush with finish surface and provided with proper type extension rings or plaster covers. Thru the wall boxes are not permitted. Check device or fixture to be mounted to box to ensure box orientation is proper.

2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operation.

3. Remove knockouts only as required and plug unused openings.

4. Where required for horizontal and vertical alignment of boxes in stud partitions, bar hangers spanning two studs shall be used. Device boxes for insertion type receptacles shall be provided with far side box supports where there are less than two entering nonflexible raceways, and where bar rangers are not provided.

5. Boxes flush mounted in fire rated partitions and on opposite sides of the partition shall be separated by a distance of 24 inches in accordance with UL listing for the box.

6. Locations of outlets indicated on Drawings are approximate. For items exposed to view, refer to architectural Drawings and coordinate locations with masonry joints, panel joints, ceiling grids, structural members, etc.
7. In case of conflict with standard mounting heights and device alignment, consult Architect prior to roughing.
8. Check all door swings on architectural Drawings to ensure lighting switches are installed on strike side of door.
9. The right to make any reasonable change in location of outlets prior to roughing is reserved by Architect. "Reasonable change" shall be interpreted as movement within 10 feet of location shown.
10. Obtain dimensioned plan from Architect for floor outlets.
11. Outlet boxes for use where surface metal raceways are allowed shall be of a type specifically designed to be used with such surface metal raceway systems.
12. Outlet boxes shall not line up back to back in partition walls.

F. Conductor Installation:

1. No conductors shall be pulled into individual raceways until such raceway system is complete and free of debris. No harmful lubricants shall be used to ease pulling.
2. All conductors shall be wired so that grounded conductor is unbroken; switches in all cases being connected in ungrounded conductor.
3. Connections throughout the entire job shall be made with solderless type devices of approved design satisfactory to Inspector of Wires.
4. All taps and splices shall be insulated equal to that of conductor insulation.
5. All conductors of each feeder in pull boxes etc. shall be grouped, tied together, supported, and identified.
6. All conductors in panelboards and other wiring enclosures shall be neatly formed and grouped.
7. All conductors of emergency only and/or normal/emergency shall be run in separate raceway systems to final outlet box.
8. Provide support for conductors in vertical raceways in accordance with Article 300-19.
9. Strip insulation from conductors with approved tools and only of sufficient length for proper termination. Cutting of conductor stranding is unacceptable.
10. Taps from paralleled conductors shall be of a type which tap each conductor, such as ILSCO "PTA" series.
11. Grounding conductors are to be identified as to associated power circuits.

3.09 FEEDER CIRCUITS

A. Provide feeders as called for on the drawings.

B. Feeders shall be defined as any circuit originating from the main building switchboard and/or distribution panels.

C. All feeder conductors shall be continuous from origin to panel or equipment termination without splicing.

D. All feeders shall be conductors pulled into raceways. Cable systems are not allowed for feeders unless specifically indicated.
3.10 BRANCH CIRCUITS

A. Provide all branch circuit wiring and outlets for a complete and operating system. The system shall consist of insulated conductors connected to the panelboards and run in raceways or as cable systems if permitted under products section, as required to the final outlet and shall include outlet boxes, supports, fittings, receptacles, plates, fuses, etc.

B. Physical arrangement of branch circuit wiring shall correspond to circuit numbering on Drawings. Combining of circuits and raceways will be allowed up to a 3 phase, 4 wire circuit in a single raceway, unless shared neutrals are not allowed by other sections of this Division, or are indicated as separate neutrals on the Drawings. Any combination of homeruns such as this, however, shall be indicated on record Drawings. Combining of conductors and raceways for tenant fitup work is allowed only for fitup boxes in accordance with details on Drawings. When a common grounded conductor is used for more than one circuit, the arrangement shall be such that a receptacle, fixture, or other device may be removed or disconnected without disconnecting the grounded conductor for other circuits. Ground fault circuit breakers and isolated ground outlets shall be wired with separate neutrals and separate grounding conductors per circuit. A consistent phase orientation shall be adhered to throughout project at terminations.

C. Circuits feeding three phase equipment shall not be combined into common raceways, unless specifically indicated.

D. All wiring in panelboards and cabinets shall be neatly formed and grouped.

3.11 FIREPROOFING AND WATERPROOFING

A. Fireproof and waterproof all openings in slabs and walls.

3.12 CUTTING AND PATCHING

A. Cutting of surfaces, including core drilling of walls and slabs, as previously indicated shall be done by Electrical Subcontractor. Openings through new wall surfaces will be provided by General Contractor if Electrical Subcontractor gives suitable notice as erection of surface proceeds. If suitable notice is not given, Electrical Subcontractor shall then be responsible for cost of corrective work required.

B. The patching of holes shall be performed by Electrical Sub-contractor utilizing methods outlined for the finish trade involved. Holes shall be patched to the satisfaction of the Architect.

3.13 MECHANICAL SYSTEM COORDINATION

A. The Mechanical System Subcontractor will be providing various items of mechanical services equipment and control apparatus. In general, Electrical Subcontractor shall provide disconnecting means and starters and connect up power wiring to this equipment.
B. The Mechanical and Electrical Subcontractor shall closely coordinate their respective portions of work.

C. If, due to local regulations, electric heating equipment furnished by the mechanical systems subcontractor is required to be installed by licensed electricians in order to allow connection by Electrical Subcontractor's licensed electricians, it will then be Mechanical Subcontractor's responsibility to engage and pay for services of such licensed electricians.

D. Power wiring to be provided by Electrical Subcontractor is the line voltage power supply wiring. Control wiring is responsibility of Mechanical System Subcontractor unless specifically indicated on electrical drawings, or in this Division of the specifications. Temperature Control Subcontractor shall refer to electrical drawings for location of all magnetic starters and VFD’s provided by the Electrical Contractor.

E. 120 volt control wiring source to one temperature control panel is the responsibility of Electrical Subcontractor.

3.14 DISTRIBUTION EQUIPMENT FIELD TESTING

A. All panelboards, individual motor starters, main distribution panel, motor controls, feeder conductors, and emergency systems shall be tested in accordance with the following. In general, all tests shall be done in accordance with the 1995 Acceptance Testing Specifications of the International Electrical Testing Association.

B. The Testing Subcontractor may be an independent contractor or a manufacturer of the equipment, which is to be tested.

C. Test report forms, delineating tests to be made, and method of recording same shall be submitted prior to commencing work. Test reports when submitted shall include interpretation of results and recommendation for any corrective work required.

D. Main Distribution Panel:

1. Visual Inspection:
   a. Check for foreign material within bus enclosure.
   b. Check for missing hardware.
   c. Inspect entire assemblies for transit damage or factory defects.
   d. Check for all bus dimensions and bracing per specifications.
   e. Check ratings of current transformers and potential transformers.
   f. Check ratings of all protective relays per drawings.

2. Physical Inspection:
   a. Torque all bus hardware to proper tension.
   b. Circuit breaker interlocks all work properly.
   c. All doors and hinged panels open and close properly.
   d. Relay blocking removed from all control and protective relays.
   e. All circuit breakers operate, close and trip mechanically.
   f. Torque all feeder conductors to terminal manufacturers' recommendations.
3. **Electrical Testing:**

   a. Breakers operated electrically trip and close from local and remote positions.
   b. All circuit breakers calibrated to manufacturer's respective time current curves as specified.

   (1) Long time pick-up amps.
   (2) Long time delay tripping at 300 percent of current setting.
   (3) Resets okay at 80 percent of pick-up value.
   (4) Short time pick-up current.
   (5) Short time delay trip time at 105 percent of setting.
   (6) Instantaneous minimum pick-up current.

   c. All protective relays calibrated to manufacturer's characteristic time curves for pick-up, drop-out, instantaneous and time delay.
   d. All instruments calibrated for accuracy.
   e. Protective relay schemes to be electrically tested by primary injection of current through current transformers and the tripping of associated circuit breakers.
   f. Insulation resistance tests made on all circuit breakers, line to load breaker open, line to ground breaker closed, 3 poses tested individually. Switchgear bus to be tested phase to phase and phase to ground with Megohometer type instrument. Relays also to be insulation resistance tested.

**E. Magnetic Starters:**

1. **Visual inspection to determine:**

   a. Shipping damage.
   b. Proper bussing and contactor sizes.
   c. Correct overload relay heater ratings. Any incorrectly sized overloads shall be replaced by the contractor who originally provided same.

2. **Electrical Testing:**

   a. Electrical operation of control relays, timing relay, and contactor coils.
   b. Insulation resistance test on all current carrying bus to ground and between phases.
   c. Calibration check of overload heater to ascertain tripping point and time delay at 300% of heater rating.

**F. Conductors:**

All secondary service conductors and all feeder conductors from switchboards and distribution panels shall be tested.

1. **Visual and mechanical inspection**

   a. Conductors to be inspected for physical damage and proper connection and sizing in accordance with single line diagram.
b. Conductor connections shall be torque tested to manufacturer's recommended values.

2. Electrical Tests:
   a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductor.
   b. Perform continuity test to insure proper conductor connection.

G. Grounding Grids or Electrodes: Measurement of resistance from ground grids or electrodes to earth to determine adequacy of grounding system in building and compliance with specifications and/or electrical code.

H. Settings of Adjustable Devices: Using the result of the fault current and coordination study specified hereinafter, the Testing Contractor shall set all adjustable devices.

3.15 DEMOLITION, REMOVAL AND RELOCATION WORK

A. The Electrical Subcontractor shall be responsible for disconnection and removal of existing electrical equipment and wiring. Refer to drawings for extent of work. Field confirm existing equipment scheduled to remain and refeed when interrupted by equipment removal.

3.16 STORAGE AND INSTALLATION OF EQUIPMENT

A. The electrical Subcontractor shall store and install electrical equipment and wiring listed for dry locations only within the building.

3.17 FAULT CURRENT, ARC FLASH AND COORDINATION STUDY

A. Employ the manufacturer of the secondary distribution equipment or an independent organization to perform a fault current, arc flash and coordination study to ensure a selectively coordinated system from the incoming mains to the branch circuit panelboards.

B. The report shall be submitted in a standard format and shall include the fault current availability at various points in the distribution system, breaker coordination curves and recommended settings of all adjustable devices in the system.

C. The study shall be submitted prior or concurrent with switchgear submittal.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. The work to be performed is shown on the Drawings listed on the contract form. The work shall be performed in accordance with City of New Bedford D.P.I. Specifications, Commonwealth of Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, Latest Edition. Said documents are by reference made a part of the contract.

B. The Work to be performed under this Section shall include furnishing all labor, materials and equipment required to do all the Earthwork and related work as shown on the Drawings or herein specified. The Work shall further include all appurtenant items not specifically shown or itemized but which are implied or required to complete the Work in accordance with the reasonable intent of the Contract Documents.

