SECTION 14202

LIMITED USE LIMITED APPLICATION ELEVATOR
(Filed Sub-Bid)

MM. GENERAL

1.01 GENERAL REQUIREMENTS

A. The "Conditions of the Contract" and "Division 1, General Requirements" form part of this Section.

1.02 FILED SUB-BID REQUIREMENTS

A Bidding procedures shall be in accordance with latest edition of Massachusetts General Laws, Chapter 149, Section 44; and Chapter 30, Section 39M. Time and place for submission of sub-bids is given in Advertisement for Bids.

B Sub-bids for work under this Section shall be for complete work and shall be filed in a sealed envelope with Awarding Authority, at time and place specified in Advertisement for Bids. The following shall appear on face of envelope:

TOWN OF PLYMOUTH
SIMES HOUSE RENOVATIONS
[NAME OF SUB-BIDDER]
SUB-BID FOR SECTION 14202, LIMITED USE LIMITED APPLICATION ELEVATOR

C Every sub-bid submitted for work under this Section shall be on forms furnished by Awarding Authority, as required by Section 44 of Chapter 149 of General Laws, and specified in Advertisement for Bids.

D Sub-bids filed with Awarding Authority shall be accompanied by bid deposits in form of a bid bond, or cash, or a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company, payable to the Town of Plymouth; in compliance with Chapter 149, Section 44B. Amount of bid deposit shall be as specified in the advertisement for bids.

E. Work of this Section is shown on the following drawings: T1, A1.1, A1.2, A1.3, A2.2, M1.3, E1.3, E3.1

F. Examine all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this section.

G. 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.

1.04 SCOPE OF THE WORK

A. Limited Use Limited Application Elevator.

1.1 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Concrete for elevator machine foundation, and pit and required sleeves for service penetrations.

B. Section 06100 - Rough Carpentry.

C. Section 07724 - Roof Hatches: Smoke venting hatch at top of hoistway.

D. Section 08310 - Access Doors and Panels: Fire rated access doors into hoistway.

E. Section 09260 - Gypsum Board Assemblies: Gypsum shaft walls.

F. Section 09650 - Resilient Flooring: Floor finish in cab.

G. Division 16 - Electrical:
   1. Electrical characteristics and wiring connections.
   2. Electrical service to lockable fused disconnect in elevator machine room.
   3. Electrical service for machine room, machine room convenience outlets, machine room lighting and lighting in elevator pit.
   4. Telephone service.

1.2 REFERENCES

A. ASME A17.1, /CSA B-44 - Section 5.2 Safety Code for Elevators and Escalators, Limited-Use/Limited Application Elevators.

B. NFPA 70 - National Electric Code.

C. CSA - Canadian Electric Code.

D. ADAAG - Americans with Disabilities Act, Architectural Guidelines.

1.3 REGULATORY REQUIREMENTS

A. Provide passenger elevator in compliance with:
   1. ASME A17.1 - Safety Code for Elevators and Escalators, Limited-Use/Limited Application Elevators.
   2. NFPA 70 - National Electric Code.

B. ADA: Provide passenger elevator in accordance with the requirements of Americans with Disabilities Act.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on elevator, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. 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.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment of cable tension and periodic cleaning and maintenance of all railing and infill components.

1.5 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to start of work of this section.

B. Review shaftway, electrical, fire alarm and other requirements with appropriate representatives.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

1.7 PROJECT CONDITIONS

A. Do not use elevator for hoisting materials or personnel during construction period.

1.8 WARRANTY

A. Warranty: Provide a two year limited warranty covering replacement of defective parts and excluding labor. Preventive maintenance agreement required.

B. Extended Warranty: Provide an additional five year limited warranty covering replacement of defective parts and excluding labor for a total of seven years. Preventive maintenance agreement required.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance for elevator system and components for the following period from Date of Substantial Completion.
1. Two years.

B. Include systematic examination, adjustment, and lubrication of elevator equipment. Repair or replace parts whenever required. Use parts produced by manufacturer of original equipment. Replace wire ropes when necessary to maintain required factor of safety.

C. Provide emergency call back service for this maintenance period.

D. Perform maintenance work using competent and qualified personnel approved by elevator manufacturer or original installer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Garaventa Lift, which is located at: 7505 134 A St. ; Surrey, BC; Canada V3W 7B3; Toll Free Tel: 800-663-6556; Tel: 604-594-0422; Fax: 604-594-9915; Email: bramsay@garaventalift.com; Web: www.garaventalift.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 HYDRAULIC PASSENGER ELEVATORS

A. Garaventa Elvoron LU/LA Hydraulic Elevator, 1,400 pounds (635 kg) capacity cable hydraulic elevator:
   1. Capacity: 1,400 pounds (635 kg).
   2. Car Size: Maximum of 18 SF (1.67 sm).
      a. Style 1L: 42 inches by 60 inches (1067 by 1524 mm) with one side right sliding doors.
   3. Travel:
      a. As indicated on the Drawings.
   4. Stops:
      a. Base Bid: 2 stops; Alternate 1: 3 stops.
   5. Speed: Nominal 30 feet per minute (0.15 m/sec).
   6. Pit Depth: Minimum 12 inches (305 mm) required.
   7. Overhead: Total overhead clearance (Refuse Space) 124 1/2 inches above the upper landing level. Provide car top prop to reduce overhead clearance requirement.
   8. Drive System: 1:2 Cable Hydraulic, Heavy Duty car sling with roller guide shoes running on 8 lb. per foot steel T-rails, Quiet submersed pump and motor (5 HP), Factory pre-set and tested 2-speed valve for smooth start and stop.
   9. Power Requirements:
      a. 208 VAC, 20 Amp, Three Phase.
      b. A Separate 115-Volt, 15 Amp Circuit is required for car lighting.
   10. Controls:
      a. Garaventa-Design PLC Controller with integrated self diagnostics.
      b. Fully automatic push button at car and landings with Braille markings..
      c. Automatic car light switch upon entry.
      d. Digital floor indicator in Car.
      e. Car arrival lanterns in car door jamb.
   11. Car and Hoistway Doors: 36 inch by 80 inch (914 by 2032 mm) two-speed horizontal sliding hoistway and car doors.
   12. Safety Features:
      a. Emergency back-up power with a manual lowering device.
      b. Safety brake system.
      c. Car operator with integral gate switch.
      d. Automatic bi-directional floor leveling.
      e. Emergency alarm button in car, Emergency keyed stop switch in car.

f. Overspeed valve.
g. Final limit switch.
h. Low oil protection timer circuit.

13. Standard Features:
    a. Car direction lantern comes with audio and visual signals.
    b. Full height photo-electric door sensors.
    c. Automatic home park feature.
14. Options:
    a. Integrated hands free telephone.
    b. Fireman service (Phase 1).
15. Machine Location:
    a. As indicated on the Drawings.

2.3 CAB DESIGN

A. Cab Design:
1. Interior Walls: Laminate panel sections.
    a. Empire Mahogany.
2. Cab Frame:
    a. Mild steel powder coated in a custom color as selected by the Architect.
3. Ceiling Finish:
    a. Stainless Steel, brushed finish.
4. Handrail Finish:
    a. Bronze, oil rubbed finish.
5. Car Operating Panel Finish:
    a. Bronze, oil rubbed finish.
6. Floor: Unfinished plywood construction.
7. Lighting: Four recessed halogen down lights.
    a. Black Trim.
8. Car Direction Lantern: Stainless car direction lantern complete with auto and visual signaling device indicating direction of travel and arrival at selected floor.
9. Car Doors: When open the doors provide a 36 inch (915 mm) by 80 inch (2032 mm) clear opening.
    a. Two Speed Horizontal Sliding equipped with full height photo-electric door sensors, color as follows:
        1) Matching cab wall finish.

2.4 HOISTWAY ENTRANCES

A. Hoistway Entrances: When open, the doors provide a 36 inch (915 mm) by 80 inch (2032 mm) clear opening.
1. Two Speed Horizontal Sliding equipped with full height photo-electric door sensors, finish as follows:
    a. Primed painted.

B. Hall Call Stations:
1. Hall Station Type:
    a. Keyless Push Button.
2. Finish:
    a. Bronze, oil rubbed finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until preliminary work including hoistway, landings and machine space has been properly prepared.

B. Verify shaftway is constructed in accordance with ASME A17.1 /CSA B-44 and all local codes.

C. Verify shaftway and machine room temperature is designed to have maintainable temperatures between 60 degrees F (16 degrees C) and 110 degrees F (43 degrees C).

D. Verify machine room, when required, is provided with lighting, light switch, convenience outlets and clear space requirements of ASME A17.1 /CSA B-44 and all local codes.

E. Verify shaftway and openings are of correct size and within tolerance.

F. Verify electrical power is available and of correct characteristics.

G. If preliminary work is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install elevator in accordance with applicable regulatory requirements including ASME A 17.1 /CSA B-44 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.

3.4 FIELD QUALITY CONTROL

A. Perform tests in compliance with ASME A 17.1 /CSA B-44 and as required by authorities having jurisdiction.

B. Schedule tests with agencies and Architect, Owner, and Contractor present.

3.5 FIELD SERVICES

A. Obtain required permits to perform tests. Perform tests required by regulatory agencies.

B. Schedule tests with agencies and Architect and Contractor present.

C. Submit test and approval certificates issued by jurisdictional authorities.

3.6 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.

B. Adjust automatic floor leveling feature at each floor to provide stopping zone of 1/4 inch (6 mm).

3.7 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components ready for inspection.

3.8 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 15300
SPRINKLER
(Filed Sub-Bid)

PART 1: GENERAL

1.1 GENERAL PROVISIONS

A. All of the Contract Documents, including the General and Supplementary Conditions and Division 1 General requirements, apply to the work of and are hereby made a part of this Section.

B. Examine all drawings and all other sections of the specifications for requirements therein affecting the work of this Section whether or not such work is specifically mentioned in this Section.

C. This section contains information that applies to all work performed under the contract and is hereby made a part of each specification section.

D. Coordinate work of this Section with that of all other trades affecting, or affected by, this Section. Cooperate with such trades to assure the steady progress of all work under the contract.

E. Materials or products specified herein and/or indicated on Drawings by trade name, manufacturer's name and/or catalog number shall be provided as specified. Substitutions will not be permitted except as described herein and in the Supplementary and General Conditions.

F. All materials shall be new of quality as specified, and when required be clearly labeled and/or stamped as manufactured in the United States.

G. A list of all materials and equipment which the Installer proposes to furnish shall be submitted for approval within ten (10) days after the contract has been awarded. Data shall be complete in all respects.

H. Where an accepted substitution or deviation requires different quantity or arrangement of supports, ductwork, piping, wiring, conduit, and any other equipment or accessories normal to this equipment, Installer shall furnish said changes and additions and pay all costs for all changes and additions to his work and the work of others affected by this substitution or deviation.

I. Deviations mean the use of any listed approved manufacturer other than those on which the Drawings are based.

1.2 FILED SUB-BID

A. Bidding procedures shall be in accordance with the latest edition of Massachusetts General Laws, Chapter 30; Section 39M, and Chapter 149, Section 4; as modified by Chapter 484 (1984) and Chapter 30B, Uniform Procurement Act (1990). Time and place for submission of sub-bids is given in Advertisement for Bids.
Sub-Bids for work under this section shall be for complete work and shall be filed in a sealed envelope with Awarding Authority, at time and place specified in Advertisement for Bids.
Following shall appear on face of envelope:

TOWN OF PLYMOUTH
SIMES HOUSE RENOVATIONS
[NAME OF SUB-BIDDER]
SECTION 230001 – FIRE PROTECTION

B. Every sub-bid submitted for work under this section shall be on forms furnished by Awarding Authority, as required by Section 44F of Chapter 149 of General Laws, and specified in Advertisement for Bids.