1. Site grading
2. Excavation for new construction and backfilling
3. Regrading of disturbed areas
4. Filling and compacting of all areas where excavation occurs
5. Excavation and gravel bases for pavements (concrete and bituminous)
6. Excavation and backfill for utility work including removals such as piping.
7. Excavation & Backfill within the building for all underground Plumbing, natural gas, electric conduits, and the like.
8. Excavation for any new subsurface equipment, structure, footing, slab, or light pole base or any other excavation which is required to accomplish the Work described in the Drawings or Specifications
9. Hauling and disposal of all debris not approved to be left on the site as fill.
10. Stripping and stockpiling top soil for reuse.
11. Remove and dispose of bituminous concrete paving required to be removed to complete excavation and regrading. (Paving may be ground & used in accordance with MHD approved recycled base material.)
1.03 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section. Other specifications that directly relate to the work of this section include, but are not limited to, the following:

1. Section 026000 – EXCAVATION & REMOVAL OF UNDERGROUND OIL TANK
2. Section 220000 - PLUMBING
3. Section 260000 - ELECTRICAL
4. Section 321216 - BITUMINOUS CONCRETE PAVING
5. Section 321313 - CONCRETE PAVING
6. Section 321600 - CURBS
7. Section 330000 - SITE UTILITIES

1.04 SUBSURFACE CONDITIONS

A. Protect all pipe lines, sewers, drains, poles, wiring, and the like that interfere in any way with the work whether or not they are specifically shown on the Drawings. Notify the proper authorities that items are protected, supported, and/or relocated as necessary to adjust them to the new work.

B. Verify inverts and locations of all existing utilities having a direct bearing on the work of this Section prior to installation of any work of this Section. Transmit above information to the Architect who shall make any alterations to the Contract Drawings as required by the existing conditions.

C. No extra compensation will be made for compliance with the above.

D. Notify public utilities companies, in writing, at least 72 hours before excavating a public way in accordance with the provision of Chapter 82, Section 40A, of the Massachusetts General Laws, in order to prevent accidental damage.

1.05 INTERPRETATION OF SITE CONDITIONS

A. During the course of construction, all interpretations of soil conditions, classification of materials and soil suitability, determine acceptability of methods and soil suitability, determining acceptability of methods and equipment to carry out the intent of the Specifications, shall be made by the Architect and/or Soils Laboratory. The decision of the Architect shall be final and binding on the Contractor.

1.06 DEFINITIONS

A. "Piping" includes, in addition to pipe, all fittings, valves, supports, and other accessories relating to such piping.

B. "Invert" means the elevation datum at the inside bottom of pipe or channel.
C. "Fill" and "Backfill" shall be, for the purpose of this Specification, considered interchangeable terms and shall mean material to be used to bring existing or construction grades up to finish grade levels.

D. "Rock Excavation", for purposes of contract price adjustment for rock excavation and removal, is material which cannot be broken and removed by power excavation equipment and requires the use of drills or explosives and is, in addition, limited to the following items:

1. Rock or stone in original ledge.
2. Hard shale in original ledge.
3. Boulders over 1 cubic yard in trenches and 2 cubic yards in open cut.

E. All excavation, except rock excavation, including paving and paving foundations, is "earth" insofar as excavation and removal of material is concerned.

F. "Trench" shall be defined as an excavation of any length where the width is less than twice the depth. All other excavations shall be classed as open.

G. "Finish grades" as used herein mean the required final grade elevations indicated on the Drawings.

H. "Building area" shall mean the area within the limits of the foundation walls and the area five (5) feet immediately surrounding these limits.

1.07 CODES, ORDINANCES AND PERMITS

A. The Specification requirements shall be adhered to where they are in excess of the minimum requirements of the rules of the "Governing Authorities".

B. Obtain all required Certificates of Inspection for work and deliver same to the Architect for approval before request for acceptance and final payment of the work.

1.08 CONTRACT DOCUMENTS

A. It is the intention of these Specifications and Drawings to call for finished work, tested, and ready for operation. Any apparatus, appliance, material, or work not shown on the Drawings, but mentioned in the Specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered, and installed under this Section without additional expense to the Owner.

B. The Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangement of equipment, conduits and piping. The locations of all items shown on the Drawings or called for in the Specifications that are not definitely fixed by dimensions or invert elevations are approximate only. If directed by the Architect, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of the other trades or for proper execution of the work.
1.09 CLEANING AND PROTECTION

A. Protect all materials and equipment during shipment, on-site storage and installation to prevent damage for the life of the project. Assume full responsibility for all work herein installed until final acceptance of the project.

B. Keep the job site free from accumulations of waste material or rubbish caused by this operation. At the completion of the work, remove all rubbish, tools, construction equipment, and surplus materials from the job site and leave the premise in a clean condition.

C. Active utilities shall be adequately protected from damage and removed or relocated only as indicated or specified. Inactive and abandoned utilities encountered in excavation and grading operations shall be removed, plugged, or capped unless noted otherwise. Report in writing to the Architect, the locations of such abandoned utilities.

D. The Contractor shall keep adjacent roads clean at all times during construction. Street sweeping shall be carried out as required. Maintain dust control measures.

E. No excavated area for utility structures or conduits shall be left open overnight. All excavated areas must be backfilled before end of work day.

1.10 MEASUREMENTS AND PAYMENT

A. Excavation and removal of rock shall be paid for as an extra only after removal of such materials has been authorized by the Architect. The quantities of excavation and removal involving an extra or other adjustment of the Contract price shall be subject to measurement verification and approval by the Architect prior to the removal of such materials.

B. Payment Lines: The following payment lines shall be used to determine changes in volume of materials to be excavated or removed or both.

1. Utility Structures: One foot outside of the outer walls and six inches below the bottom of the structures. Measure banks of excavation vertically.

2. Utility Trenches: Width shall be the outside diameter of the pipe or ductbank plus two feet. Maximum depth shall not exceed six inches below the bottom of the pipes, etc. Banks or trenches shall be vertical.

C. Rock Excavation: When, during the process of excavation, rock is encountered, such material shall be uncovered and exposed. Notify the Architect before proceeding further. Employ qualified personnel acceptable to the Architect, to take cross-section of rock before removal of same, and provide computations of cross-section within the payment line limits. Do not proceed with the excavation of material claimed as rock until the material has been classified by the Architect. Failure to uncover such material, or notify the Architect, or take cross-sections, shall forfeit the right-of-claim to any payments. The quantity of rock removed will be based on the payment limits as established herein.
1. When explosives are used, work shall be executed by experienced powdermen or persons who are licensed or otherwise authorized to use explosives. Explosives shall be stored, handled, and used in accordance with local requirements and regulations and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Incorporated and all OSHA Regulations.

2. Prior to starting work, supply to the Architect, Insurance coverage with limits as indicated in the General Conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Obtain off-site material as herein specified consisting of clean granular material from off-site Borrow Pits as approved by the Soils Laboratory prior to trucking to the site.

1. Maintain borrow source material in a clean condition, uncontaminated by organic soils or other deleterious materials. If borrow material from the cut sectors is stockpiled, such stockpiles shall be suitable protected, drained, and maintained to insure full availability of the materials.

2. Material weighing less than 100 lbs. per cubic foot (maximum laboratory dry weight) is not acceptable as fill material. Placed material shall be free of all objectionable material such as leaves, grass, and roots.

2.02 ORDINARY BORROW

A. Any non-plastic friable material free from organic or other deleterious material having a maximum stone size of 6 inches.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Finer by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>60-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>20-85</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-30</td>
</tr>
</tbody>
</table>
2.03 GRANULAR FILL

A. Wherever granular fill is called for in the Drawings or Specifications, the material shall be brought from off-site sources and shall be free of ice, snow, sod, rubbish, or other deleterious material and conform to the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% finer by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>100</td>
</tr>
<tr>
<td>No. 10</td>
<td>30-95</td>
</tr>
<tr>
<td>No. 40</td>
<td>0-70</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

2.04 SELECT SAND AND GRAVEL (STRUCTURAL FILL)

A. Select fill where called for on the drawings and Specifications shall consist of clean sand and gravel from off-site sources meeting the following gradation requirements of MHD Standard M1.03.0 Type 'B'.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% finer by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>50-85</td>
</tr>
<tr>
<td>No. 4</td>
<td>40-75</td>
</tr>
<tr>
<td>No. 50</td>
<td>8-28</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

2.05 GRAVEL

A. Gravel borrow fill where called for on the Drawings and Specifications shall be from off-site sources and shall conform to the following gradation requirements of MHD Standard M1.03.0 Type 'B'.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% finer of weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>50-85</td>
</tr>
<tr>
<td>No. 4</td>
<td>40-75</td>
</tr>
<tr>
<td>No. 50</td>
<td>8-28</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

2.06 BANK-RUN GRAVEL

A. Bank-run gravel shall be obtained from approved natural deposits and unprocessed except for the removal of deleterious materials and stones larger than the maximum size permitted.
B. Bank-run gravel shall be unfrozen and substantially free from vegetation, roots, loam and other organic matter, clay, snow, frozen particles and other fine or harmful substances.

C. Bank-run gravel: Inorganic granular material meeting the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% finer of weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>100</td>
</tr>
<tr>
<td>2&quot;</td>
<td>80-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>20-65</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-12</td>
</tr>
</tbody>
</table>

2.06 3/4 INCH STONE

A. Where designated on the Drawings and Specifications as 3/4 inch stone, the material shall consist of 3/4 inch processed stone and shall conform to the following gradation requirements of MHD Standard M2.04.4.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% finer by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>100</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>90-100</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>10-50</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>0-20</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-5</td>
</tr>
</tbody>
</table>

2.07 3/8 INCH STONE

A. Where designated on the Drawings and Specifications as 3/8 inch stone, the material shall consist of 3/8 inch processed stone and shall conform to the following gradation requirements of MHD Standard M2.01.6.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% finer by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>85-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>20-50</td>
</tr>
<tr>
<td>No. 8</td>
<td>0-15</td>
</tr>
<tr>
<td>No. 16</td>
<td>0-5</td>
</tr>
</tbody>
</table>
2.08 GRAVEL BASE COURSE

A. Base course under walks and roads or wherever "Mass Specs" or "City of New Bedford Specs" appear shall be hard, durable particles from sources approved by the Architect, free from organic matter and clay, and conforming to the following gradation requirements of MHD Standard M2.01.7.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% by weight passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>70-100</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>50-85</td>
</tr>
<tr>
<td>No. 4</td>
<td>30-55</td>
</tr>
<tr>
<td>No. 50</td>
<td>8-24</td>
</tr>
<tr>
<td>No. 200</td>
<td>3-10</td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION

3.01 ENVIRONMENTAL CONTROLS

A. Prior to commencement of any work, provide the Architect with detailed drawings, reports, etc., as required to adequately define proposed methods to protect the environment of the project and the surrounding area in accordance with local, state, and federal regulations and as herein described. Conform to the Order Of Conditions.

B. Be responsible for and maintain, during the course of operations on the project, existing drainage ways both into and from the project. All proposed drainage systems, as shown on the project plans, or which may be required during the course of the work, shall be maintained functional at all times. The exposed areas of subgrade in both cut and fill sectors shall be graded to positively drain. In impounded surface water areas, no additional fill material shall be placed. Failure to maintain positive drainage of the subgrade shall be adequate cause for the Architect to order temporary suspension of the work.

C. Provide and maintain, for the entire course of the operations of the project, erosion and silt control measures to prevent the intrusion of any silt, oil, chemical, or other pollutants to any downstream drainage way, conduit, stream, etc., or abutting property beyond the project limit lines. In the event of failure to comply, the Contractor assumes the cost of all damages resultant there from.