C. Sub-bids filed with Awarding Authority shall be accompanied by bid deposits in the form of a bid bond, cash, certified check, or a treasurer's or cashier's check, issued by a responsible bank or trust company, payable to the Awarding Authority in compliance with Chapter 149, Section 44B. Amount of bid deposit shall be 5 percent of value of bid.
D. Work to be done under this section is shown on the following drawings. : FP0.1, FP1.1, FP1.2.
E. Remaining contract drawings are included for reference and coordination.
F. Sub-Sub-Bid Requirements: None

1.3 SYSTEM NARRATIVE

A. The following sprinkler narrative is provided to comply with the requirements of Massachusetts State Building Code, 8th Edition, 780 CMR 901.2.1. (For Fire Sprinkler Only, Other Responsible Designers shall provide narratives for their respective trades.) For additional details on systems and equipment see attached plans and specifications.
B. Building Description
   1. The project consists of a mixed use commercial space and apartment building located at 29 Manomet Point Rd., Plymouth MA. The building contains mixed uses: R-2 for apartments and B for the offices and A-3 for the museum areas.
   2. The building is 3 stories tall plus full basement. The building is approximately 40 ft in total height. The first floor areas consist of meeting rooms and museum areas, the second floor area consists of office areas and the third floor consists of two residential dwelling units. The basement consists of mechanical and storage spaces. The building is approximately 8,500 sq. ft. of floor area.
   3. All floor structure is dimensional lumber with ceilings tight to bottom of structure. The attic does have exposed combustible structure so protection will be required.
C. Applicable Laws, regulations and standards
   1. 780 CMR Massachusetts State Building Code, 8th Edition
   2. NFPA 13 "Standard for the Installation of Sprinkler Systems" 2007 Edition
   3. MGL Chapter 148 section 26 G
D. Fire Protection Systems to be Installed
   1. Design Methodology
      a. Mechanical, electrical and storage areas: Areas will be designed based on Ordinary Hazard Group 1, occupancy requirements. The design density will be 0.15 gpm/sq.ft. with a maximum sprinkler coverage of 130 sq.ft. Quick response type sprinkler heads shall be utilized.
         i) System shall be hydraulically designed per NFPA 13. Based on the "Room Design Method" per NFPA 13-2007 section 11.2.3.3.
      b. Office and Museum Areas: Areas to be designed based on Light Hazard, Occupancy Requirements. The design density will be 0.10 gpm/sq.ft. with a maximum sprinkler coverage per listing of head. Quick response standard coverage heads will be used.
         i) System shall be hydraulically designed per NFPA 13. Based on the "Areas Density Method" per NFPA 13-2007 section 11.2.3.2.
      c. Dwelling units and Hallways: Areas to be designed based on Light Hazard, Occupancy Requirements. The design density will be 0.10 gpm/sq.ft. with a maximum sprinkler coverage per listing of head. Residential type sprinkler heads shall be utilized.

i) System shall be hydraulically designed per NFPA 13. Based on the "Residential Sprinkler Method" per NFPA 13-2007 section 11.3.1.

d. A 4" fire department connection shall be provided on the sidewall of the building. The sprinkler system electric bell shall be located above the fire department connection.

e. For system details see attached plans and specifications.

2. Testing

a. All testing shall be done at the expense of the contractor, who shall furnish the required equipment. Any and all system shutdowns must be coordinated with the Owners and the Engineer. Contractor shall provide 5 day notice of any shutdown.

b. System shall be tested in compliance with the requirements of NFPA 13 and local Fire Departments Requirements. All tests shall be conducted to the satisfaction of the engineer and owner.

c. The sprinkler system shall be tested hydrostatically for 2 hours without visible leakage at not less than 200 psi or at 50 psi in excess of the maximum static pressure, whichever is greater.

d. Contractor shall conduct a full flow test of the sprinkler system to ensure that water flow detecting devices and associated alarm circuits are working properly.

e. When testing is complete the system shall be returned to operation. The alarm receiving office and all concerned personnel at the facility shall be notified that the test is complete and that the system has been returned to full service.

1.4 SCOPE OF WORK

A. Included in this Section is the furnishing of all labor, materials, equipment and accessories required to provide a complete installation of the work described herein and on the Drawings. Build the work of other trades into the work of this Section as required.

1. Furnish and install a complete fire protection system for the entire building as shown on plans and as required per NFPA 13 and local fire authorities having jurisdiction. System shall include but is not limited to the following:

a. Wet sprinkler system throughout the occupied portion of the building. All piping and heads shall be concealed except within the basement.

2. The fire protection system shall be complete including permits and inspections. Bid shall include all costs associated with making a complete system.

3. Plans show all know combustible void spaces which will require sprinkler coverage. FPC shall review building during construction and report any area which may required additional sprinkler coverage.

B. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities having jurisdiction, as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda, all of which are part of Contract Documents.

C. The work under this Section consists of:

1. Working Plans
2. Sprinkler Heads
3. Pipe Materials
4. Double check valve assembly
5. Valves
6. Hangers, Anchors and Inserts

7. Pipe Hangers and Supports
8. Electric Bell
9. Hydrant Flow Test
10. Fire Department connection
11. Seismic Restraint
12. Link seal pipe sealing
13. Sleeves
14. Identification
15. Record drawings.
16. Access panels
17. Fire stopping
18. Coordination with Fire Alarm installer
19. Permits fees
20. Submittals
21. Provide Close-Out procedures per Division 1.

1.5 ALTERNATES

A. Refer to Division 1. - Alternates for work that may affect the work of this Section.

1.6 RELATED WORK IN OTHER SECTIONS

A. The following work is not included in this Section and will be performed under other Sections:
   1. Fire Alarm system
B. Proceed with work as fast as possible to meet all construction schedules. At all times keep a competent superintendent in charge of the work. Such superintendent shall be replaced if unsatisfactory to the Owner and/or Engineer.
C. Maintain a complete file of all contract and shop drawings at the site available for inspection by Owner's representatives.
D. Upon installation of equipment shop drawings shall be initialed and dated. This procedure will serve to ensure proper scheduling and enable Owner's representative's time to check the work in progress.

1.7 ITEMS SUPPLIED UNDER OTHER SECTIONS FOR INSTALLATION BY THIS SECTION

A. None.

1.8 ITEMS SUPPLIED UNDER THIS SECTION FOR INSTALLATION BY OTHER SECTIONS

A. Fire alarm components including tamper switches and flow switches, alarm bells shall be wired by the Electrical Contractor.

1.9 QUALITY ASSURANCE

A. Perform work in strict accordance with rules, regulations, standards, codes, ordinances, and laws of local, state, and Federal governments, and other authorities having lawful jurisdiction, and be responsible for compliance therewith. Such authorities include but are not limited to the following:
   1. Local and state building, plumbing, mechanical, electrical, fire and health department codes.

2. National Fire Protection Association (NFPA)
3. National Board of Fire Underwriters (NBFU)
4. Occupational Safety and Health Act (OSHA)
5. Factory Mutual Association (FM)
6. Material and equipment shall be Underwriter's Laboratory (UL), ASME and AGA approved, as applicable, for intended service.

B. When two or more codes, regulations, etc. conflict with each other or with Contract Documents, the more severe requirement shall govern conduct of work. The Engineer may relax this requirement at his sole discretion when such relaxation does not violate ruling of any authority having jurisdiction. Approval for such relaxation must be obtained in writing.

C. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents.
1. American National Standards Institute (ANSI)
2. American Society of Mechanical Engineers (ASME)
3. National Electric Manufacturers Association (NEMA)
4. American Society for Testing and Materials (ASTM).
5. National Fire Protection Agency (NFPA)

1.10 SUBMITTALS

A. Submit the following in accordance with Conditions of the Contract and Division-1 Specification Sections.

B. Material and equipment requiring Shop Drawings or Product Data submittal shall include but shall not be limited to:
1. Piping, hangers, fittings, unions, flanges, and couplings.
2. Valves
3. Sprinkler heads
4. Escutcheons.
5. Link-seal pipe sealing
6. Supply access panels for installation by GC

C. Seismic Restraints: Submit shop drawings and calculations detailing seismic hanger restraint requirements to meet state and local codes along with a letter of compliance signed by a registered structural engineer confirming that the piping hangers meet State Seismic Code Requirements.
1. Provide Manufacturer's installation details.
2. Product Manufacturer's product data on strut channels including but not limited to types, finishes, gauge thickness and hole patterns. For each different cross-section submit cross sectional properties including section modulus and moment of inertia.

D. Submit working plans as defined by NFPA 13 for all floors. Plans shall be submitted for review by project team prior to submission to fire department.

E. Submit a line item schedule of values for review prior to equipment submittals for use in the requisition process.

F. Submit a schedule for the work in coordination with the G.C.'s schedule.

G. Submit lead-time requirements for any equipment with more than a three-week lead-time.

H. At substantial completion, prepare a set of as-built drawings per Division 1.

1.11 PERMITS, FEES AND INSPECTIONS

A. The Contractor shall give all necessary notices, obtain all permits and pay all government fees, sales taxes and other costs, including utility connections or extensions, in connection with this work; file all permit applications required by all government departments having jurisdiction.
B. Obtain all required certificates of inspection for work and deliver them to the Engineer before requesting acceptance and final payment for the work.
C. The Installer shall inform the Engineer of any work or materials which conflict with any of the applicable codes, standards, laws and regulations for his trade before submitting his bids. No claims for corrections required for code compliance will be considered after bidding

1.12 INSTALLER QUALIFICATIONS

A. Each Installer performing work under any section of this division shall be a licensed firm regularly engaged in the type of work to be provided under these sections.
B. Each Installer shall be able to provide, upon request, a list of at least five (5) similar jobs he has completed in the last two (2) years.

1.13 GUARANTEES AND WARRANTIES

A. The provisions under Conditions of the Contract and Division 1 are included.
B. Guarantee work of this Section in writing for one year from date of Substantial Completion of the project. (Not just the sprinkler system)
   1. Defects in materials, equipment, workmanship or installation that develop within this period shall be repaired and replaced promptly to Engineer's satisfaction at no cost to Owner.
   2. Written guarantee shall stipulate that damage caused in making necessary repairs and replacements shall be corrected at no cost to Owner.
   3. The sprinkler system shall be considered substantially complete only after all piping and heads have been installed, system is fully operational and the local AHJ has signed off on all components of the system.
C. Guarantee shall include provision of 24-hour service for complete system during guarantee period at no cost to Owner.
   1. Choice of service organization shall be subject to Owner's approval.
D. Submit guarantee to Engineer through Contractor before final payment.
E. Transfer individual equipment and material guarantees, which are still in force to Owner at end of guarantee period.
F. Guarantee the system to be free from defective materials and workmanship for a period of one (1) year from date of Owner's acceptance. Guarantees and warranties for work under this contract to be delivered to the owner upon completion of his work.
G. Regulatory Requirements: Comply with the requirements of the following codes:
   1. 780 CMR Massachusetts State Building Code, 8th Edition
   2. NFPA 13 "Standard for the Installation of Sprinkler Systems" 2007 Edition
   3. UL and FM Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled, and Factory Mutual approved for the application anticipated.

1.14 CONTRACT DOCUMENTS

A. Work to be performed under this Section is shown on the accompanying drawings.

B. Listing of drawings does not limit responsibility of determining full extent of work required by Contract Documents.
   1. Refer to Architectural, Mechanical, Plumbing, Electrical, Structural and other drawings on file, as well as other specification sections, which indicate type of construction in which the work must be installed.
   2. Locations shown on Drawings shall be checked against general and detailed drawings of the construction proper.

C. Drawings are diagrammatic and indicate general arrangements of systems and work included in Contract.
   1. Drawings are not intended to specify or to show every offset, fitting, or component; however, Contract Documents require components and materials, whether or not indicated or specified, as necessary to make installations fully complete and operational.
   2. Drawings are intended to show the general arrangement of the systems and not every sprinkler head, pipe, fitting and elbow required to make a functional system. FPC is responsible for providing additional sprinkler heads and piping as required to make a fully functional code compliant system.

D. Questions regarding drawings or specifications shall be addressed to the Engineer in writing prior to Award of Contract.
   1. Otherwise, the Engineer's interpretation of meaning and intent of drawings and specifications shall be final.

1.15 DISCREPANCIES IN DOCUMENTS

A. Where Drawings or Specifications indicate discrepancies or unclarities, advise the Engineer in writing before Award of Contract.
   1. Otherwise, the Engineer's interpretation of documents shall be final; no additional compensation shall be permitted due to discrepancies or unclarities thus resolved.

B. Where drawings or specifications do not coincide with recommendations of manufacturer of material or piece of equipment, alert the Engineer in writing before installation of item in question.
   1. Otherwise, make changes in installation, as the Engineer requires without additional cost to owner.

C. When specifications and drawings are in conflict with each other, or with Contract Documents, the more severe (costly) requirement shall be provided as part of the base bid work.
   1. The Engineer may relax this requirement at his sole discretion when such relaxation does not violate ruling of any authority having jurisdiction.
   2. Approval for such relaxation must be obtained in writing.

1.16 DRAWINGS AND SPECIFICATIONS

A. It is the intent of Drawings and Specifications to obtain a complete and satisfactory installation. An attempt has been made to define the work of the Installer. Drawings are diagrammatic and should be followed as closely as actual construction of the building and the work of other trades may permit.

B. The Contractor shall accept full responsibility to complete all work which may be indicated on any of the Drawings or in any division of the Specification.

C. The Specifications and Drawings are complementary and are to be taken together for a complete interpretation of the work. Exceptions are those notes on the Drawings, that refer to an individual element or work, and take precedence over the Specifications where they conflict with same.

D. The Drawings utilize symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of symbols and diagrams so that any elements necessary for a complete installation are excluded.

E. Certain details appear on the Drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility.

F. Examine the mechanical and electrical Drawings and Specifications and visit the job site prior to submitting bid. Some mechanical and electrical equipment may constitute obstructions and require additional heads to provide full coverage from what is shown on the plans. FPC is responsible for identifying these conditions during bidding and including any additional heads which are required in their bid. No additional compensation will be approved.

G. Complete Coverage: The intent of the drawings is to provide complete coverage of all areas as required by code. FPC is responsible for identifying any missing heads which are required during bidding and including any additional heads and piping in their bid. No additional compensation will be approved.

H. The Engineer/Owner shall be notified of any discrepancies, omissions, conflicts or interferences which occur between Drawings and Specifications. If such notification is received in adequate time additional data or changes will be issued by addendum to all bidders.

I. In the event that extra work is authorized, and performed by this trade, work shown on drawings depicting such work, and/or described by addendum is subject to the base building specifications in all respects.

1.17 WORKING DRAWINGS

A. Submit working drawings as defined by NFPA 13, for review by Owner/Engineer before submitting plans to AHJ. Owner/Engineer shall review and comment and contractor shall modify plan accordingly. Then plans shall be submitted to AHJ for review. No equipment or material shall be ordered or installed prior to AHJ approval. Equipment or materials ordered or installed before review may not be accepted and will have to be removed from the project.

B. Working plans shall be drawn to an indicated scale, on sheets of uniform size, with a plan of each floor, and shall show those items from the following list that pertain to the design of the system:

1. Name of owner and occupant
2. Location, including street address
3. Point of Compass
4. Full height cross section, or schematic diagram, including structural member information if required for clarity and including ceiling construction and method of protection for nonmetallic piping
5. Location of partitions
6. Location of fire walls
7. Occupancy class of each area or room
8. Location and size of concealed spaces, closets, attics, and bathrooms
9. Any small enclosures in which no sprinklers are to be installed
10. Size of city main in street and whether dead end or circulating; if dead end, direction and distance to nearest circulating main; and city main test results and system elevation relative to test hydrant
11. Other sources of water supply, with pressure or elevation

12. Make, type, model, and nominal K-factor of sprinklers including sprinkler identification number
13. Temperature rating and location of high-temperature sprinklers
14. Total area protected by each system on each floor
15. Number of sprinklers on each riser per floor
16. Total number of sprinklers on each dry pipe system, preaction system, combined dry pipe-preaction system, or
17. deluge system
18. Approximate capacity in gallons of each dry pipe system
19. Pipe type and schedule of wall thickness
20. Nominal pipe size and cutting lengths of pipe (or center to center dimensions), Where typical branch lines prevail, it shall be necessary to size only one typical line
21. Location and size of riser nipples
22. Type of fittings and joints and location of all welds and bends, The contractor shall specify on drawing any sections to be shop welded and the type of fittings or formations to be used
23. Type and locations of hangers, sleeves, braces, and methods of securing sprinklers when applicable
24. All control valves, check valves, drain pipes, and test connections
25. Make, type, model, and size of alarm or dry pipe valve
26. Make, type, model, and size of pre action or deluge valve (26) Kind and location of alarm bells
27. Size and location of standpipe risers, hose outlets, hand hose, monitor nozzles, and related equipment
28. Private fire service main sizes, lengths, locations, weights, materials, point of connection to city main; the sizes, types and locations of valves, valve indicators, regulators, meters, and "al\'e pits; and the depth that the top of the pipe is laid below grade
29. Piping provisions for flushing
30. Where the equipment is to be installed as an addition to an existing system, enough of the existing system indicated on the plans to make all conditions clear
31. For hydraulically designed systems, the information on the hydraulic data nameplate
32. A graphic representation of the scale used on all plans
33. Name and address of contractor
34. Hydraulic reference points shown on the plan that correspond with comparable reference points on the hydraulic calculation sheets
35. The minimum rate of water application (density), the design area of water application, in-rack sprinkler demand, and the water required for hose streams both inside and outside
36. The total quantity of water and the pressure required noted at a common reference point for each system
37. Relative elevations of sprinklers, junction points, and supply or reference points
38. If room design method is used, all unprotected wall openings throughout the floor protected
39. Calculation of loads for sizing and details of sway bracing
40. The setting for pressure-reducing valves
41. Information about backflow pre\'enters (manufacturer, size, type)
42. Information about antifreeze solution used (type and amount)

43. Size and location of hydrants, showing size and number of outlets and if outlets are to be equipped with independent gate valves. Whether hose houses and equipment are to be provided, and by whom, shall be indicated. Static and residual hydrants that were used in flow tests shall be shown
44. Size, location, and piping arrangement of fire department connections

C. The drawings shall show all apparatus such as valves, supports, access panels, pipe size, equipment, piping specialists and bottom elevations of each pipe.
D. Drawings shall become part of the final as-built records. Coordinate with mechanical, plumbing and electrical, drawings for available ceiling clearances. If a discrepancy is found, contact the Engineer for clarification before submitting drawings.
E. The Engineer's review does not relieve the Contractor of the responsibility to comply with all requirements of this Specification, codes and authorities having jurisdiction.

1.18 RECORD DRAWINGS

A. Provide Record Drawings per Division 1 and requirements below.
B. As work progresses and for duration of Contract, maintain complete and separate sets of prints of Contract Drawings at job site at all times.
1. Record work completed and all changes from original Contract Drawings clearly and accurately. Record valve tags as they are installed.
C. At completion of work, Owner shall furnish set of CAD, AutoCAD Vrs:2006 originals to Contractor.
1. Contractor's professional draftsman shall transfer changes to CAD, AutoCAD Vrs:2006; submit hard copy drawings and zip files to the Engineer for review and approval.
D. Upon approval of Record Drawings, print 3 full size sets and 2 half size sets; submit to Engineer.
E. "As-built" hydraulic calculations shall include all deviations from design drawings.

1.19 CUTTING AND PATCHING

A. Provide required sleeves, forms and inserts through existing walls, partitions, floors or roofs as required.
B. The cost of cutting and patching of walls, partitions, ceilings and floors and concrete inserts necessary for reception of this trade's work shall be the Contractor's responsibility.
C. When it becomes necessary to cut finished materials, submit to the Engineer for approval, drawings showing the work required and obtain approval before doing such cutting.
D. No structural members shall be cut without the previous written approval of the Engineer and the Owner

1.20 DEFINITIONS

E. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).
F. Other definitions for fire protection systems are listed in NFPA Standards.
G. Working Plans as used in this Section means those documents (including drawings prepared pursuant to the requirements contained in NFPA 13 for obtaining approval of the authority having jurisdiction.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. Materials and equipment provided under this Section to make for a complete installation shall be U.L. listed and/or FM-approved and in compliance with NFPA Standards.

2.2 PIPING AND FITTINGS

A. All piping and fittings shall comply with the most recent applicable ASTM Standards.
B. All the hose threads shall be National Standard.
C. Service: Exterior underground piping:
   1. Exterior underground pipe shall be Class 150 cement lined cast-iron pipe per ANSI A21.6-1062, UL approved. If allowed or required by local codes and authorities and the Owner's insuring agent, cement asbestos or plastic pipe and fittings may be used, provided that material, construction, and installation are in conformance with NFPA fire codes.
D. Service: Risers and distribution piping.
   1. Steel Pipe: ASTM A53, ASTM A135, or ASME B36.10, Schedule 10 or 40 black.
   2. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
   3. Cast Iron Fittings: ASME B16.1, flanges and fittings; ASME B16.4, threaded fittings.
   4. Malleable Iron Fittings: ASME B16.3, threaded type; ASTM A47.
   5. Mechanical Grooved Couplings: Malleable iron housing, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
   6. Steel Pipe: ASTM A53, ASTM A135, or ASTM A795, Schedule 5 black.
   7. Steel Fittings: Cold drawn steel, mechanically attached, with butylene or EPDM O-ring.
E. Service: Risers and distribution piping. (Alternative material. CPVC pipe and fittings may be used at the contractors discretion in concealed locations where allowed by code. All exposed piping must be steel. FPC is responsible for providing any required draft stopping or additional sprinkler heads required to comply with piping manufacturer's installation instructions for use of CPVC piping.)
   1. CPVC: Chlorinated Polyvinyl Chloride (CPVC) Pipe shall meet or exceed the requirements of ASTM F442 in standard dimension ratio (SDR) 13.5.
   2. Fittings shall meet or exceed the requirements of ASTM F437 (schedule 80 threaded), ASTM F438 (schedule 40 socket) and ASTM F439 (schedule 80 socket).
   3. Both pipe and fittings shall be Listed by Underwriters Laboratories for use in wet automatic fire sprinkler systems and shall bear the logo of the Listing Agency. See UL Fire Protection Equipment Directory, categories VIWT and HFYH.
   4. Solvent Cement
      a. All socket type joints shall be made up employing solvent cements that meet or exceed the requirements of ASTM F493. The standard practice for safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement shall be listed by NSF International for use with potable water, and approved by the CPVC manufacturers. The solvent cements shall be compatible with their CPVC pipe and fittings.
      b. Follow CPVC manufacturer's instructions for set and cure times for solvent cement joints. Avoid significant stresses during set and cure times. Do not apply any stress that will disturb an undried joint. Sprinkler fittings shall be allowed to cure in accordance with the manufacturer's guidelines and the contractor shall assure the outlets are clear of any excess cement prior to installing sprinklers.