D. Provide for the control of dust to the satisfaction of the Architect.

3.02 REFERENCE POINTS

A. Locate and maintain bench marks, monuments, and other reference points. If destroyed or disturbed, place as directed by the Architect and/or local and state authorities.
3.03 LAYOUT

A. Provide and pay for the services of a Registered Land Surveyor who will provide the following:
   1. Monuments or stakes on all property corners so that the entire locus is staked in the field.
   2. Center line location and grade for the access ways, parking areas.

B. Protect and preserve all such monumentation after being established and replace same if damaged.

C. The Surveyor shall locate and maintain as-built drawings, including swing ties to all valves, stubs, manholes, angle, points, etc., herein installed. At the completion of the work, submit as-built drawings for submission to the Architect.

3.04 EQUIPMENT

A. All Earth Work under this Section shall be performed with earth moving equipment capable of efficiently completing the scope of the work and subject to the approval of the Soils Laboratory and/or the Architect.

3.05 PROTECTION OF SUBGRADE

A. The Contractor shall employ special measures as herein specified and/or as directed in the field by the Architect to avoid disturbing the strength of the natural subgrade in an approved manner shall be made during the course of the construction.

B. Provide and operate pumps or other equipment as necessary, to keep excavation free from water at all times, until succeeding operations are begun.

C. As original ground surface is worked and fill is added, daily provisions shall be made for drainage of surface water away from the exposed subgrade.

D. No heavy equipment shall be allowed to travel over wet areas of the subgrade. Notify the Architect if trafficking by equipment not under control of this Section occurs.

E. Properly compact layers of subgrade fill as soon as they are placed.

F. As soon as subgrade or general fill is placed, compacted, and approved by the Soil Laboratory, place and compact the granular fill sub-grade material.

3.06 TEMPORARY SHEETING, SHORING & BRACING

A. The Contractor shall provide shoring systems adequately anchored and braced to resist earth and hydrostatic pressures at locations as needed to support excavations during construction. The sheeting/shoring systems shall be designed by a Massachusetts Professional Engineer.
B. Shop drawings and calculations shall be submitted for review and approval prior to start of any work for temporary excavation support. All shop drawings, details & calculations submitted shall bear the Professional Engineer stamp of the Engineer responsible for the design.

C. The General Contractor shall install, maintain and monitor (1 day before and each day excavation is open) 3 (minimum) settlement monitoring points on the building footing or foundation wall. Location of monitoring points to be determined by shoring design engineer.

D. The Contractor shall locate required bracing to clear all permanent work.

E. Bracing which must be relocated shall be installed prior to the removal of original bracing.

F. The Contractor shall remove shoring and bracing in stages to avoid disturbances to adjacent and underlying soils and damage to structures, pavements, facilities and utilities. The contractor shall repair or replace adjacent work damaged or displayed through the installation or removal of shoring and bracing work.

3.07 ROUGH GRADING

A. Upon completion of the site clearing work for each operation, the area of operation shall be rough graded. All organic materials, unsuitable fill, debris, and other deleterious materials, shall be removed from areas to be filled or backfilled. Frozen material shall not be used in filling.

B. Dispose of or supply all borrow of specified types, necessary to complete the rough grading to the required elevations.

C. Do all bring the areas within the contract limit lines to the subgrade levels as shown on the plans.

D. If field conditions cause yardage to change for any reason, dispose of or furnish all fill as required at no cost.

E. The finished subgrade surface shall be protected from the action of the elements. Any settlement or washing out that may occur from that, or any other cause prior to the acceptance of the work shall be repaired, and grades, re-established to the required elevations and slopes.

F. Newly graded areas shall be protected from the action of the elements. Any settlement or washing out that may occur from that, or any other cause prior to the acceptance of the work shall be repaired, and grades, re-established to the required elevations and slopes.

G. Areas under pavements bearing on ground shall be graded to required levels using acceptable material for fill and be thoroughly compacted.

H. During the performance of rough grading operations, the subgrade shall be examined critically and any areas discovered which, in the opinion of the Soils Laboratory, are soft and unstable, shall be excavated to such depths as may be necessary to insure satisfactory supporting properties. These areas of excavation shall be backfilled immediately and shall be brought back to the elevation of the surrounding area with approved fill material and in accordance with the earth fill construction procedure.
I. Redress areas as required and/or directed before placing of pavements, walks, and slabs and/or granular fill in the above areas.

3.08 FILLING AND COMPACTION

A. After the clearing and stripping of topsoil and removal of debris and other deleterious material, the areas to receive fill shall be drained and/or pumped free of all standing water.

B. Fill shall not be placed upon frozen subgrade within building limits or below pavements where raise in grade is less than 3 feet. Overnight frost, not more than 2 inches thick, shall be broken up by cleats or crawler or other acceptable means prior to placing fill.

C. Fill may be placed upon frozen subgrade in landscaped areas or below pavement where raise in grade exceeds 3 feet provided that:
   1. All snow is removed.
   2. All free ice or water is removed first.

D. The following are minimum procedures to be utilized in the placing and compaction of all fill. The final compaction methods shall be subject to the approval of the Soils Laboratory. Critical areas are defined as all fill below building limit lines and the upper most 12 inches of subgrade under parking lot, bank-run gravel under paving, and base course under paving. Less critical areas are those under landscaped areas and below 12 inches under the paved areas.

   1. Compaction Method: Hand operated vibratory plate or light roller (in confined areas only)
      
      Maximum Stone Size: 2"
      
      Maximum Loose Lift Thickness: Critical areas - 4", less critical areas - 6"
      Minimum # of Passes: Critical Areas – 4, less critical areas - 4

   2. Compaction Method: Hand operated vibratory drum rollers weighing at least 1000#, or light crawler tractor (in confined areas only)
      
      Maximum Stone Size: 4"
      
      Maximum Loose Lift Thickness: Critical Areas - 6", less critical areas - 8"
      Minimum # of Passes: Critical areas – 4, less critical areas - 4

   3. Compaction Method: Loaded 10-wheel dump truck
      
      Maximum Stone Size: 6"
      
      Maximum Loose Lift Thickness: Critical Areas - 10", less critical areas - 10"
      Minimum # of Passes: Critical areas – 4, less critical areas - 4
4. Compaction Method: Heavy crawler tractor (Cat D8 minimum)

- Maximum Stone Size: 8"
- Maximum Loose Lift Thickness: Critical areas - 12", less critical areas - 12"
- Minimum # of Passes: Critical areas – 4, less critical areas - 2

5. Compaction Method: Light vibratory drum roller min. wt. @ drum: 3000#; min. dynamic force: 10,000#

- Maximum Stone Size: 6"
- Maximum Loose Lift Thickness: Critical areas - 12", less critical areas - 12"
- Minimum # of Passes: Critical areas - 4, less critical areas - 2.

E. The following compaction requirements shall apply, in each case expressed as percentage of maximum dry density achieved by laboratory ASTM Modified Proctor Method D1557:

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Foundations</td>
<td>95%</td>
</tr>
<tr>
<td>Top 12&quot; of subgrade underlying granular fill below pavement</td>
<td>95%</td>
</tr>
<tr>
<td>Below floor slabs, but above foundation</td>
<td>95%</td>
</tr>
<tr>
<td>Deeper than 12&quot; from top of subgrade underlying gravel below pavement</td>
<td>95%</td>
</tr>
<tr>
<td>Landscaping areas</td>
<td>90%</td>
</tr>
</tbody>
</table>

F. The moisture content of placed material shall not deviate from the optimum by more than 2 percent. Moisture content of any material which displays pronounced deformation under construction equipment shall not exceed the optimum. Drying of wet soil shall be expedited by the use of plows, discs, harrows, or other approved methods. If additional water is required, it should be uniformly distributed through the use of approved water wagons and shall be thoroughly incorporated into the material by means of discs or other suitable mixing equipment. Care shall be taken to avoid trapping water within the fill.

G. The fill and borrow areas should be maintained in a freely draining conditions at all times. Proper drainage shall be provided for any water or springs which may be encountered.

- Frozen fill shall not be placed nor shall any acceptable fill be placed on frozen or snow covered surface except as outlined in (D) above.

I. All cut areas shall be rolled and compacted to produce a compaction equal to that of the filled areas. If soft, yielding material is encountered in cuts, or in fills as a result of trapping water, and cannot be satisfactorily stabilized by moisture control and compaction, the unstable material shall be excavated to the depth required by the Soils Laboratory. The excavation shall then be filled with suitable material and compacted in accordance with the requirements outlined above.
3.09 SUBGRADE PREPARATION

A. After the subgrade is compacted to the specified requirements, the subgrade shall be fine graded to within 1/10 of a foot of the required elevations. Proof roll the entire subgrade in the presence of the Soils Laboratory.

B. Proof roll with vibratory drum roller 10,000 lbs. with minimum of two complete coverage in each direction.

C. Any suspect areas revealed by proof rolling shall be investigated by backhoe excavation. Deficiencies shall be corrected as directed by the Soils Laboratory.

3.10 GRANULAR FILL

A. Immediately upon completion of subgrade under areas to be paved and after approval by Soils Laboratory, place, compact, and grade the granular fill as specified to within 1 inch of the required elevations as shown on the plans.

B. At the time the site is ready for pavement base material, place additional granular fill as required to meet the elevations shown, the proof roll the same as 3.07 above.

C. Take precautions to protect granular fill during subsequent operations so as to keep it clean and free draining and segregated from other deleterious materials.

3.11 EXCAVATION

A. Material of every nature encountered in the performance of this Contract shall be excavated to indicated lines, elevations, and grades.

B. Excavate properly to provide sufficient work space to permit the placing, inspection, and completion of the work embraced in the completion of the Project. Excavations shall be made to elevations and dimensions indicated on the drawings, and shall include the removal of unusable earth and debris. All pumping, drainage, bailing, and shoring where such is required, shall be included.

C. All space beneath foundations, resulting from unauthorized excavations or from slides or cave-ins shall be refilled with approved concrete and foundations shall be laid at the excavated level as directed, or other methods acceptable to the Soils Laboratory.

D. After completion and approval of the subgrade within the building area, excavate for footings and foundations carrying all excavations so that all bearing area will be either or virgin soil or on controlled compacted fill.

E. Excavated materials not required or not suitable for backfilling and rough grading, and debris, shall be removed from the site at no additional cost to the Owner.
3.12 BACKFILLING

A. Backfill as soon as permanent work has been completed and walls have attained sufficient set and strength.

B. Except where otherwise specified, backfilling shall be done with granular fill and done promptly so as to protect the foundation from frost. Place backfill in layers as stated in Para. 3.07. Compact before placing succeeding layer. When sheeting, bracing, or shoring is removed, fill voids.

C. Exercise extreme care in backfilling against newly placed walls. Walls with fill on one side shall be properly supported laterally, either with the designed structure by temporary means. Walls with fill on both sides shall have fill placed in alternate layers on each side of the wall. Place no more than one (1) foot at a time, compacted each list as herein specified.

3.13 EXCAVATION AND BACKFILLING FOR UTILITIES

A. Excavate and backfill for all underground utilities and structures.

B. Utilities shall not be laid directly on ledge or boulders or remains of old foundation or structure. This material shall be removed to a minimum of 6 inches below the utilities and backfilled and compacted as hereinafter specified.