F. Steel pipe, installed for the water motor alarm line, piping from drain line valves and inspector's test valves, dry pipe and preaction sprinkler system piping, and where pipe is exposed to outdoor weather, etc., shall be internally and externally galvanized. Galvanized fittings are required where galvanized piping is used. Any piping leading to a pressure-operated waterflow indication device shall also be galvanized. The starting point is on the alarm connection to the alarm check valve.

2.3 BASIC VALVES

A. Gate Valves - Two Inch (2") (50mm) and Smaller: Body and bonnet of cast bronze, 175 pound cold water working pressure - nonshock, threaded ends, solid wedge, outside screw and yoke, rising stem, screw-in bonnet, and malleable iron handwheel. Valves shall be capable of being repacked under pressure, with valve wide open.

B. Gate Valves - Two and One-half Inch (2-1/2") (65mm) and Larger: Iron body; bronze mounted, 175 pound cold water working pressure nonshock. Valves shall have solid taper wedge; outside screw and yoke, rising stem; flanged bonnet, with body and bonnet conforming to ASTM A126, Class B; replaceable bronze wedge facing rings; flanged ends; and a packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet, and bronze bonnet bushing. Valves shall be capable of being repacked under pressure, with valve wide open.

C. Swing Check Valves: MSS SP-71; Class 175, cast iron body and bolted cap conforming to ASTM A126, 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.

2.4 SPECIALTY VALVES AND MANIFOLDS

A. Alarm Check Valve: 175 psig working pressure, designed for horizontal or vertical installations, and have cast iron, flanged inlet and outlet, bronze grooved seat with "O" ring seals, single hinge pin and latch design. Provide trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, precision retarding chamber, drip cup assembly piped with check valve to main drain line, and fill line attachment with strainer.

B. Flow Switch Riser Manifold: Factory assembled unit consisting of flow switch, pressure gauge, sight glass on test & drain connection, and relief valve where required for grid systems. Assembly shall be U. L. tested and listed, and painted red with white identification markings indicating flow direction and tapping uses.

2.5 BACK FLOW PREVENTER ASSEMBLY

A. Provide double check valve backflow preventer assembly on water service entry where indicated on drawings.

B. The main valve body shall be manufactured from 300 series stainless steel, 100% lead free through the waterway.

C. The double check shall consist of two independently operated spring loaded cam-check valves, required test cocks, and optional inlet and outlet resilient seated shutoff valves.

D. The modular cam-check includes a stainless steel spring and cam-arm, rubber faced disc and a replaceable seat. There shall be no brass or bronze parts used within the cam-check valve assembly. The valve cover shall be held in place through the use of a single grooved style two-bolt coupling.

E. The main assembly shall consist of two independently operating torsion spring check assemblies, two resilient seated isolation valves, and four ball valve type test cocks.

F. The assembly shall be an Ames Company Series 2000SS.

2.6 LINK SEALS

A. Provide modular, mechanical seal for all pipe penetrations that run through the foundation, consisting of rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
B. Link-Seal® pressure plates shall be molded of glass reinforced nylon.
C. Hardware shall be mild steel with a 60,000 psi minimum tensile strength and 2-part Zinc Dichromate coating per ASTM B-633 and Organic Coating, tested in accordance with ASTM B-117 to pass a 1,500-hour salt spray test (or 316 Stainless Steel).
D. Coloration shall be throughout elastomer for positive field inspection.
E. Each link shall have permanent identification of the size and manufacturer's name molded into the pressure plate and sealing element.
F. The Contractor will submit to verify the modular seals are domestically manufactured at a plant with a current ISO-9001:2000 registration.
G. Copy of ISO-9001:2000 registrations shall be a submittal item. PSI-Thunderline/ Link-Seal® Modular Seal as manufactured by Pipeline Seal & Insulator, Inc, Houston, TX, or pre-approved equal.

2.7 AUTOMATIC SPRINKLER HEADS

A. Sprinkler Heads: Fusible link type, and style as indicated or required by the application and the coverage area as noted on the drawings. Unless otherwise indicated, provide heads with nominal one half inch (1/2") (15mm) discharge orifice, for "Ordinary" temperature range.
B. Heads shall be as manufactured by Tyco, Viking or Reliable.

2.8 ALARM DEVICES

A. General: Types and sizes shall mate and match piping and equipment connections.
B. Water Flow Indicators: Vane type waterflow detector, rated to 250 psig; designed for horizontal or vertical installation; have 2-SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere 125 volts AC and 0.25 ampere 24 volts DC; complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover which sends a signal when cover is removed.
C. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full open position.

2.9 FIRE DEPARTMENT VALVES

A. Fire Department Connection (Threaded):
   1. Polished Chrome Plated, flush wall type, with wall escutcheon.
   2. Connections shall be (2) 2-1/2" double clapper inlets. Each connection to have brass plugs with chains.
   3. Unit shall have wall escutcheon with words "STANDPIPE - FIRE DEPT CONNECTION" or "AUTO SPKR - FIRE DEPT CONNECTION," or "AUTO SPKR & STANDPIPE - FIRE DEPT CONNECTION" in raised letters depending on use.
   4. Connection shall be Crocker model 6010 or equivalent by Guardian Equipment, Inc.

2.10 INSPECTOR'S TEST VALVES

A. Inspector's test valves shall be installed and supplied for the highest and most remote part of the system in relation to the riser assembly and shall discharge outside of the building. The test valves shall be conveniently accessible within seven feet (7') of the floor.
B. Provide drain line as required.

2.11 SUPPORTS AND PLATES

A. Metal pipe supports, sway braces, hangers, clamps, and all other accessories shall be of an approved pattern and placed to conform to the requirements of NFPA.
B. Pipe passing through floors, walls and ceilings shall be provided with painted cast iron plates. Piping passing through smoke or fire partitions shall be sleeved and caulked with fire retarding material.

2.12 EXTRA MATERIALS

A. Valve Wrenches: Furnish to Owner, two (2) valve wrenches for each type of sprinkler head installed.
B. Sprinkler Heads and Cabinets: Furnish six (6) extra sprinkler heads of each style included in the project. Furnish each style with its own sprinkler head cabinet and special wrenches as specified in this Section

2.13 SEISMIC RESTRAINT

A. All Pipe hangers and equipment supports shall be constructed in accordance with Seismic Zone requirements as outlined in the Massachusetts State Building Code.
B. The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of piping systems where required. This contractor shall submit shop drawings and calculations detailing the requirements to meet state and local codes along with a letter of compliance signed by a registered structural engineer confirming that the piping hangers meet State Seismic Code Requirements.
C. Seismic Bracing and Support Systems:
    1. Design analysis shall include calculated dead loads, static seismic loads and capacity of materials utilized for the connection of the equipment or system to the structure.
    2. Analysis shall detail anchoring methods, bolt diameter and embedment depth.
    3. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
    4. Friction from gravity loads shall not be considered resistance to seismic forces.
D. Cables provided for seismic shall be color coated and prestressed.

2.14 SLEEVES

A. Sleeves Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors:
    1. Pipes: Form with schedule 40 steel pipe
B. Sleeves for Pipe Through Non-fire Rated Floors:
    1. Pipes: Form with schedule 40 steel pipe

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing:
   1. Pipes: Form with schedule 40 steel pipe and seal with and UL listed fire stopping.
D. Piping passing through slab on grade shall not require sleeves.
E. Sleeves through outside walls shall be schedule 40 black steel pipe with 150 pound black steel slip-on welding flanges, welded at center of sleeve, painted with one coat of bitumastic paint inside and outside.
   1. Space between sleeve and pipe shall be packed with oakum to within two inches of each wall face.
   2. Remaining space shall be packed and made watertight with waterproof mastic.
F. Size sleeves two pipe sizes larger than pipe to allow for movement due to expansion and contraction.
G. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation.
H. Inserts shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete

2.15 FIRE STOPPING

A. Pipe penetrations of fire rated walls and/or floors shall be sealed to maintain integrity of construction. All products. materials and methods of installation shall be UL approved and meet NFPA requirements.
B. Fire stopping of piping shall adhere to Section 701.1.5 of the "Standard Building Code"
C. Unless otherwise noted on drawings or modified by Engineer and/or authorities having jurisdiction, the following materials may be used:
   1. Rock Wool: Minimum four (4) pounds per cubic foot density; flame spread fifteen (15), smoke developed zero (0), fuel contribution zero (0) by ASTM E84; minimum melting point 2000 degrees F.
   2. Concrete and masonry are also approved firestop materials by NFPA 90A.
   3. UL approved products such as Dow-Corning RTV Silicone Foam; 3M Fire Barrier.
D. UL, NFPA and manufacturer's recommendations shall be strictly followed.
E. Submit complete data on fire stopping materials and construction methods for review by Engineer before proceeding with work. Submittal shall include penetration detail of each type of penetration and exact UL listed assembly which is being penetrated. (Where this is not available in standard detail selection manufacturer shall provide engineering detail showing this information.)

PART 3: EXECUTION

3.1 PIPING INSTALLATIONS

A. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. Install piping as required.
   1. Deviations from approved "Working Plans" for sprinkler piping, require written approval of the authority having jurisdiction. Written approval shall be on file with the Owner prior to deviating for the approved "Working Plans".
B. All piping shall be concealed unless otherwise noted on the drawings.
C. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.
D. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions in pipes two inches (2") and smaller, adjacent to each valve. Unions are not required on flanged devices or in piping installations using grooved mechanical couplings.

F. Install flanges on valves, apparatus, and equipment having two and one-half inch (2-1/2") and larger connections.

G. Hangers and Supports: In addition to the requirements specified in the Division 15 Section "Supports and Anchors", comply with the requirements of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems.

H. Provide sleeve seal at pipe penetrations in exterior walls.

I. Install test connections sized and located in accordance with NFPA 13 complete with shutoff valve. Test connections may also serve as drain pipes if approved by local authorities having jurisdiction.

J. Install pressure gauge on the riser or feed main at or near each test connection. Provide gauge with a connection not less than one-fourth inch (1/4") and having a soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal.

3.2 PIPE JOINTS

A. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows.
   1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   2. Align threads at point of assembly.
   3. Apply appropriate tape or thread compound to the external pipe threads.
   4. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
   5. Damaged Threads: Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

B. Flanged Joints: Align flanges surfaces parallel. 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 to appropriate torque specified by the bolt manufacturer.

C. Mechanical Grooved Joints: Cut or roll grooves on pipe ends dimensionally compatible with the couplings.

D. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.3 VALVE INSTALLATIONS

A. General: Install fire protection specialty valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 13, and the Authority Having Jurisdiction.

B. Gate Valves: Install supervised-open gate valves so located to control all sources of water supply except fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve. Refer to Division 15 Section "Mechanical Identification" for valve tags and signs.

3.4 SPRINKLER HEAD INSTALLATIONS

A. Use proper tools to prevent damage during installations.
B. Where heads are installed in lay-in tile ceilings, mount heads in the center of tiles.

3.5 FIELD QUALITY CONTROL

A. Flush, test, and inspect sprinkler piping systems in accordance with NFPA 13.
B. Flush, test, and inspect standpipe systems in accordance with NFPA 14.
C. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

3.6 PIPING AND VALVE IDENTIFICATION

A. Piping:
   1. All piping shall, for the purpose of identification, be provided with either painted or taped color coded markers. Identification markers shall include letters designating the pipe service and have arrows indicating direction of flow.
   2. Install markings after painting or insulation or pipe has been completed.
B. Valves:
   1. Attach a two inch (2") (50mm) round brass tag stamped with designating numbers one inch (1") (25mm) high filled in with black enamel to each valve, except those in fixtures.
   2. Securely fasten valve tag to valve spindle or handle with a brass chain.
C. Painting:
   1. Prime and Paint red all piping exposed to view.

3.7 SPECIAL RESPONSIBILITIES

A. Coordination: Cooperate and coordinate with other trades in executing work of this section as described hereunder.
   1. Perform work so that progress of entire project including work of other trades whether involved in work of this or other Sections shall not be interfered with or delayed.
   2. Provide information as requested on items furnished under this Section, which shall be installed under other Sections.
   3. Obtain detailed information from manufacturers of equipment to be provided under this Section as to proper methods of installation.
   4. Obtain final roughing dimensions or other information as needed for complete installation of all items furnished under other Sections or by Owner.
   5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections.
      a. Give full information so that openings required by work of this Section may be coordinated with other work and other openings may be provided for in advance.
      b. In case of failure to provide necessary and sufficient information in proper time, trade involved will be required to do cutting and patching or have same done, at own expense and to full satisfaction of Engineer.
   6. Notify Engineer of location and extent of existing piping and equipment, which interferes with new construction.
      a. In coordination with and with approval of Engineer, relocate such piping and equipment to permit new work to be provided as required by Contract Documents.

b. With approval of Engineer, remove non-functioning or abandoned piping and equipment.
c. If requested by Engineer, remove non-functioning or abandoned piping and equipment, which does not interfere with new work.
d. Dispose of or store items as requested by Engineer.

7. Coordinate with other trades prior to installation of piping. If coordination does not occur then contractor shall be responsible for all costs associated with relocation of piping and equipment to allow for all trades to install equipment.
   a. If additional heads, piping or equipment is required due to lack of coordination than contractor shall provide additional heads, piping or equipment at no cost to the owner.

B. Maintenance of equipment and systems: Provide maintenance for fire protection equipment and systems until final acceptance by the Engineer and the Owner, and take such measures as necessary to ensure adequate protection of equipment and material during delivery, storage, installation and shutdown conditions.
   1. This responsibility shall include provisions required to meet conditions incidental to delays pending final test of systems and equipment under seasonal conditions.
   2. Use of Premises: Use of premises shall be restricted as directed by the Engineer and the Owner and as required below.
   3. As required, during progress of work, remove and properly dispose of resultant dirt and debris, and keep premises reasonably clean.
      a. Upon completion of work, remove equipment and unused material provided for work, and put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Engineer, and as specified in General Conditions.
   4. Conduct work so as not to interfere with functioning of existing sewers and water mains.
      a. Extreme care shall be observed to prevent debris from entering piping. Confer with Engineer as to disruption of water service or other utilities due to testing or connection of new work to existing.

C. Superintendence: Keep superintendent or foreman on site during progress of work. Instructions given to such representative by Engineer shall be binding of Contractor.
   1. Do not change representative without prior notification to Engineer.

D. Inspections by Engineer: Undertaking of periodic inspections by Engineer, Engineer, or designated agent shall not be construed as supervision of actual construction, nor make either responsible for providing safe place for performance of work of various trades or suppliers, or for visitors or occupants, or make either responsible for omission of safety devices called for by codes, ordinances, or specifications of manufacturer of equipment supplied.

E. Surveys and Measurements
   1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.
   2. In event of discrepancy between actual measurements and those indicated, notify Engineer in writing and do not proceed with work until written instructions have been issued by Engineer.

F. Firestopping and proofing:
   1. Contractor shall provide fire stopping of all penetrations through fire rated partitions. Fire stopping shall comply with UL listing requirements.
   2. Patching and repairing of spray fireproofing due to cutting or damaging to fireproofing during course of work specified under this Section shall be performed by installer of

fireproofing and paid for by trade responsible for damage and shall not constitute grounds for an extra to Owner.

3.8 MATERIALS AND WORKMANSHIP

A. Work shall be executed in workmanlike manner and shall present neat and mechanical appearance when completed.
   1. Piping shall run concealed except in unfinished basement, mechanical rooms and areas where no finished ceiling exists.
   2. Material and equipment shall be installed according to manufacturer's recommended best practice such that completed installation shall operate safely and without leakage, undue wear, noise, vibration, corrosion, or water hammer.
   3. Use of dielectric couplings between dissimilar materials is mandatory. Work shall be properly and effectively protected, and pipe openings shall be temporarily closed to prevent obstruction and damage prior to completion.

B. Fully insure workmen and work as required by law and General Conditions.

C. Except as otherwise noted, material or equipment mentioned in these Specifications or on Drawings shall be furnished new.
   1. Provide supplies, appliances and connections necessary for complete and operational installation.
   2. Equipment shall be provided with components required or recommended by OSHA and applicable NFPA documents, and shall be UL approved where applicable.
   3. Protection facilities including expanded metal cloth guards over belt drives and couplings shall be provided in conformance with OSHA standards and all other applicable regulations.

D. Notwithstanding any reference in Specifications or on Drawings to material or piece of equipment by name, make or catalog number, such reference shall be interpreted as establishing type, function, and standard of quality desired and shall not be construed as limiting competition.

E. Finish of materials, components and equipment shall not be less than industry good practice.
   1. When material or equipment is visible or subject to corrosive or atmospheric conditions, finish shall be as approved by Engineer.

F. Owner shall not be responsible for material and equipment prior to testing and acceptance.

3.9 SEISMIC RESTRAINT

A. All seismic restraint systems shall be installed in strict accordance with the manufacturer's guidelines.

B. Transverse piping restraints shall be at 40-foot maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

C. Longitudinal restraints shall be at 80-foot maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

D. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints.

E. Branch lines may not be used to restrain main lines.

F. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors and guides shall be installed as required to provide specified motion capability and limit motion of adjacent piping.

G. Do not brace a system to two independent structures such as ceiling and wall.

H. Provide appropriately sized openings in walls, floors and ceilings for anticipated seismic movement.

3.10 SLEEVES, PLATES, AND INSERTS

A. Lay out chases, openings and partitions before installation to permit coordinated installation. Coordinate with other trades.
   1. Sleeves and inserts shall be set in forms before concrete is poured.
   2. Sleeves set in floors or fire walls but not used in final installation shall be filled with concrete or grout flush with floor or wall to ensure proper fire stop.
   3. Necessary sleeves in floors or fire walls not provided because of omission or change may be core drilled except where watertight sleeves are required.

B. Provide sleeves for piping between floors and through fire walls or smoke partitions. Provide approved packing between sleeves and piping to provide fire stop.
   1. Piping passing through slab on grade shall not require sleeves.
   2. Sleeves shall be 122 gauge or heavier steel, first pipe size or larger than outside diameter of pipe to be sleeved.

C. Sleeves through outside walls shall be schedule 40 black steel pipe with 150 pound black steel slip-on welding flanges, welded at center of sleeve, painted with one coat of bitumastic paint inside and outside.
   1. Space between sleeve and pipe shall be packed with oakum to within two inches of each wall face.
   2. Remaining space shall be packed and made watertight with waterproof mastic.

D. Watertight sleeves through floors shall be schedule 40 black steel pipe, set no less than one inch above finished floor surfaces.

E. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation.
   1. Inserts shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete.

3.11 ESCUTCHEONS

A. Escutcheons shall be installed around exposed pipe passing through finished floor, wall, ceiling, or cabinet.
   1. Escutcheons shall be heavy cast brass, chromium-plated, unless otherwise noted, adjustable, and shall be of sufficient outside diameter to cover sleeve opening and shall fit snugly around pipe.

3.12 JOINTS AND CONNECTIONS

A. Joints and connections shall be permanent and shall be gas- and water-tight. Jointing shall be types specified for service indicated.
   1. Joints and connections shall meet requirements of manufacturers best recommended practice.
   2. All transitions between different piping materials shall be made using approved adapters.
   3. Adapters for transitions between two types of piping materials shall be manufactured for purpose intended.

3.13 TESTING

A. Upon completion of the installation, the system will be hydrostatically tested and flushed as specified in NFPA 13.

B. All inspections and tests required by the authorities and agencies listed under "Design Standards" shall be arranged and paid for by the Installer. He shall deliver certificates of all such inspections to the architect before final payment if made.

END OF SECTION

SECTION 15400

PLUMBING
(Filed Sub Bid)

PART 1: GENERAL

1.1 GENERAL REQUIREMENTS

A. Include the General Conditions of the Contract and Division 1, General Requirements, as part of this Section.

B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work of this Section with that of all other trades affecting, or affected by, this Section. Cooperate with such trades to assure the steady progress of all work under the contract.

1.2 FILED SUB-BID

A. Bidding procedures shall be in accordance with the latest edition of Massachusetts General Laws, Chapter 30; Section 39M, and Chapter 149, Section 4; as modified by Chapter 484 (1984) and Chapter 30B, Uniform Procurement Act (1990). Time and place for submission of sub-bids is given in Advertisement for Bids.

B. Sub-Bids for work under this section shall be for complete work and shall be filed in a sealed envelope with Awarding Authority, at time and place specified in Advertisement for Bids. Following shall appear on face of envelope:

TOWN OF PLYMOUTH
SIMES HOUSE RENOVATIONS
[NAME OF SUB-BIDDER]
SECTION 220001 - PLUMBING

C. Every sub-bid submitted for work under this section shall be on forms furnished by Awarding Authority, as required by Section 44F of Chapter 149 of General Laws, and specified in Advertisement for Bids.

D. Sub-bids filed with Awarding Authority shall be accompanied by bid deposits in the form of a bid bond, cash, certified check, or a treasurer's or cashier's check, issued by a responsible bank or trust company, payable to the Awarding Authority in compliance with Chapter 149, Section 44B. Amount of bid deposit shall be 5 percent of value of bid.

E. Work to be done under this section is shown on the following drawings. : P0.1, P1.1, P1.2, P1.3, P2.1. Remaining contract drawings are included for reference and coordination.

F. Sub-Sub-Bid Requirements:

1. Sub-bidder's attention is directed to Massachusetts GL Chapter 149, Section 44H as amended, which provides in part as follows.

2. Each sub-bidder shall list in Paragraph E of the "Form for Sub-Bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which (the Section of the Specifications for that sub-trade) required such listing; provided that,- in the absence of a contrary provisions in the Specifications, any sub-bidder may, without listing any bid price, list his own name in said Paragraph E for any such class of work or part thereof and perform that work with persons on his own payroll, if such sub- bidder, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work or part thereof

with persons on his own payroll and is qualified so to do. This Section requires that the following class(es) of work shall be listed in Paragraph E under the conditions indicated herein.

Classes of Work	Drawing Reference
Insulation	P0.1, P1.1, P1.2, P1.3, P2.1

1.3 SCOPE OF WORK

A. Included in this Section is the furnishing of all labor, materials, equipment and accessories required to provide a complete installation of the work described herein and on the Drawings. Build the work of other trades into the work of this Section as required.

B. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities having jurisdiction, as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda, all of which are part of Contract Documents.

C. The work under this Section consists of:

1. Pipe Materials
2. Plumbing Fixtures
3. Pipe Protection
4. Expansion Tank
5. Link Seals for piping penetrations at foundations.
6. Thermostatic Tempering Valve
7. Circulator and Controls
8. Hangers, Anchors and Inserts
9. Pipe Hangers and Supports
10. Insulation
11. Valves
12. Water Hammer (Shock) Arresters
13. DHW tank (gas)
14. Combustion venting for DHW tank & furnace
15. Sleeves
16. Jointing Compounds
17. Identification
18. Access panels
19. Sewage Ejector
20. Provide Close-Out procedures per Division 1.