C. In general, the width of trenches shall be kept to a minimum and in the case of piping shall not exceed the sum of the pipe o.d. plus 2'-0" to at least 12 inches above the pipe. Trench walls may be cut back from 12 inches above the pipe to subgrade.

D. Excavation shall be carried to 6 inches below utility or structure and to the required line or grade. Machine excavation will be permitted. Immediately upon excavation of trench in the case of piping or excavation for manholes or other structures, place and compact 6 inches of 3/4" inch processed stone as herein specified in paragraph 2.06 at the proper line and grade, digging bell holes to insure bearing throughout the pipe barrel in the case of piping.

E. Backfilling within the area of the utility work shall be carried to the lines and levels required for the grades shown on the drawings and as specified. Backfilling shall not be started until conditions have been inspected and approved by the Architect, nor any fill placed until structural members involved have sufficient strength to withstand the pressure to be imposed.

F. Fill material shall be as detailed on the drawings, placed in the dry horizontal layers and approved of each layer shall be obtained from the Soils Laboratory before proceeding with the next. Each layer shall be compacted to 95% of maximum dry density and at a water content equal to optimum water content plus-or-minus 2%. The maximum dry density and optimum water content shall be determined by the Soils Laboratory.
G. Backfill trenches only after pipe has been inspected, tested, and locations of pipes and appurtenances have been recorded. Backfill by hand around pipe and for a depth of 2 feet above the pipe, and tamp firmly in lifts not exceeding 6 inches in thickness, taking care not to disturb the pipe. Compact the remainder of the backfill, in maximum 9 inch layers, thoroughly with a rammer of suitable weight, or approved mechanical tampers to a minimum relative density of 95%. Trenches shall not be left open overnight.

H. Backfill material for utility structure shall be placed symmetrically on all sides, in 9 inch layers. Each layer shall be compacted with mechanical or hand tampers to a minimum relative density of 95%. Excavated areas for structures shall not be left open overnight.

I. With prior approval of the Architect, the water line may be partially backfilled leaving all joints exposed prior to testing. As the entire is backfilled furnish and install plastic tracer line labeled "Water main" approximately 18" below finished grade.

3.14 GRAVEL BASE COURSE FOR PAVEMENTS

A. Furnish, place, compact, and fine grade the gravel base for all pavement, to the thicknesses shown on the plans and to the satisfaction of the Soils Laboratory.

B. Finished grading of base course shall be evenly graded, sloped to drain, and within 1/10 foot tolerance of required final grade.

C. Gravel base material shall conform to gradation requirements of Geotechnical report shall be approved by the Soils laboratory at the process plant or pit.

3.15 BASE FOR SLABS ON GRADE

A. Furnish, place, and compact, and fine grade the base for all slabs on grade to the thickness shown on the plans.

END OF SECTION
SECTION 311000

SITE PREPARATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.

B. The principal work of this Section includes, but may not be limited to, the following:

1. Clearing, grubbing, and disposing of vegetation, including bushes, trees, stumps, roots and debris within work limit lines.
2. Stripping and storage of topsoil within the stockpile areas to be designated by the Architect or shown on the drawings.
3. Protection of trees and other vegetation, stone walls, and objects indicated on the drawings or designated by the Architect.
4. Removal of existing pavements, curbs, sidewalks, steps, signage and posts, fencing and all other site improvements that interfere with construction as indicated on the drawings. Pavement shall be properly disposed of at an off-site landfill.
5. Installation and relocation of construction fencing during construction phasing.
6. Coordination of the disconnection and capping of utilities and/or removal or relocation of utilities and utility poles as required.

1.03 RELATED WORK

A. Carefully examine all of the Contract Document for requirements which affect the work of this Section. Other specifications which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 310000 - EARTHWORK
2. Section 321216 - BITUMINOUS CONCRETE PAVING
3. Section 321313 - CONCRETE PAVING
4. Section 321600 - CURBS
5. Section 330000 - SITE UTILITIES
PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.01 PERFORMANCE

A. The Contractor shall accept the site as he finds it and shall remove all stumps, rocks, paving, improvements, and rubbish in the contract area. When the Contractor is ready to proceed with the clearing of trees from the site, he shall notify the Architect who will clearly identify in the field all trees to be saved. All other trees and brush shall be cleared from the area as directed. All rocks, strips, obstructions to work and undesirable material shall be removed from the site a properly and legally disposed of at an approved land fill site.

B. All trees and shrubs to remain shall be protected during the entire progress of the work. This includes protection of the root system. All trees shall be fenced with snow fencing as detailed on the drawings and maintained during course of construction.

C. Prior to excavating and after tree, stump, brush, etc., removal, strip the topsoil from the area of the buildings and the excavation and grading boundaries and stockpile on the site where directed by the Architect.

D. All topsoil must be stripped from areas to be occupied by either site improvements or building construction prior to the on-site storage of any materials or the installation of any temporary construction facilities.

E. Any existing abandoned/unused foundation members, cesspools, septic tanks, or similar subsurface facilities encountered within the project area are to be destroyed and removed in their entirety.

F. Construct around stockpiles, a silt barrier consisting of hay bales, snow fence, and environmental fabric as detailed on the drawings. This installation shall be coordinated as to timing and placement with the Engineer, the Conservation Commission. Pay particular attention to the Order of Conditions.

END OF SECTION
SECTION 312319

DEWATERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. This Section includes Construction Dewatering.

B. The following related work is specified under the designated Sections:

1. Section 026000 – EXCAVATION & REMOVAL OF UNDERGROUND OIL TANK
2. Section 220000 – PLUMBING
3. Section 260000 – ELECTRICAL
4. Section 310000 – EARTHWORK
5. Section 312500 – EROSION AND SEDIMENTATION
6. Section 321216 – BITUMINOUS CONCRETE PAVING
7. Section 330000 – SITE UTILITIES

1.03 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, provide, test, operate, monitor, and maintain a dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

1. Work includes removing dewatering system when no longer needed.
2. Maintain dewatering operations to ensure erosion is controlled, stability of excavations and constructed slopes is maintained, and flooding of excavation and damage to structures is prevented.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Completely protect adjacent properties from siltation caused by outfall operations.
1.04 SUBMITTALS

A. Shop Drawings: For dewatering system, show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

1. Include a written report outlining control procedures to be adopted if dewatering problems arise.
2. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. 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.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

D. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform dewatering who has specialized in installing dewatering systems similar to those required for this Project and with a record of successful in-service performance.

B. Regulatory Requirements: Comply with water disposal requirements of the City of New Bedford and the Commonwealth of Massachusetts agencies.

1.06 PROJECT CONDITIONS

A. Project Site Information: A geotechnical report has been prepared for this Project and is available for information only. The report is not part of the Contract Documents. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Make additional test borings and conduct other exploratory operations as necessary.
B. Survey adjacent structures and improvements, employing a qualified professional engineer or surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, resurvey benchmarks weekly, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, 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.

3.02 DEWATERING

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls. Maintain site drainage at all times.

B. Before excavation below ground-water level, place system into operation to lower water to specified levels and then operate it continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

   1. Maintain piezometric water level a minimum of 24 inches (600 MM) below surface of excavation.

E. Dispose of water removed from excavations in a manner to avoid endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner to avoid inconvenience to others. Provide sumps, sedimentation tanks, temporary sedimentation basins, and other flow-control devices as required by authorities having jurisdiction. Prevent erosion or siltation of adjacent areas and watercourses.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on a continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense.

   1. Remove dewatering system from Project site on completion of Dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.03 OBSERVATION WELLS

A. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated and additional observation wells as may be required by authorities having jurisdiction.

B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

   1. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

END OF SECTION
SECTION 312500

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including, but not limited to, the following:

1. The work to be performed is shown on the Drawings listed on the contract from. The work shall be performed in accordance with City of New Bedford Specification, Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, Latest Edition. Said documents are by reference made a part of the contract.

2. The work is to be phased. Construct the project in phases as directed by the Architect to suit the project progress schedule, as well as the completion dates of the various phases and the overall project. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architect’s drawings.

3. Furnish and Install all slope protection, sedimentation and erosion control measures as necessary to retain all erosion and sediments within the construction area, as shown on the Drawings and/or as specified herein, including, but not limited to:

   a. Provide and maintain hay bales or erosion control silt fence for control of soil runoff on exposed slopes, drainage structures and temporary stockpiles.

   b. Seeding annual ryegrass, installing erosion control blankets, or temporary mulch as a temporary cover on all exposed slopes and stockpiled topsoil.

   c. Providing stone construction entrance pads to site and cleaning adjacent roadway surfaces of all accumulated sediment and debris as required or a minimum of once per week.

   d. Temporary settling basins.

   e. Erosion Control Blankets (ECB) on all key identified slopes.

   f. Temporary seeding and lawn stabilization of disturbed areas.

   g. Dust control.

   i. Provide and maintain Dandy Bags at all existing or new catch basins.

B. The following Related Work is specified under the designated Sections:

1. Section 024100 – DEMOLITION
2. Section 311000 – SITE PREPARATION
3. Section 310000 – EARTHWORK
4. Section 321216 – BITUMINOUS CONCRETE PAVING
1.03 QUALITY ASSURANCE

A. Material Standards and Standards of Workmanship: Equal to the Commonwealth of Massachusetts Guidelines for Soil Erosion and Sediment Control and Local City Requirements.

B. Requirements specified and noted on drawings are minimum. Provide additional measures as required by the local, State or Federal authorities as a result of Contractor’s specific scheduling and Work sequencing, or weather conditions at no additional cost to the Owner.

C. Qualifications: Engaged firm shall be able to demonstrate experience in the installation of the erosion and sedimentation controls described in the Contract Documents.

1.04 SUBMITTALS

A. Product data for the following:

1. Silt Fence
2. Soil stabilizers
3. Sediment Control Bags
4. Fertilizers, seed
5. Limestone
6. Chemical preservatives and controls – also confirm that each of the materials proposed to be applied are permitted within the Commonwealth of Massachusetts and the City of New Bedford.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Seed, Fertilizer and Lime: Deliver in original sealed, labeled, and undamaged containers, showing weighs, analysis, and name of manufacturer.

B. Protect materials form deterioration during delivery and while stored at site.

1.06 COORDINATION AND SCHEDULING

A. General: Sow lawn seed and install all stabilization measures as soon as possible in accordance with the Contractor’s schedule.

B. Weather Limitations: Proceed with lawn development only when existing and forecast weather conditions are suitable for work.
1.07 MAINTENANCE

A. Begin maintenance of stabilized areas immediately after each area is stabilized and continue until project is accepted.

B. Maintain and establish all disturbed areas by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. Replant bare areas.
2. Add new mulch and tackifier in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.

1.08 JOB CONDITIONS

A. Existing Conditions: The contractor shall examine all work that the work of this Section is contingent upon, and report any deficiencies to the Architect. Commencement of the work will be construed to mean complete acceptance by the Contractor of the preparatory work of others. No adjustment will be made for discrepancies brought to the Architect’s attention after work has begun.