1.4 ALTERNATES

A. Refer to Division 1. - Alternates for work that may affect the work of this Section.

1.5 RELATED WORK IN OTHER SECTIONS

A. The following work is not included in this Section and will be performed under other Sections:

1. Fire Protection, Section 15300
2. Mechanical, Section 15500
3. Electrical, Section 16000

1.6 ITEMS SUPPLIED UNDER OTHER SECTIONS FOR INSTALLATION BY THIS SECTION

A. The equipment demolished and moved into the dumpster by this contractor shall be physically removed from the site and legally disposed of by the G.C.

1.7 ITEMS SUPPLIED UNDER THIS SECTION FOR INSTALLATION BY OTHER SECTIONS

A. High-level alarm enunciator for sump wired by E.C

1.8 QUALITY ASSURANCE

A. Perform work in strict accordance with rules, regulations, standards, codes, ordinances, and laws of local, state, and Federal governments, and other authorities having lawful jurisdiction, and be responsible for compliance therewith. Such authorities include but are not limited to the following:

1. Local and state building, plumbing, Mechanical, electrical, fire and health department codes.
2. 248 CMR Fuel Gas and Plumbing Code
3. International Energy Conservation Code (IECC 2009)
4. National Fire Protection Association (NFPA)
5. Occupational Safety and Health Act (OSHA)
6. Factory Mutual Association (FM)
7. Material and equipment shall be Underwriter's Laboratory (UL), ASME and AGA approved, as applicable, for intended service.

B. When two or more codes, regulations, etc. conflict with each other or with Contract Documents, the more severe requirement shall govern conduct of work. The Engineer may relax this requirement at his sole discretion when such relaxation does not violate ruling of any authority having jurisdiction. Approval for such relaxation must be obtained in writing.

C. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents.

1. American National Standards Institute (ANSI)
2. American Society of Mechanical Engineers (ASME)
3. National Electric Manufacturers Association (NEMA)
4. American Society for Testing and Materials (ASTM).
5. National Fire Protection Agency (NFPA)

1.9 SUBMITTALS

A. Provide submittals in accordance with Conditions of the Contract and Division-1 Specification Sections.

B. Material and equipment requiring Shop Drawings or Product Data submittal shall include but shall not be limited to:

1. Fixtures.

2. Fixture Hangers.
3. Piping, hangers, fittings, unions, flanges, and couplings.
4. Valves.
5. Insulation.
6. DHW tank.
7. Escutcheons.
8. Clean-outs.
9. Modular Pipe Seals
10. Access Panels
11. Sewage Ejector
12. Combustion exhaust and intake venting materials and terminations.

C. Seismic Restraints: Submit shop drawings and calculations detailing seismic hanger restraint requirements to meet state and local codes along with a letter of compliance signed by a registered structural engineer confirming that the piping hangers meet State Seismic Code Requirements.

1. Provide Manufacturer's installation details.
2. Product Manufacturer's product data on strut channels including but not limited to types, finishes, gauge thickness and hole patterns. For each different cross-section submit cross sectional properties including section modulus and moment of inertia.

D. Submit manufacturer's installation instructions, service manuals, and parts lists under applicable provisions.

E. Submit a line item schedule of values for review prior to equipment submittals for use in the requisition process.

F. Submit a schedule for the work in coordination with the G.C.'s schedule.

G. Submit lead-time requirements for any equipment with more than a three-week lead-time.

H. Submit Massachusetts product approval for all plumbing and gas related products.

I. Submit proof of potable water system sterilization.

J. At substantial completion, prepare a set of as-built drawings per Division 1.

1.10 GUARANTEES AND WARRANTIES

A. The provisions under Conditions of the Contract and Division 1 are included.

B. Guarantee work of this Section in writing for one year from date of Substantial Completion.

1. Defects in materials, equipment, workmanship or installation that develop within this period shall be repaired and replaced promptly to Engineer's satisfaction at no cost to Owner.
2. Written guarantee shall stipulate that damage caused in making necessary repairs and replacements shall be corrected at no cost to Owner.
3. The plumbing system shall be considered substantially complete only after all fixtures are installed, functional and cleaned, and all potable piping has been sanitized.

C. Guarantee shall include provision of 24-hour service for complete system during guarantee period at no cost to Owner.

1. Choice of service organization shall be subject to Owner's approval.

D. Submit guarantee to Engineer through Contractor before final payment.

E. Transfer individual equipment and material guarantees, which are still in force to Owner at end of guarantee period.

1.11 CONTRACT DOCUMENTS

A. Work to be performed under this Section is shown on the accompanying drawings.

B. Listing of drawings does not limit responsibility of determining full extent of work required by Contract Documents.

1. Refer to Architectural, Plumbing, Electrical, Structural and other drawings on file, as well as other specification sections, which indicate type of construction in which the work must be installed.

2. Locations shown on Drawings shall be checked against general and detailed drawings of the construction proper.

C. Drawings are diagrammatic and indicate general arrangements of systems and work included in Contract.

1. Drawings are not intended to specify or to show every offset, fitting, or component; however, Contract Documents require components and materials, whether or not indicated or specified, as necessary to make installations fully complete and operational.

D. Questions regarding drawings or specifications shall be addressed to the Engineer in writing prior to Award of Contract.

1. Otherwise, the Engineer's interpretation of meaning and intent of drawings and specifications shall be final.

1.12 DISCREPANCIES IN DOCUMENTS

A. Where Drawings or Specifications indicate discrepancies or ambiguities, advise the Engineer in writing before Award of Contract.

1. Otherwise, the Engineer's interpretation of documents shall be final; no additional compensation shall be permitted due to discrepancies or ambiguities thus resolved.

B. Where drawings or specifications do not coincide with recommendations of manufacturer of material or piece of equipment, alert the Engineer in writing before installation of item in question.

1. Otherwise, make changes in installation, as the Engineer requires without additional cost to owner.

C. When specifications and drawings are in conflict with each other, or with Contract Documents, the more severe (costly) requirement shall be provided as part of the base bid work.

1. The Engineer may relax this requirement at his sole discretion when such relaxation does not violate ruling of any authority having jurisdiction.

2. Approval for such relaxation must be obtained in writing.

1.13 RECORD DRAWINGS

A. Provide Record Drawings per Division 1 and requirements below.

B. As work progresses and for duration of Contract, maintain complete and separate sets of prints of Contract Drawings at job site at all times.

1. Record work completed and all changes from original Contract Drawings clearly and accurately. Record valve tags as they are installed.

C. At completion of work, Owner shall furnish set of CAD, AutoCAD Vrs:2011 originals to Contractor.

1. Contractor's professional draftsman shall transfer changes to CAD, AutoCAD Vrs:2011; submit hard copy drawings and zip files to the Engineer for review and approval.

D. Upon approval of Record Drawings, print 3 full size sets and 2 half size sets; submit to Engineer.

PART 2: PRODUCTS

2.1 PIPE MATERIALS

A. Service: Above-ground hot and cold water.

1. Pipe Material: Type L copper tubing, hard temper.
   a. Pipe shall comply with ASTM B-88
2. Fitting Material: Wrought copper conforming to ANSI-ASME B16-22.
3. Joints: Solder, "lead free" (less than 0.2% lead). NSF cert. ASTM B-32

B. Service: Above-ground hot and cold water within residential spaces only.

1. Tubing Material: Cross-linked Polyethylene (PEX) tubing conforming to ASTM-F876 and NSF 14/61.
2. Fitting Material: Conforming to ASTM F877-99.
3. Joints: Conforming to ASTM F877-99. (cold expansion fittings with PEX reinforcing ring shall not be permitted)

C. Service: Belowground hot and cold water

1. Pipe Material: Type K copper tubing, hard temper.
   a. Pipe shall comply with ASTM B-88
2. Fitting Material: Wrought copper.
3. Joints: Solder, "lead free" (less than 0.2% lead). NSF cert. ASTM B-32

D. Service: Above-ground Sanitary and Vent.

1. 2" and larger
   a. Pipe Material: Service weight cast iron no-hub soil pipe conforming to CISPI 301 and ASTM A-888.
   b. Fitting Material: Cast iron drainage fittings conforming to CISPI 301 and ASTM A-888.
   c. Joints:
      1) Heavy-duty shielded coupling with gasket conforming to ASTM C-1540.
      2) Standard shielded coupling with gasket conforming to CISPI 310 and ASTM C1277.
2. Smaller than 2"
   a. Pipe Material: Type DWV copper conforming to ASTM B306-99.

b. Fitting Material: wrought copper drainage fittings conforming to ANSI B16-29.

c. Joints: threaded or soldered.

E. Service: Below-ground Sanitary, Storm and Vent.

1. Pipe Material: Service weight cast iron no-hub soil pipe, asphalt or coal tar pitch coated. ASTM A-74

2. Fitting Material: Cast iron drainage fittings conforming to CISPI 301 and ASTM A-888.

3. Joints: Heavy-duty gasket conforming to CISPI 310 and ASTM C1277.

F. Service: Aboveground Sanitary, Storm and Vent within residential spaces only.

1. Pipe Material: Poly Vinyl Chloride (PVC) Schedule 40 ASTM D 1784, Cell class 12454. (Solid Core piping, Foam Core piping is not acceptable.)

2. Fitting Material: Poly Vinyl Chloride (PVC) Schedule 40, ASTM D2665

3. Joints: Socket type, solvent cemented. All joints shall be cleaned with cleaner designed for cleaning PVC. ASTM D2564. Cleaner shall be purple in color.

G. Service: Natural Gas.

1. Pipe Material: Steel pipe conforming to ASTM A53, Schedule 40 steel.

2. Fitting Material: malleable iron.

3. Joints: Tapered pipe thread with thread compound Pipe dope (Teflon tape not acceptable).

2.2 PLUMBING FIXTURES

A. Work includes, but is not limited to the following fixtures, See schedule on associated drawings.

1. Water Closets.

2. Lavatories, faucets, and drains.

3. Shower/Tub valve and drain.

4. Kitchen sinks, faucets, and drain/strainer.

5. Laundry connection fixture.

6. Hose Bibs

7. Floor drains

8. Utility sink

B. REFERENCES

1. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.

C. QUALITY ASSURANCE

1. Fixtures: By the same manufacturer for each product specified throughout.

2. Trim: By the same manufacturer for each product specified throughout.

D. ACCEPTABLE MANUFACTURERS

1. American Standard;

2. Eljer;

3. Kohler;

4. Manufacturers as listed in the plumbing fixture schedule or approved equal.

E. INSPECTION

1. Confirm location and size of fixtures and openings before rough-in and installation.
2. Verify that adjacent construction is ready to receive rough-in work of this Section.

F. INSTALLATION

1. Install each fixture with trap, easily removable for servicing and cleaning.
2. Provide chrome plated rigid or stainless steel flexible supplies to lavatories and toilet fixtures with key stops, reducers, and escutcheons.
3. Provide integral stops at shower valves.
4. Provide drain, strainer and lever actuated drain plug at showers and lavatories.
5. Install components level and plumb.
6. Install and secure fixtures in place with wall supports and bolts.
7. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900, color to match fixture.
8. Mount fixtures according to dimensions shown on Architectural drawings

G. ADJUSTING AND CLEANING

1. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
2. At completion, clean plumbing fixtures and equipment.

H. FIXTURE SCHEDULE

1. See schedule printed on drawings.
2. The products listed in the schedule establish the minimum quality and performance standard for each fixture, and the materials used in their manufacture.