B. Protection of Adjacent Lands:

1. The Contractor shall be totally responsible for protection of any lands or properties as may be subject to any effect or by-product of his demolition/construction effort. Special care shall be taken to avoid erosion of fill or cut slopes onto adjacent properties or downstream siltation of diversion of existing surface drainage. Any damage is to be corrected immediately.
2. Erosion control measures in the locations shown and as detailed and described in the Contract Documents shall be considered minimum requirements and the Contractor shall take whatever other erosion and sedimentation controls steps necessary to accommodate his particular construction procedures.

C. Schedule Procedure:

1. Erosion control construction shall be done prior to the commencement of demolition, site preparation or earthwork operations. The initial method outlined herein is intended to route all practicable surface water from the excavation area into erosion control facilities. The Contractor shall install any additional protective measures as may be required to control siltation from the site.
2. The following sequence of construction shall be followed: Revisions shall be only with the approval of the Architect and the responsible municipal governing agency.

   a. Place sedimentation control measures along slopes, at catch basins and across swales and outfalls as shown on the Drawings, and where directed by the Architect.
   b. Proceed with construction of the remaining items of work in accordance with the approved project sequence and schedule. The contractor shall be responsible
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

for maintaining the integrity of all sediment and erosion control measures for the
duration of the Contract.
c. Clean and maintain all sedimentation control components to achieve the
intended purpose of both temporary and permanent erosion and sediment control
facilities.

PART 2 - PRODUCTS

2.01 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed
Analysts’ “Rules for Testing Seeds” for purity and germination tolerance.

1. Seed Mixture: 50% Annual Ryegrass; clean with a minimum of 0.50% noxious weed
seed; minimum 97% pure with a germination rate minimum of 80%.
2. If seeding occurs after September 15, substitute winter rye for annual rye grass.

B. Straw Mulch: Provide air-dry, clean, mildew-and seed-free, salt hay or threshed straw of
wheat, rye, oats, or barley.

C. Fiber Mulch: Biodegradable dye-wood cellulose-fiber mulch, nontoxic, free of plant growth
or germination-inhibitors, with maximum moisture content of 15 percent and a pH range of
4.5 to 6.5.

D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for
slurry application, nontoxic and free of plant growth-or germination-inhibitors.

2.02 EROSION-CONTROL MATERIALS

A. Compost Wattles

1. Compost wattles shall consist of compost consisting of 25%-100% organic matter with a
pH of 5.0-8.5, a moisture content less than 60% and 99% passing a 2” sieve and 30% to
50% passing a 3/8” sieve inside of a biodegradable sock/netting. Compost wattles shall
measure at least twelve (12) inches in diameter.

2. Stakes for wattles shall be one of the following materials. Lengths shall be approximately
two feet (2').
   a. Wood stakes of sound hardwood, one inch by one inch (1” x 1”) in size.
   b. Steel reinforcing bars of at least No. 4 size.

B. Erosion Control Blanket: C125BN coconut fiber erosion control blanket (100%
biodegradable) as manufactured by North American Green or approved Equal. Include
biodegradable stakes.

C. Temporary Mulch: Straw hydromulch or other approved product.
D. Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, 0.92 lb. Per sq. yd. (0.5 kg per sq. m) minimum, with 50 to 65 percent open area. Include manufacturer’s recommended steel wire staples, 6 inches (150mm) long.

2.03 SILTATION FENCE

A. Silt fence shall consist of the following elements:

1. Fabric for siltation fence shall be a minimum width of 3 feet and conforming to the following criteria:

<table>
<thead>
<tr>
<th>Fabric Properties</th>
<th>Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength (lbs)</td>
<td>124</td>
<td>ASTM D 4632</td>
</tr>
<tr>
<td>Grab Tensile Elongation (%)</td>
<td>15</td>
<td>ASTM D 4632</td>
</tr>
<tr>
<td>Mullen Burst Strength (psi)</td>
<td>300</td>
<td>ASTM D 3786</td>
</tr>
<tr>
<td>Puncture Strength (lbs)</td>
<td>65</td>
<td>ASTM D 4833</td>
</tr>
<tr>
<td>Flow Rate (gal/min/sf)</td>
<td>10</td>
<td>ASTM D 4491</td>
</tr>
<tr>
<td>Apparent Opening Size (sieve)</td>
<td>30</td>
<td>ASTM D 4751</td>
</tr>
<tr>
<td>Ultraviolet Stability (% strength retained)</td>
<td>70</td>
<td>ASTM D 4355</td>
</tr>
</tbody>
</table>

2. Acceptable fabric materials include “Mirafi Envirofence” by TenCate Mirafi, “Style 2130” by Amoco Fabrics Co., and “LS125-Super Grade” by ACF Environmental, or as approved by the Engineer.

3. Silt fence posts shall be wood or metal. Wood posts shall be a minimum of 1¼ inch by 1½ inch by 5 feet long hardwood stakes commonly used to support siltation fabric. Metal posts shall be a minimum of 1-inch diameter and 5 feet long. Posts shall be spaced at a maximum distance of 8 feet on center.

4. Furnish and install suitable nylon cord to secure abutting silt fence posts.

2.04 CRUSHED STONE: Conform to MHD, Section M2.01.1, gradation 2”.

PART 3 - EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Prior to the start of any construction activities on the site, a preconstruction conference shall be held to establish supervisory and inspection procedures for sediment and erosion control measures. This meeting shall be attended by the Contractor, the Architect, the Local Sediment and Erosion Control Officer, and the Owner.

B. Submit detailed sequenced construction schedule for the Architect’s review and approval. Do not proceed until this schedule is approved.
3.02 CONSTRUCTION ENTRANCE

A. Install construction entrances to each project work area and staging area. Location and number of entrances to be modified based on Contractor’s specific sequencing of work and as approved by the Architect. Maintain each entrance by regrading and providing additional stone as required to maintain a clean and open surface.

1. Dimensions: 50’ length minimum (typical), 6” depth of crushed stone. Refer to Contract Drawings.
2. Adjacent pavements are to be kept clean of construction generated sediment and debris. Sweeping shall occur once per week at a minimum or more frequently if so required.

3.03 TEMPORARY SETTLING BASINS

A. Construction temporary settling basins and install erosion control devices washer indicated and around existing and proposed drainage structures in accordance with manufacturer’s installation and recommendations. Make any adjustment to location as required by field condition, the Architect, or local Town officials. Install erosion control at limits of grading and topsoil stripping elevations. Do not allow any sediment to enter existing drainage piping systems or wetlands.

3.04 MAINTENANCE

A. Maintain basins and Erosion control devices by restaking and replacing as required. Remove buildup of silt as necessary or as directed by the Architect. Maintain operations until all lawn/planted areas are stabilized and all paving is completed.

3.05 TEMPORARY SEEDING

A. Seed all exposed slopes and stockpiled topsoil with winter or annual ryegrass at a rate of two (2) pounds/1,000 sq. feet of area. Seeding shall be done immediately after rough grading operations are complete and maintained until finish grading and seeding have begun.

3.06 HYDROMULCHING/HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and maximum 10% of fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.
2. Apply slurry uniformly to all area to be seeded in a 2-step process. Apply first slurry application at the minimum rate of 500 lb. Per are (5.5 kg per 100 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1200 lb. Per acre (11 kg per 100 sq. m).
3.07 TEMPORARY EROSION CONTROL FABRIC OR MULCH

A. Temporary Erosion Control Fabric or Mulch: Immediately upon formation of rough grades, install on all key identified slopes as per manufacturer’s recommendations or slopes steeper that one foot vertical to three feet horizontal or any areas and drainage swales which receive concentrated run-off water and areas that are susceptible to erosion as required by the Architect. Overlap joint of erosion control blankets one foot and secure as recommended by the manufacturer. Maintain until permanent vegetative cover is established.

3.08 CLEAN UP

A. Upon stabilization of all disturbed areas and the completing of construction activity, remove all erosion control devices including stone construction entrances and restore surrounding areas to acceptable conditions.

END OF SECTION
SECTION 321216

ASPHALT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. The work to be performed is shown on the Drawings listed on the contract form. The work shall be performed in accordance with the local D.P.W. Specifications, Latest Edition and the Commonwealth of Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, Latest Edition. Said documents are by reference made a part of the contract.

B. The Work to be performed under this Section shall include furnishing all labor, materials and equipment required to do all the Bituminous Concrete Paving and related work as shown on the Drawings or herein specified. The Work shall further include all appurtenant items not specifically shown or itemized but which are implied or required to complete the Work in accordance with the reasonable intent of the Contract Documents.

C. The principal work of this Section includes, but may not be limited to the following:

1. New Bituminous Concrete Paving for Walks, Parking Areas, Bituminous Concrete (Cape Cod) Berms, and other areas as shown.
2. Paving to consist of a two (2) course hot placed and compacted pavement of mineral aggregate, mineral filler, and bituminous material, to the various depths and cross sections shown on the documents.
3. Fine grading of the gravel base course.

1.03 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section. Other specifications that directly relate to the work of this section include, but are not limited to, the following:

1. Section 310000 - EARTHWORK
2. Section 321316 - PORTLAND CEMENT CONCRETE SITEWORK
3. Section 321600 - CURBS
4. Section 330000 - SITE UTILITIES
1.04 QUALITY ASSURANCE

A. The following Specifications and all related items and methods shall meet Commonwealth of Massachusetts Department of Public Works Construction Standards and Materials Specifications, latest Edition. Method of payment part of each Section is deleted and shall not be included.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Asphalt Paving and Materials

1. All materials shall meet the requirements of the Commonwealth of Massachusetts Highway Department for Highways and Bridges, Latest Edition, Standard Specifications for Type I-1 Bituminous Concrete Paving, and the materials selected shall be of the highest quality. Prior to starting work, submit job mix formula for review and approval.

2. Bituminous prime coat shall be medium curing Type MC-D or MC-1 conforming to the Commonwealth of Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, Latest Edition. Asphalt cement shall be of a typical penetration grade for the local area. All bituminous material shall meet the minimum requirements of AASHO specifications.

3. Bituminous concrete aggregates and fine aggregates shall conform to MHD Section M3.11 as amended.

4. Bituminous concrete shall meet the following requirements when tested by the Marshall method. The requirements are based on the bituminous concrete being compacted with 50 blows and tested at 140 degrees F.

<table>
<thead>
<tr>
<th>Physical Test</th>
<th>Surface Course</th>
<th>Binder Course</th>
<th>Asphalt Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
<td>1000 PSI</td>
<td>1000 PSI</td>
<td>800 PSI</td>
</tr>
<tr>
<td>Flow 1/100&quot;</td>
<td>6 - 18</td>
<td>6 - 18</td>
<td>6 - 20</td>
</tr>
<tr>
<td>Total Voids</td>
<td>2 - 5</td>
<td>3 - 6</td>
<td>3 - 8</td>
</tr>
</tbody>
</table>

5. Asphalt cement content to be determined by three point Marshall curve. The amount of asphalt cement shall be selected from the maximum density obtained and within the above minimum requirements.

PART 3 - EXECUTION

3.01 PAVEMENT FOUNDATION CONDITIONS

A. Subgrade materials and preparation are specified in Section 310000. Gravel base material, thickness, and compaction is detailed on the Drawings. Fine grading is specified herein.
3.02 ESTABLISHMENT OF GRADES

A. Establish grade stakes from the Contract Drawings Site Grading Plan. The grade stakes shall be set to desired section and elevation and due allowances shall be made for existing improvements, proper drainage and adjoining property rights.

3.03 PROTECTION OF WORK BY OTHERS

A. Protect all work previously installed such as manholes, catch basins, sewer cleanouts, lighting posts, bases, curbs, sidewalks, etc. Repair any damage to this work caused by work of this Section.

3.04 PAVEMENT TRIMMING

A. Only sawcutting (without overcuts) shall be allowed as a means of creating the final (permanent) edge between existing and new hot-mix asphalt. All overcuts shall be filled with bituminous joint sealer. The standard cutback for all permanent pavement patches shall be 24" beyond the original pavement cuts made to perform the Contractor's work.

3.05 PAVEMENT APPLICATION

A. The gravel base course shall be fine graded in accordance with the Drawings and the maximum allowable deviation shall be 1/2 inch in ten (10) feet. Spread additional screening into any area showing segregation and roll into the surface until all voids in the base course have been completely filled. Rolling of the entire base shall be performed in the presence of the Soils Laboratory.

B. The bituminous prime coat shall be applied to the base course at the rate of 0.05 gallons per square yard. The base course shall be relatively dry at the time the primer is applied. The prime coat shall be allowed to cure for a minimum of twenty-four (24) hours.

C. Bituminous concrete shall be installed to the minimum thickness as specified. The compacted thickness shall be equal to or greater than the thickness specified. No skin patching will be accepted. Compaction of the bituminous concrete shall be equal to 97% of that obtained in the Laboratory. Bituminous concrete shall be rolled with a ten-ton roller as soon after placing as is practical.

D. Provide a slope for drainage as indicated on the Drawings. Slope to catch basins as provided.

E. The surface of the finished pavement shall be free of roller depressions. When tested with water, the surface shall not contain any irregularities which will impede water flow.

F. Bituminous concrete paving shall abut concrete curbs and walls making a smooth, even, clean joint as indicated on the Drawings.

3.06 FIELD QUALITY CONTROL

A. As directed by the Architect, the Owner will furnish the services of a testing laboratory to perform compaction and thickness testing. All testing is to be performed in accordance with ASTM or AASHO recommended procedures.
ELIZABETH CARTER BROOKS SCHOOL
WINDOW, DOOR & BOILER REPLACEMENT
New Bedford, Massachusetts

END OF SECTION
**SECTION 321313**

**CONCRETE PAVING**

**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. The Work to be performed under this Section shall include furnishing all labor, materials and equipment required to do all the Portland Cement Concrete Site Work and related work as shown on the Drawings or herein specified. The Work shall further include all appurtenant items not specifically shown or itemized but which are implied or required to complete the Work in accordance with the reasonable intent of the Contract Documents.

B. The principal work of this Section includes, but may not be limited to, the following:

1. Reinforced Concrete Pads
2. Concrete Walkways and Stoops
3. Joint Treatments
4. Reinforcement
5. Surface Finish
6. Curing

1.03 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements which affect the work of this Section. Other Specifications which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 033000 – CAST-IN-PLACE CONCRETE
2. Section 310000 – EARTHWORK

1.04 SUBMITTALS

A. Submit product data under provisions of the General Conditions.

B. Submit manufacturer’s instructions under provisions of the General Conditions
C. Product Data: Submit product data for the following materials and items.
   1. Reinforcement
   2. Forming Accessories
   3. Admixtures
   4. Integral Color (product data and actual product samples (up to 5))
   5. Patching compounds
   6. Sealants (including colors)
   7. Joint fillers
   8. Shop Drawing Reinforcement: Submit detailed shop drawings for fabrication, bending and placement of concrete reinforcement. Elevations of walls shall include form tie placement.
  10. Show bar schedules, stirrup spacing, diagrams of bent bars and arrangement of reinforcement including bar overlap.
  11. Include special reinforcement required for opening through concrete structures.
  12. Plastic slip dowel system
  13. Laboratory Test Reports: Submit concrete materials test reports and mix design reports certifying that each material or item complies with or exceeds the specified requirements.

1.05 SAMPLES

A. Mock-up Panels: Prepare one mock-up panel for each paving type at the project site to demonstrate proficiency of the workmen, and define the degree of aggregate exposure. Mock-up panels shall be a minimum of 4'-0" x 4'-0". Contractor shall use the methods and materials proposed for use on the final installation including but not limited to integral color, jointing, edging and finish texture. Uniformity in appearance of each panel shall be the responsibility of the Contractor. The approved mock-up shall serve as a standard appearance for final work. Approved mock-up may not be part of the completed work.

B. Plastic Slip Dowel System

1.06 QUALITY ASSURANCE

A. The following Specifications and all related items and methods shall meet The Commonwealth of Massachusetts Department of Public Works Construction Standards and Materials Specifications, Latest Edition (MDPW). Method of payment part of each Section is deleted and shall not be included.

B. Installer Qualifications

1. An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this project and whose work has resulted in construction with record of successful in-service performance.
C. Manufacturer Qualifications
   1. Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
      a. Manufacturer must be certified according to the National Ready Mix Concrete Association’s Plant Certification Program.

D. Testing Agency Qualifications
   1. An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

E. Source Limitations
   1. Obtain each type or class of cementitious material of the same brand from the same manufacturer’s plant and each aggregate from one source.

F. ACI Publications

G. Concrete Testing Services
   1. Engage a qualified independent testing agency to perform material evaluation test and to design concrete mixes.

H. Walks constructed for use by persons with accessibility challenges shall conform to the applicable portions of the Americans with Disability Act Accessibility Guidelines (ADA), Massachusetts Architectural Access Board (MAAB) and the Massachusetts State Building Code.

PART 2 - PRODUCTS

2.01 FORMS
   A. Form Materials
      1. Plywood, metal, metal-framed plywood or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surface.
      2. Use flexible or curved forms for curves of a radius 100 feet or less.

   B. Form-Release Agent
      1. Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Conform to all State and local requirements for levels of toxicity.
2.02 STEEL REINFORCEMENT

A. Epoxy-Coated Welded Wire Fabric
   1. ASTM A 884/A 884M, Class A, plain steel. Flat sheets required. No rolls.

B. Reinforced Bars
   1. ASTM A 615/A 615M, Grade 60, deformed.

C. Steel Bar Mats
   1. ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

D. Joint Dowel Bars
   1. Galvanized smooth steel dowels, ASTM A 615/A 615M, Grade 60. Cut dowels true to length with ends square and free of burrs. Provide polypropylene plastic slip dowel sleeves system. System shall be similar to “Speed Dowel” by Aztec Concrete Accessories, or approved equal.

E. Tie Bars
   1. ASTM A 615/A, Grade 60, deformed.

F. Hook Bolts
   1. ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

G. Bar Supports
   1. Bolters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI’s “Manual of Standard Practices” from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows.
      a. Equip wire bar supports with sand plates or horizontal runners where base materials will not support chair legs.
      b. For epoxy-coated reinforcement, use epoxy or other dielectric-polymer coated wire bar supports.

H. Epoxy Repair Coating
   1. Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.
2.03 CONCRETE MATERIAL

A. Use the same brand and type of cementitious material from the same manufacturer throughout the project. Bath mixing at the site is not acceptable.

B. Compressive Strength: Minimum 4,000 psi at 28 days.

C. Portland Cement: ASTM C 150, Type I or II.

D. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as per MPDW M2.02.02, ¾ inch aggregate.
   1. Do not use fine or coarse aggregates containing substances that cause spalling.

E. Water: ASTM C 94

2.04 ADMIXTURES

A. Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture: ASTM C 260, 5-6 percent.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water Reducing and Retarding Admixture: ASTM C 494, Type D.

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard dry.

B. Moisture-Retaining Cover: White polyethylene film or white burlap polyethylene sheet, ASTM C171; or resin-based, clear emulsion liquid dissipating cure which will not discolor the concrete, conforming to ASTM C309 Type I or ID, Class A & B and AASHTO M-148.

2.06 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt saturated, cellular fibers, as manufactured by Sealight, W.R. Meadows, or approved equal.
   1. Thickness: ½ inch.
   2. Depth: To match full section of concrete pavement.
B. Removable Vinyl Joint Cap Strips: Compatible with filler strips width, as manufactured by Vinylex Corp. or approved equal. Provide in length equal to lengths of filler strips.

C. Joint Sealer: Compatible with filler strips, two component polyurethane elastomeric type complying with FS-TT-S-00227, self leveling designed for pedestrian and vehicular traffic, as manufactured by Sika, Percora, or approved equal. Include primer and backing rods as required.
   1. Type: Class II, non-load bearing, for bonding freshly mixed to hardened concrete.
   2. Type: Class I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
   3. Type: Class IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.07 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal weight concrete determined by either laboratory trial mixes or field experience.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
   1. Do not use Owner’s field quality-control testing agency as the independent testing agency.

C. Proportion mixes to provide concrete with the following properties:
   1. Compressive Strength (28 Days): 4,000 pounds per square inch.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   4. Sacks of Cement (minimum): 7 sacks per cubic yard.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

2.08 EXPOSED AGGREGATE

A. Exposed, hard, sound, durable, and free of all deleterious materials and staining qualities. Provide aggregates from a single source.
   1. Store select seeding aggregates off the ground and protected from moisture.
   2. Aggregate shall match color, size and gradation of the aggregate used in the exposed aggregate sidewalks and pavement existing in the immediate vicinity of the Project.

2.09 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94, and MDPW, Section M4.
2.10 COLOR ADMIXTURE

A. Colored, water-reducing, self-controlling admixtures that contain no calcium chloride. Conform to ASTM 494 and 979. Color agent shall be integral mixed into batch concrete at the plant. Accepted admixture manufacturer L.M. Scofield Co., Atlanta, GA (800) 800-9900 or approved equal.

B. Color selection shall be by Architect.

C. Provide formulated color sealer in accordance with the admixture manufacturer recommendations.

2.11 SEALING MATERIALS

A. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   1. Available Products:
      c. Metalcrete Industries; Seal N Kure 30.

B. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, specifically manufactured for use with colored concrete.

C. Clear Acrylic Sealer: Manufacturer’s standard waterborne, membrane-forming, medium-gloss, acrylic copolymer emulsion solution, specifically manufactured for colored concrete, containing not less than 15 percent solids by volume, non-yellowing, and UV resistant.

D. Slip-Resistant Additive: Manufacturer’s standard finely graded aggregate or polymer additive, designed to be added to clear acrylic sealer, to result in a slip-resistant surface.

E. Polyethylene Film: ASTM D 4397, 1 mil thick, clear.

PART 3 - EXECUTION

3.01 PREPARATION

A. Proof-roll prepared surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and sub grade is ready to receive pavement. Do not install concrete over saturated, muddy or frozen base.

B. Remove loose material from compacted base surface immediately before placing concrete.
3.02 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement and curbs to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement. At points where change of grades is more than 2% introduce approved vertical curve. No abrupt changes in grade will be accepted.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

C. Curb forms to be true to horizontal and vertical alignment. Forms to be true to radiuses specified.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI’s “Manual of Standard Practice” for fabricating reinforcement and with recommendations in CRSI’s “Placing Reinfocing Bars” for placing and supporting reinforcement.