I. FIXTURE HANGERS AND SUPPORTS

1. Certain fixtures require the use of a concealed, matching fixture hanger.
   a. Provide hangers as manufactured by Zurn, Smith, Watts, or approved equivalent for wall mount lavatories.
   b. Provide toilet flanges for securing toilets to the floor.
2. Pay close attention to dimensional requirements with respect to wall thicknesses and to wall construction type. Coordinate with the GC prior to start of wall construction.
   a. Select the proper hanger based on fixture type, installation conditions and requirements.
3. Pay close attention to the requirements shown on Architectural drawings for individual fixture mounting height and location.

2.3 DOMESTIC HOT WATER HEATER (CATEGORY-4)

A. Provide steel tank with ceramic porcelain-like coating.

B. Provide 2" Mon-CFC foam insulation.

C. Venting System-Power Vent Direct Vent closed combustion unit utilizes external air for combustion and exhausts directly to the outside through a separate two-pipe system.

D. Provide hot surface ignition.

E. Provide brass drain valve.

F. Provide T&P relief valve.

G. Provide flue baffle.

H. Provide surface mount thermostat for automatic temperature control. Built in energy cut off switch prevents abnormally high water temperature

2.4 EXPANSION TANK

A. Domestic hot water expansion tank shall be ASME rated with replaceable bladder and suitable for potable water.

B. Tank volume and acceptance volume shall be as specified in the applicable drawing.

C. Tank shall be as manufactured by TACO, Wessels, or Amtrol.

2.5 THERMOSTATIC TEMPERING VALVE- #2 (HONEYWELL AMX)

A. Provide tempering valve meeting the capacity and performance as indicated in the equipment schedule on the drawings to limit the temperature of the domestic hot water that is distributed throughout the building.

B. The valve shall be ASSE 1017 certified.

C. Thermostatic element shall be capable of maintaining mix water temperature of +/- 3°F at 0.5 gpm with a 20°F hot water approach temperature.

D. Valve body shall be of bronze and stainless steel construction with Teflon coated wear surfaces.

E. Valve shall reduce mixed flow rate in seconds in the event of cold supply line failure.

F. Provide piping and accessories per the detail on plumbing drawings and as otherwise recommended by the manufacturer. Valve assembly shall include check valves, thermometers, strainers, and isolation valves.

G. Output mix temperature range shall be 90°F to 130°F. Calibrate valve to deliver 120°F water.

H. Tempering valve shall be AMX series as manufactured by Honeywell or equivalent by Powers or Armstrong.

2.6 CIRCULATOR AND CONTROLS

A. Provide centrifugal in-line circulators as indicated on the equipment schedules and where shown on plans.

B. Circulator shall be of in-line design, and provided with a bronze body suitable for use in domestic water systems.

C. Unit shall feature self-lubricating cartridge assembly.

D. Circulator shall be rated for continuous operation at a pressure not less than 125 psig and a temperature of no less than 220 degrees F.

E. Motor shall be permanent split capacitor type. Voltage shall be selected with highest voltage available at the point of installation and coordinated with electrical contractor or electrician.

F. Provide analog 24 hour time clock and aquastat to control operation.

G. Circulator and control shall be as manufactured by Grundfos, Taco, or Bell & Gossett.

2.7 PIPE PROTECTION

A. ADA-conforming, wheelchair accessible lavatories and sinks shall be provided with under sink protective pipe covers that are intended to minimize risk of scalding from hot surfaces or abrasions from sharp surfaces.

B. All exposed plumbing, including P-trap and angle valve assemblies, shall be fitted with molded vinyl covers. Cover shall be constructed of 1/8" thick, anti-microbial vinyl and include UV resistant coating.

C. Covers shall be secured with non-abrasive, reusable fasteners to allow convenient servicing.

D. Cover to be selected by architect from manufactures standard color chart. Include color selection chart with submittal.

E. Pipe covers shall be Lav-Guard2 as manufactured by Truebro, Inc, or approved equal as manufactured by Plumberex or McGuire.

2.8 HANGERS, ANCHORS, AND INSERTS

A. Provide hangers to support all piping from building structure to maintain required grade and pitch of pipe lines, prevent vibration, secure piping in place, and provide for expansion and contraction. Hangers shall be secured to inserts wherever practical.

B. Hangers shall be adjustable clevis hanger type.

1. Hanger rods shall have machine threads.

C. Vertical brackets shall be used where horizontal piping is racked along walls. Trapeze hangers may be used where conditions permit.

1. Hangers for insulated piping shall be outside insulation with 12 inch long galvanized insulation shields.

D. Hanger rods shall be connected to beam clamp, UL approved concrete inserts, or Phillips or approved equal expansion shields as required to attach to the building construction.

1. No ram-set or shot shields will be allowed.

E. Hanger spacing shall conform to requirements of state and local plumbing codes.

1. In no case shall horizontal piping be supported at intervals greater than 10 ft.- 0 in.

F. Piping below basement or lowest level slab (that is, buried piping) need not be supported from structure if slab is not designed as structural slab.

2.9 PIPE HANGERS AND SUPPORTS

A. Uninsulated pipes 2 inch and smaller:

1. Adjustable steel swivel ring (band type) hanger.
2. Adjustable steel swivel J-hanger.
3. Malleable iron ring hanger or hinged ring hanger.
4. Malleable iron split-ring hanger with eye socket.
5. Adjustable steel clevis hanger. (MSS Type 1)

B. Insulated pipe- Hot water piping:

1. 2 inch and smaller pipes:

a. Adjustable steel clevis with galvanized sheet metal shield.

2. 2-1/2 inch and larger pipes:

a. Adjustable steel yoke pipe roll with pipe covering protection saddle.

b. Pipe roll with sockets with pipe covering protection saddle.

C. Insulated pipe- Cold water piping:

1. 5 inch and smaller pipes:

a. Adjustable steel clevis with galvanized sheet metal shield.

2. 6 inch and larger pipes:

a. Pipe roll with sockets with pipe covering protection saddle.

b. Adjustable steel yoke pipe roll with pipe covering protection saddle.

D. PEX tubing (cross linked Polyethylene)

1. Use only plastic tubing supports.

2. Select supports with respect to service temperature of tubing to ensure maximum continuous working temperature of support is not exceeded.

3. Provide suspension clips or approved plastic insulator at penetrations through studs/joists and where abrasion is a concern. Provide nailing plates to protect tubing concealed within the wall.

4. Support horizontal PEX every 32" with U-clips or suspension clips.

5. Support vertical PEX every 48" and at each floor using J-Clamp or lock clip style fasteners.

6. Provide ear drop bend support where PEX turns sharply to exit a wall (e.g. for connection to a radiator).

7. Supports shall be as manufactured by Viega, Sioux Chief, or Uponor.

E. Pipe Clamps

1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts. For insulated lines use double bolted pipe clamps.

F. Multiple or Trapeze Hanger

1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8 inch minimum or stronger as required.

2. Mount pipes to trapeze with 2 piece pipe straps sized for outside diameter of pipe.

G. For pipes subjected to axial movement:

1. Strut mounted roller support. Use pipe protection shield or saddles on insulated lines.

2. Strut mounted pipe guide.

H. Wall Supports

1. Pipes 4 inch and smaller:

a. Carbon steel hook.

b. Carbon steel J-hanger.

I. Floor Supports

1. Hot piping under 6 inch and all cold piping:

a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. Pipe saddle shall be screwed or welded to appropriate base stand.

J. Vertical Supports

1. Steel riser clamp sized to fit outside diameter of pipe.

K. Copper Tubing Supports

1. Hangers shall be sized to fit copper tubing outside diameters.
2. Adjustable steel swivel ring (band type) hanger.
3. Malleable iron ring hanger or hinged ring hanger.
4. Malleable iron split-ring hanger with eye socket.
5. Adjustable steel clevis hanger.
6. For supporting vertical runs use epoxy painted or plastic coated riser clamps,.
7. For supporting copper tube to strut use epoxy painted pipe straps sized for copper tubing or plastic inserted vibration isolation clamps.

L. Insulation Shields:

1. 18 gage galvanized steel shield over insulation to cover the lower 180 degree of pipe, minimum 12 inches long centered on pipe support.

M. Pipe Protection Saddles

1. Pipe protection saddles shall be formed from carbon steel, 1/8 inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch shall have a center support rib.

N. Hanger Finishes

1. Indoor Finishes

a. Hangers and clamps for support of bare copper piping shall be coated with copper colored epoxy paint. Additional PVC coating of the epoxy painted hanger shall be used where necessary.

b. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633.

c. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 or have an electro-deposited green epoxy finish.

2. Outdoor and Corrosive Area Finishes

a. Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor use.

2.10 INSULATION

A. All pipes shall be insulated as follows.

B. Fiberglass Insulation shall be: Fibrous glass insulation with factory-applied fire retardant vapor barrier jacket with K factor of 0.27 at 75 degrees F mean temperature; by Owens-Corning, Certain-Teed, Manville or approved equal, unless otherwise specified.

C. Insulation, jackets and adhesives shall be flame retardant. Fire and smoke Hazard ratings to be as tested under procedure ASTM E-84, NFPA 255 and UL 723, not exceeding:

Flame Spread	25
Smoke Developed	50

MINIMUM INSULATION THICKNESS SCHEDULE

APPLICATION	NOMINAL PIPE SIZE			
	< 1"	1" to 1-½"	1-½" to <4"	4" to 8"
Domestic Cold Water	½"	½"	½"	½"
Domestic Hot Water Supply	1"	1"	1"	1"
Domestic Hot Water Return	1"			
Roof Drain Conductors	½"			

D. Fittings shall be insulated by using pre-formed insulation fittings.

E. All insulation to include continuous vapor barrier.

F. Insulation and vapor barrier on piping which passes through walls or partitions shall pass continuously through sleeve, except that piping between floors and through fire walls or smoke partitions shall have space allowed for application of approved packing between sleeves and piping, to provide firestop as required by NFPA. Seal ends to provide continuous vapor barrier where insulation is interrupted.

G. Install materials in accordance with manufacturer's instructions.

H. Install materials only after piping has been tested and approved.

I. Use glues and tapes that are from the same manufacturer as the insulation itself. Install per manufacturers recommendations. Provide separate submittal for these products.

J. In exposed piping, locate insulation and cover seams in least visible locations. Seal to be continuous.

K. Insulate all fittings, valves, and unions.

L. Pipe hangers shall be external to all pipe insulation.

M. Insulation by a firm regularly specializing in this work and employing workers particularly skilled therein shall install insulation.

1. No covering applied by plumber's helpers will be acceptable.

2.11 NATURAL GAS VALVES

A. Isolation valves (2" and smaller)

1. Provide bronze two-piece, ¼ turn, full port ball valve with chrome-plated brass ball, blowout proof stem and T-style lever handle.
2. Valve shall have PTFE seats and stem packing seal.
3. Rated for 600 PSIG WOG service.
4. As manufactured by Apollo, Watts, Jenkins

B. Isolation valves (2-1/2" and larger)

1. Provide cast Iron non-lubricated plug valve
2. Rated for 200 psig WOG,

3. Units shall be cast iron body, bronze or nickel plated cast iron plug, thermoplastic coated seat, square head or lug type operator and flanged ends.

C. Line Pressure Regulator

1. Unit shall be as manufactured by Maxitrol, Fisher or Sensus
2. Unit shall have vent limiting device rated for use with regulator and shall not require vent piping.
3. Unit shall comply with ANSI Z21.80 standards and shall be rated for dead end lockup service.
4. Provide minimum of 10 pipe diameters on outlet of valve to minimize turbulence.