   1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lap splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.04 JOINTS

A. General: Construct construction, expansion, score joints, and tool edging true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlet, structures, walks, other fixed objects, and where indicated. Approval required prior to pour.

   1. Locate expansion joints at intervals of 30 feet maximum, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Install removable vinyl cap strips and set top of cap strip flush with finished concrete surface.
4. Furnish joint fillers in on-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
5. Protect top edge of joint filler during concrete placement with metal cap after concrete has been placed on both sides of joint.
6. Install dowel bars and support assemblies at joints where and as indicated.

C. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
   1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
   3. Provide tie bars at sides of pavement strips where indicated.
   4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Score Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness as follows:
   1. Grooved Joints: Form contraction joint after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks (tool wings) on concrete surfaces. Maximum spacing of 3'-0" in any direction. Areas of concrete sidewalk replacement shall be patterned to match existing pavement. Joints shall be straight or true to radius shown – poor workmanship is just cause for rejection of pavement.
      a. Radius: ¼ inch.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: Tool edges of pavement, gutters, curbs and joints in concrete after initial floating with an edging tool to following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surface.
   1. Radius: ¼ inch.

F. Rub all exposed vertical faces of curbs to eliminate blemishes, pockmarks, honeycombing, and all other defects. Plastering is not permitted.
3.05 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work. Protect adjacent work from damage, splatter, and all other concrete operations.

B. Remove snow, ice, or frost from sub base surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten sub base to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
   1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

I. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.
   2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, reinforcement steel, and sub grade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power driven floats, or by hand floating if area is small or inaccessible to poser units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture (standard). Provide cleanly finished fine textured broom finish on all colored concrete pavements including variating directions of the brooming.
   2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic (handicap access ramps).

C. Detectable Warning Surface Tile: Complete installation of concrete ramp and surface finish in accordance with these specifications.
   1. The factory-installed plastic sheeting must remain in place during the entire installation process, to prevent the splashing of concrete onto the finished surface of the tile.
   2. When preparing to set the tile, it is important that NO concrete be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Holes around the tile perimeter allow air to escape during the installation process. Concrete will flow through the large holes in each vane on the underside of the tile. This will lock the tile solidly into the cured concrete.
   3. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, an electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. Hold the tile a minimum of 1” from the back of any curb or away from any edge of the pour. The Cast-In-Place Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The contract drawings indicate...
that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

4. Immediately after tile placement, the tile elevation is to be checked to adjacent concrete. The tile elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates.

5. While concrete is workable, a 3/8" radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to float the concrete around the tile's perimeter, flush to the field level of tile.

6. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile to rock the tile, causing a void between the underside of tile and concrete.

7. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets. Two suitable weights of 25 lb each shall be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.

8. Following the curing of the concrete, protective plastic wrap is to be removed from the tile face by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft wire brush will clean the residue without damage to the tile surface.

3.07 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with SSHB, Section 476, and ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof.
3.08 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
   1. Elevation: ¼ inch.
   3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed ¼ inch.
   4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
   5. Vertical Alignment of Tie Bars and Dowels: ¼ inch.
   6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel ¼ inch per 12 inches.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel ¼ inch per 12 inches.
   8. Joint Spacing: 3 inches.

B. Typical cross slope of pavement is 1.5% unless otherwise indicated. In no case will water be allowed to stand or puddle on any finished pavement.

3.09 SEALANTS INSTALLATION

A. Install joint sealants in all expansion joints in accordance with the manufacturer’s installation instructions. Clean and prime joints. Remove dirt and loose coatings.

B. Apply sealant in continuous beads, without open joints, voids, or air pockets. Hand tool and finish all joints.

C. Confine materials to joint areas with masking tape or other precautions. Insure joint sealing is cleanly executed with no override onto adjacent pavement.

D. Remove excess compound promptly as work progresses and clean adjoining surfaces. Protect until full cured.

E. In rough surfaces of joints of uneven widths, hold joint sealant well back into joints.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing shall be performed according to the following requirements:
   1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C172, except modified for slump to comply with ASTM C 94.
   2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day’s pour of each type of concrete. Additional tests will be required when concrete consistency changes.
3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day’s pour of each type of concrete. Additional tests will be required when concrete consistency changes.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.

5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.

6. Compressive-Strength Tests: ASTM C 39; one set for each day’s pour of each concrete class exceeding 5 cu. Yd., but less than 25 cu. Yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.

7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

8. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.

10. Strength level of concrete will be considered satisfactory if average of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.

C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28 day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as the sole basis for approval or rejection.

E. Additional Tests: Testing agency shall make additional tests for the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.11 REPAIR AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. The Work to be performed under this Section shall include furnishing all labor, materials and equipment required to do all the Curbs and related work as shown on the Drawings or herein specified. The Work shall further include all appurtenant items not specifically shown or itemized but which are implied or required to complete the Work in accordance with the reasonable intent of the Contract Documents.

B. The principal work of this Section includes, but may not be limited to, the following:

1. Precast Concrete Curbing

1.03 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements which affect the work of this Section. Other Specifications which directly relate to the Work of this Section include, but are not limited to, the following:

1. Section 310000 - EARTHWORK
2. Section 321313 – CONCRETE PAVING
3. Section 330000 - SITE UTILITIES

1.04 CODES, ORDINANCES, AND PERMITS

A. Give all requisite notices and file all requisite plans relating to this work with the proper authorities, secure all permits for this work, and pay all fees for same.

B. Perform all work in accordance with all applicable local, state, and federal codes, statutes, or regulations.
1.05 SHOP DRAWINGS AND MATERIAL SCHEDULES

A. Submit shop drawings for the following materials and equipment:

1. Precast Concrete Curbing
2. In dependently developed, dimensioned layout drawings of all curb sections & transition pieces. Drawings shall contain a table with linear footage of curb, quantity of radii and transition pieces.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE CURB

A. Precast Concrete Curb shall be Rockcurb Precast concrete curb as manufactured by Scituate Concrete Pipe Corp or approved equal. Curbing shall be fiber mesh reinforced, 6% air entrained, 5,000 lb. High Performance concrete. Each curb section shall be reinforced with two (2) #4 rebars and complete with interlocking dowel holes for proper alignment.

B. Precast Concrete Curb shall be of the shape, size and configuration shown on plans. Special factory cost units shall be provided as follows:

1. All curb sections including straight to straight, straight to special, special to special shall be furnished with self aligning dowel holes.

2. Where flush curbing is specified or at transition from precast to vertical or to sloped granite use properly sized transition curb units to achieve the curb height change in a 2 foot sloped run.

3. Use wheel chair ramp curb at all transitions where accessible ramps are called for on the drawings.

4. Outside non-radius corners shall be made up with 2’x2’ 90° corner. Radius corners shall be made up to the indicated dimensions with radius curb. Curb shall not be cut to create outside corners or radii.

5. Use 6’ straight curb section at drainage structures.

6. Accurately locate and dimension curbing so that all runs of curb are made with precast section and without any field cutting of curbing. Provide special lengths as may be required to avoid field cuts.

7. Mountable curb for emergency vehicle access shall be cast to the profile and dimension indicated on the drawings.

PART 3 - EXECUTION

3.01 LAYOUT AND EXECUTION

A. All curbs shall be true to line and grade and shall be laid out in the field with suitable offset stakes and top elevation clearly marked on appropriately spaced stakes.
B. Hold the curb elevations shown on the Grading Plan. Set all top of curb in the field to be 6” above the finish paving grade immediately in front of the curb. Top of curb to be 6” above the overlay in areas indicating on overlay over existing paving.

C. Curbs are to be set parallel to all buildings and structures. Finish face of all Curb is to be vertical and plumb.

D. After excavation to the grade specified above prepare the trench bottom as follows:

1. Place 6” of compacted crushed stone in the bottom of the trench for setting and leveling of all Precast Concrete Curb.

2. Pour 6” of Class “C” cement on the pavement side for backing on all Precast Concrete Curb.

4. The curb shall be set at the line and grade required as shown on the plans unless otherwise directed. Curb shall be fitted together as closely as possible.

5. The joints between curbs (both front and back) shall be carefully filled with cement mortar and neatly pointed on the top and front exposed portions. After pointing, the curbstones shall be satisfactorily cleaned of all excess mortar that may have been forced out of the joints.

END OF SECTION
SECTION 321723

PAVEMENT MARKING

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 WORK INCLUDED

A. Provide all additional equipment and materials not otherwise specified, and do all work necessary for pavement marking, as indicated on the Drawings including but not limited to parking space striping, painted parking islands, fire lane markings, handicap parking symbols, loading areas, stop lines, painted crosswalks, and painted lettering.

1.03 RELATED WORK UNDER OTHER SECTIONS

A. Carefully examine all of the Contract Documents for requirements which affect the work of this Section. Other Specifications which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 321216 – BITUMINOUS CONCRETE PAVING

1.04 REFERENCES

A. Work shall conform to codes and standards of the following:


1.05 LAYOUT OF WORK

A. The Contractor shall furnish to the Architect for approval a schedule of pavement marking operations in accordance with MHD Specifications Section 860.61.

1.06 TRAFFIC CONTROL

A. Suitable warning signs shall be placed near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions.
B. Place traffic cones along newly painted lines to control traffic and prevent damage to newly painted surfaces. Remove when paint has dried fully.

C. Painting equipment shall be marked with large warning signs indicating slow moving painting equipment in operation.

PART 2- PRODUCTS

2.01 PAVEMENT STRIPING

A. Materials for pavement markings shall conform to MHD Specifications M7.01.03 (for White Thermoplastic Reflectorized Pavement Markings) and M7.1.04 (for Yellow Thermoplastic Reflectorized Pavement Markings)

B. Paint shall be in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer’s name, formulation number and directions, all of which shall be plainly legible at time of use.

C. Paint shall be homogeneous, easily mixed to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of six months.

D. Paint color for handicap parking symbol, parking stall stripes, stop lines and other traffic related items shall be white traffic paint.

2.02 MARKING EQUIPMENT

A. Machines, tools and equipment used in the application of pavement markings shall conform to MHD Specifications Section 860.60 and shall be approved and maintained in satisfactory operating condition.

B. Push-type machines of a type commonly used for application of paint to pavement surfaces shall be acceptable for marking roadway and parking areas. Applicator machine shall have the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

PART 3- EXECUTION

3.01 SURFACE PREPARATION

A. New pavement surfaces shall be allowed to cure for a period of not less than 48 hours before application of marking materials.
B. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods, as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed using scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion, as directed.

3.02 PAVEMENT MARKING

A. Marking materials shall be applied to clean, dry surfaces in accordance with the requirements of MHD Specifications Section 860.62.

B. Paint shall be applied pneumatically with approved equipment.

C. Pavement marking materials shall be applied evenly to the pavement surface to be coated at a rate specified in MHD Specifications Section 860.62.

D. Guidelines and templates shall be employed as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols.

E. Edges of markings shall be sharply outlined.

F. Maximum drying time requirements of the paint manufacturer shall be enforced to prevent undue softening of bitumen, and pickup, displacement or discoloration by vehicle tires.

G. If markings require more drying time than stated by the paint manufacturer, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.03 PROTECTION OF MARKINGS

A. Markings shall remain protected in accordance with MHD Specifications Section 860.63.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 DESCRIPTION OF WORK

A. Work Included: Providing and installing all site improvements shown on the Drawings and as specified herein, including:

1. Project Signage and Posts
2. Steel Bollards

1.03 RELATED WORK DESCRIBED ELSEWHERE

A. Carefully examine all of the Contract Document for requirements which affect the work of this Section. Other specifications which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 099000– PAINTING
2. Section 033000– CAST-IN-PLACE CONCRETE
3. Section 310000 – EARTHWORK
4. Section 321216 – BITUMINOUS CONCRETE PAVING
5. Section 321313 – CONCRETE PAVING
6. Section 321600 – CURBS

1.04 SUBMITTALS

A. Shop Drawings: Contractor shall provide fully dimensioned shop drawings and manufacturer's technical literature for all improvements and confirm fabrication, reinforcing, and anchoring systems for approval.
PART 2 - PRODUCTS

2.01 METAL BOLLARDS: Schedule 40 galvanized seamless pipe including concrete core and schedule 40 galvanized steel dome welded to pipe and ground smooth. Install as per detail.
   A. Reflective tape, 3M, Reflexite, or approved equal.
   B. Prime and paint. Colors to be approved. See Division 9.

PART 3 - EXECUTION

3.01 JOB CONDITIONS
   A. Confirm completion of pavements and other improvements are properly sequenced prior to installation of specified improvements.

3.02 PROJECT SIGNAGE
   A. Install signs and posts at each designated location.
   B. Install signage plates and fabricated steel post/bollard assembly where and as detailed at handicap parking areas.
   C. Signs to be installed level and plumb, at a constant vertical alignment.

3.03 BOLLARDS
   A. Fabricate and finish bollards as detailed. Install bollards where and as detailed. Hold bollards at a constant alignment.
   B. Install collapsible bollards in concrete footings in accordance with manufacturer recommendations. Minimum depth 42" below finish grade. Hold top of footing 3" below bottom of adjacent bituminous concrete.
   C. Install minimum section and obtain Owner’s approval prior to proceeding with work. Minimum length of each piece of decking - 10'-0".

3.04 PROTECTION/CLEAN UP
   A. Protect: until acceptance of the project. Replace or refinish the surfaces if damaged prior to acceptance.
   B. Clean up all debris from installation procedures.

END OF SECTION
SECTION 330000

SITE UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to SECTION 012300, ALTERNATES, for alternates which may affect the work of this SECTION.

1.02 SUMMARY

A. This Section includes the following:

1. All labor, materials, and operations in connection with the installation of the Site Utilities Work.

2. The principal work of this Section includes, but is not necessarily limited to the following:

   a. Natural gas service

B. The following related work is specified under the designated Sections:

1. Section 220000 – PLUMBING
2. Section 260000 – ELECTRICAL
3. Section 310000 – EARTHWORK
4. Section 312319 – DEWATERING
5. Section 312500 – EROSION AND SEDIMENTATION
6. Section 321216 – BITUMINOUS CONCRETE PAVING
7. Section 321313 – CONCRETE PAVING

1.03 REFERENCE STANDARDS, SPECIFICATIONS, AND CODES

A. The following are hereby made a part of this SECTION by reference thereto:

1. All work installed under this SECTION shall comply with all Local, State, County and Federal Codes, Laws, Statutes, and Authorities having jurisdiction. Include any and all permit, connection, and/or inspection fees in the bid. Where the Contract Documents indicate more stringent requirements than the above Codes and Ordinances, the Contract Documents shall take precedence.
2. Give all requisite notices and file all requisite plans relating to this work with the proper Authorities, secure all permits for this work, and pay all fees for same.
3. All Site Utilities related materials and methods shall conform to the Commonwealth of Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, Latest Edition.

1.04 SUBMITTALS

A. Submit for approval Shop Drawings for the following:

1. Precast Concrete Structures
2. Piping of all description including Valves and Hydrants
3. Frames and Covers

1.05 RECORD DRAWINGS

A. Maintain on the site at all times one (1) set of black or blue line on white Drawings which shall at all times be accurate, clear and complete, showing the actual location of all piping and structures as installed in colored pencil.

B. The Contractor shall, as part of the application for substantial completion, provide the Owner a set of “As-Built” drawings for the scope of work provided under this section. “As-Built” drawings shall be prepared and endorsed by a Massachusetts Registered Professional Engineer or Land Surveyor and shall bear the seal of such professional. Drawings shall depict, in relationship to the design plan, the “As-Built” condition of all the utility systems including but not limited to: Drainage, Sewer, Subsurface Sewage Disposal System, Electric, CATV, Telephone, Alarm, Data, Water and Underground Tanks. “As-Built” shall identify the location, elevations, pipe size, pipe material of all site utilities related to grade components.

1.6 CONTRACT DOCUMENTS

A. It is the intent of these Specifications and Drawings to call for finished work, tested, and ready for operation. Any apparatus, appliance, materials, or work not shown on the Drawings but mentioned in the Specifications, or vice-versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, and installed.

B. The Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangements of equipment, conduits, and piping. The locations of all items shown on the Drawings or called for in the Specifications that are not definitely fixed by dimensions or invert elevations are approximate only. If directed by the Architect, make reasonable modifications in the layout as needed to prevent conflict with other work or for proper execution of work.
PARTS 2 - PRODUCTS

2.01 GENERAL

A. Material and equipment for installation under this Section of the Specifications shall be new, unused, free of defects, and the best quality of a manufacturer of established reputation. Any defective or damaged material shall be immediately removed from the Site.

B. Each piece of pipe, fitting, valve, etc., delivered under this Section of the Specifications shall have indelibly cast or marked thereon the manufacturer's name, trademark, pressure rating, and the date of manufacture.

C. Specifications for materials included herein are intended for the purpose of establishing minimum quality requirements, and all materials are subject to approval by the Architect.

2.02 PIPING

A. All piping installed for this job shall be marked with manufacturer's data indicating type, size, etc. Refer to Drawings for various pipe materials to be used on this project.

2.03 DETECTABLE UNDERGROUND WARNING TAPE

A. Detectable warning tape shall be installed 12" directly above all buried utilities. Detectable warning tape shall consist of a nominal 4.5 mil (0.0045") overall thickness and 6" wide, with a solid aluminum foil core. The imprinted warning message is “Buried, or Encased” to prevent rub-off, and is impervious to acids, alkalis and other destructive elements found in soil. The imprint is as such that it allows for total reflectivity. A tape must be visibly seen before it can be read. The tape shall meet the testing requirements of ASTM D-882, Method A.

B. Legend/Color & Imprint:

1. Tape shall read “CAUTION BURIED ___________ LINE BELOW” with respective utility type indicated.
2. Tape color coding:
   a. Electric – Red
   b. Gas – Yellow
   c. Water – Blue
   d. Sewer – Green
   e. Fiber Optic/Telephone – Orange
   f. Storm Drain - Green

2.04 CONCRETE

A. Conform to the Concrete Section of the specification for 4,000 PSI 6% air entrained concrete for all concrete structures for the work of this section. Including reinforcing steel where detailed.
2.05 SAND BORROW
   A. Sand borrow meeting the gradation requirements of MassDOT M1.04.0 Type b shall be used as backfill around all water and natural gas piping.

2.06 CONTROLLED DENSITY FILL
   A. Controlled Density Fill shall be installed in lieu of gravel in utility trench backfills with the public right-of-way as required by the City of New Bedford.
   B. Controlled Density Fill (CDF) material is a flowable, self consolidating, rigid setting, low density material that can substitute for compacted gravel in backfills, fills and structural fills.
   C. All ingredients shall comply with the following:
      1. Portland Cement: AASHTO M 85
      2. Fly Ash: AASHTO M 295 Class F
      3. Sand: M4.02.02
      4. Air Entraining Admixtures: M4.02.05
   D. Controlled Density Fill shall meet the material requirements of MassDOT M4.08.0 Type 2E (Flowable (Excavatable)) with the following requirements:
      1. Compressive Strength at 28 Days: 30-80 pounds per square inch (psi)
      2. Compressive Strength at 90 Days: 100 pounds per square inch (psi) maximum
      3. Slump: 10-12 inches

PART 3 - EXECUTION

3.01 GENERAL
   A. Furnish the services of a Registered Land Surveyor for layout of Site Utility Systems.
      1. Leaching trenches and manholes shall be established with offsets and grade. Establish line and grade for all piping. Provide additional control along the pipe runs by use of lasers. Grade stakes and batter boards are not acceptable except as may be used in conjunction with lasers.
   B. Verify inverts and locations of all existing utilities prior to installation of any work. Transmit above information to the Architect who shall make any alterations to the Contract Drawings as required by the existing conditions. Proceed with construction only after written permission from the Architect. If any work is installed without prior written notice of the Architect, and said work requires alteration due to existing conditions, said alterations shall be made by the Contractor at his expense.
C. Protect all pipe lines, sewers, drains, poles, wiring and the like that interfere in any way with the work whether or not they are specifically shown on the Drawings. Notify the proper Authorities that items are protected, supported and/or relocated as necessary to adjust them to the new work.

3.02 PROTECTION, SHORING AND PUMPING

A. Protect open excavations with fencing, warning lights and/or other suitable safeguards and as may be additionally required by the Authorities having jurisdiction.

B. Protect bottom of excavation from frost. Do not place new work on frozen ground. Shore and brace excavation and provide sheet piling, if necessary, to prevent cave-ins and to conform to Local, State, and Federal Safety Regulations. Remove shoring and piling before backfilling is completed, but not until permanent supports are in place.

C. Provide all necessary pumps, well points and pumping facilities, including attendants, to keep all excavation free from water from whatever source at all times when work is in progress and when necessary for protection and integrity of the work in place. Trenches shall be kept water-free during jointing and for sufficient time thereafter to allow the jointing material to become fully set and completely resistant to water penetration. Pump discharge to be in such a manner that it does not flood, interfere or damage any other area of work.

3.03 INSTALLATION OF PIPE

A. Trenches shall be opened only to such extent as approved by the Architect and the total lengths of open trench shall be as short as practical at all times. Immediately upon opening of trench, pipe bedding shall be placed, compacted, and dressed as specified.

B. Carefully examine each pipe length before laying, and do not lay defective or damaged pipe. Lay pipe lines to grades and alignment indicated. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable.

C. Pipe laying shall proceed upgrade with spigot ends of bell-and-spigot pipe, and tongue ends of tongue-and-groove pipe pointing in direction of flow.

D. Execute installation of flexible joints by placing gaskets and jointing materials in accordance with recommendation of particular manufacturer in regard to use of lubricants, cements, adhesives and other special installation requirements. Surfaces to receive lubricants, cements or adhesives shall be clean and dry. Affix gaskets and jointing materials to pipe not more than twenty-four (24) hours prior to installation of pipe and protect from sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials so damaged shall be removed and replaced. Pipe shall be aligned with previously installed pipe and joint pulled together. If, while making joint, gasket or jointing material becomes loose and can be seen through exterior joint recess when joint is pulled up to within 1 inch of closure, pipe shall be removed and joint remade.

END OF SECTION