2.12 POTABLE WATER VALVES

A. Isolation valves (2" and smaller)

1. Provide bronze two-piece, ¼ turn, full port ball valve with chrome-plated brass ball, blowout proof stem and lever handle.
2. Valve shall have PTFE seats and stem packing seal.
3. Rated for 600 PSIG WOG service.
4. Provide extended valve stems where insulation thickness is greater than 1" or where handle movement is impeded by insulation.
5. As manufactured by Apollo, Watts, Jenkins or approved equal.

B. Check valves (2" and smaller)

1. Provide spring type check valves with bronze body, conical brass disc, and threaded connections. Spring and guide bushing shall be stainless steel.
2. Valve shall have PTFE seat.
3. Rated for 400 PSIG WOG service
4. As manufactured by Watts, or approved equal.

C. Fixture stop valves

1. Provide ¼ turn, chrome plated brass ball valve fixture stop valves.
2. Valve shall have brass ball and PTFE seats.
3. Provide angle or straight pattern to best match rough plumbing
4. Valve shall be as manufactured by Brass Craft, Chicago, McGuire or approved equal.

D. Balancing Valves (DHWR 1/2")

1. Circuit balancing valves to have two ¼" NPT brass metering ports with internal check valves and gasketed caps located on each side of the valve seat.
2. Valves are to be calibrated ball valve type and provide three functions:
   a. Precise flow measurement
   b. Precision flow balancing
   c. Positive drip tight shut-off
3. Valve hand-wheel shall have memory stop feature to provide a means for locking the valve position after the system is balanced.
4. Valve shall have a calibrated nameplate to indicate valve position.

5. Valve body shall be bronze with threaded or soldered pipe connections.
6. Ball shall be brass with reinforced TFE seat rings.
7. Balancing valves to be CB series by Bell & Gossett, or Armstrong, or Taco.

E. Balancing Valves (3/4" and larger)

1. Circuit balancing valves to have two ¼" NPT brass metering ports with Nordel check valves and gasketed caps located on both sides of valve seat.
2. Two additional ¼" NPT connections with brass plugs are to be provided on the opposite side of the metering ports for use as drain connections.
3. Drain connections and metering ports are to be interchangeable to allow for measurement flexibility when the valves are installed in tight locations.
4. Valves are to be "Y" pattern, modified, equal percentage globe style and provide three functions:
   a. precise flow measurement
   b. precision flow balancing
   c. positive drip tight shut-off
5. Valve shall provide multi-turn, 360-degree adjustment with a micrometer type indicator located on the valve hand-wheel.
6. Valve hand-wheel shall have hidden memory feature to provide a means for locking the valve position after the system is balanced.
7. Ninety-degree turn adjustable valves are not acceptable.
8. Valve body shall be bronze (<3% lead)) with ultra high strength engineered resin plug.
9. Plug shall have precision-contoured channels to distribute flow uniformly across valve seat.
10. Valve stem shall be bronze; hand-wheel and sleeve shall be high strength resin.
11. Valves shall have a minimum of four complete 360-degree hand-wheel turns.
12. Balancing valves to be Armstrong, MEPCO, or Tour & Andersen.

F. Pressure Reducing Valve

1. Regulator shall have bronze body construction with stainless steel strainer and seats.
2. Unit shall be factory set at 50 psi.
3. Unit shall be Series U5 as manufactured by Watts Regulator Company or equivalent unit by Cash Acme or Taco

2.13 WATER HAMMER (SHOCK) ARRESTERS

A. Provide water hammer arresters in locations shown on drawings and for all laundry washing machines.

B. Install on both hot and cold water branch lines in an upright position as close as possible to the valve or valves being served.

C. Arrestor shall be Series 5000 "Hydrotrol" by J.R. Smith, Watts, or PPP, Inc.

2.14 SLEEVES

A. Sleeves Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors:

1. Pipes: Form with schedule 40 steel pipe

B. Sleeves for Pipe Through Non-fire Rated Floors:

1. Pipes: Form with schedule 40 steel pipe

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing:

1. Pipes: Form with schedule 40 steel pipe and seal with and UL listed fire stopping.

D. Sleeves for Pipes penetrating slab on grade floors:

1. Pipes: Form with schedule 40 steel pipe
2. Cover piping with 1" foam insulation to avoid direct contact with concrete

E. Sleeves through outside walls shall be schedule 40 black steel pipe with 150 pound black steel slip-on welding flanges, welded at center of sleeve, painted with one coat of bitumastic paint inside and outside.

1. Space between sleeve and pipe shall be packed with oakum to within two inches of each wall face.
2. Remaining space shall be packed and made watertight with waterproof mastic.

F. Size sleeves two pipe sizes larger than pipe to allow for movement due to expansion and contraction.

G. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation.

H. Inserts shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete

2.15 JOINTING COMPOUNDS

A. Provide pipe dope, Teflon tape, wax rings, neoprene gaskets and other jointing compounds as required by best standard practice and only on service as recommended by manufacturer.

B. Work shall conform to manufacturer's recommendations with regard to use of putties, jointing compounds or both in installing plumbing fixtures and trim.

2.16 ACCESS PANELS

A. Supply for Installation by GC access panels for concealed serviceable/replaceable plumbing components.

1. At a minimum provide access panels for shock arrestors, balancing valves and any concealed other valves, trap primers, indirect waste connections, cleanouts and drain plugs.

B. The Contractor shall determine the quantity and size of access panels to provide reasonable access for maintenance. No access panel shall be smaller than 8x8. Access panel size and location shall be subject to engineers review.

C. Access Doors: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following, or equal:

1. Cesco Products, North Brooklyn Park, NY
2. Nystrom Products Company, Minneapolis MN.
3. Milcor, Inc., Lima OH.
4. Larson Manufacturing Co., Brookings SD.

D. Access Panels – For Fire Resistance Rated Construction: For fire-resistance rated wall and ceiling surfaces: Standard flush panel door meeting the following requirements:

1. Panel and frame rating: UL "8" label for 90 minutes.
2. Frame Type:
   a. For gypsum board and veneer plastered walls and ceilings: 16 gauge galvanized bonderized steel frame, with 22 gauge galvanized steel d~911 bead.
      1) Nystrom IP series.
   b. For plastered walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel plaster bead.
      1) Nystrom IP series.
3. Door: Insulated Flush panel door follows:
   a. Typical wall types: Flush door, Sandwich construction with 2 inch thick mineral wool fiber insulation between two layers of 20 gage galvanized bonderized steel.
4. Hinge: Flush continuous piano hinge with stainless steel pin.
5. Closer: Spring closer.
6. Latch/lock:
   a. Flush cam latch, operated by Allen or Torx head screwdriver.
7. Emergency latch release: For ceiling panels and wall panels accessible from the back which are greater than 18 by 18 inches in size, provide an interior latch release mechanism to permit panel to be opened from back (interior side) of panel.

E. Access Panels – For Non-Rated Construction, Non-Public Areas: For non-rated wall and ceiling surfaces (service and non-public areas): Flush panel door type meeting the following requirements:
   1. Frame Type:
      a. For gypsum board and veneer plastered walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
         1) Karp KDW series.
         2) Nystrom NW series.
         3) Williams WB-PL series.
   2. Door: Flush panel door as follows:
      a. Typical all wall types, except tile: 14 gage galvanized bonderized steel.
   3. Hinge:
      a. Typical: Concealed spring hinge enabling door to open 175 degrees and permit removal of door from frame.
      b. Panels greater than 24 by 36 inches: Flush continuous piano hinge with stainless steel pin.
   4. Latch/lock:
      a. Flush cam latch, operated by Allen or Torx head screwdriver.
      b. Emergency latch release: For ceiling panels and wall panels accessible from the back which are greater than 18 by 18 inches in size, provide an interior latch release mechanism to permit panel to be opened from back (interior side) of panel.

F. Access Panels For Non-Rated Construction, Public Areas: For non-rated gypsum board and veneer plastered walls and ceilings (Public areas): Recessed door type meeting the following requirements:

1. Manufacturer's types:
   a. Karp DSC-210PL series.
   b. Nystrom RP series.
   c. Williams WB-ATP series.
2. Frame type: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel plaster bead with expanded lath.
3. Door: Recessed 16 gage galvanized bonderized steel door, with self-furring 3.4 pound galvanized steel lath welded to door.
4. Hinge: Concealed pivot rod hinge.
5. Latch/lock:
   a. Flush cam latch, (operated by screwdriver) with plastic grommet.
6. Emergency latch release: For ceiling panels and wall panels accessible from the back which are greater than 18 by 18 inches in size, provide an interior latch release mechanism to permit panel to be opened from back (interior side) of panel.

G. Panels fabricated from galvanized bonderized steel: Baked on rust inhibitive gray primer finish

2.17 CATEGORY IV COMBUSTION AIR INTAKE AND EXHAUST VENTING SYSTEM

A. As defined by Massachusetts fuel gas code 248 CMR a Category IV appliance is an appliance that operates with a positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

B. Provide direct vent combustion air intake and exhaust venting system in accordance with boiler manufacturer's instructions.

C. Allowable vent pipe material for furnace shall be Polypropylene, conforming to UL-1738 requirements.

1. Venting system shall be InnoFlue SW as manufactured by Centrotherm or approved equal.

D. Allowable Combustion Air Intake Pipe material shall be PVC, Schedule 40, conforming to ASTM Standard D1785. Pipe cement/primer shall conform to ASTM D2564

E. DHW tank shall use the stainless steel concentric piping system recommended by the manufacturer

F. Coordinate final vent termination location and appearance with the GC and the Engineer prior to installation. All combustion air will be provided from outside of the building, no indoor room air shall be used.

G. Venting shall pitch downward toward equipment.

H. Install venting as straight as possible. Strictly observe the manufacturer's requirements regarding maximum equivalent lengths.

I. Where vents terminate less than 7ft above grade provide signage. A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print

size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".

J. Provide submittal of manufacturers venting system design including installation instructions, details, and parts lists

2.18 DUPLEX SEWAGE EJECTOR

A. Provide complete sewage ejector system connected to waste systems intended to lift waste up and to drain into a gravity drain systems.

1. Include all piping connections for waste and vent. Match piping type with the rest of the connecting system piping.
2. Provide approved connections.
3. Provide isolation and check valves for each discharge line.

B. Coordinate requirements with all trades

1. Electrical to provide line voltage power.
2. GC to provide opening in the floor and concrete work to stabilize and secure the basin and provide for finished floor requirements.

C. Provide duplex pump system & control.

1. Provide two sewage ejector pumps per equipment schedule each with its own float switch.
2. Provide float switch for each pump and arrange so that one switch is set to operate the pump at an appropriate water level above the other. Include high level alarm.

D. Provide collection basin.

1. Basin shall be manufactured of fiberglass with cast iron piping connections.
2. Basin cover shall steel, removable and equipped with air tight gasketing and piping connections.

E. Provide high level alarm system.

1. Provide high level alarm with remote audio/visual enunciator. Locate enunciator per Owners direction with maximum wire run length at 100 feet.
2. Plumbing contractor to provide low voltage alarm and transformer if required

PART 3: EXECUTION

3.1 SPECIAL RESPONSIBILITIES

A. Coordination: Cooperate and coordinate with other trades in executing work of this section as described hereunder.

1. Perform work so that progress of entire project including work of other trades whether involved in work of this or other Sections shall not be interfered with or delayed.
2. Provide information as requested on items furnished under this Section, which shall be installed under other Sections.
3. Obtain detailed information from manufacturers of equipment to be provided under this Section as to proper methods of installation.
4. Obtain final roughing dimensions or other information as needed for complete installation of all items furnished under other Sections or by Owner.

5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections.
    a. Give full information so that openings required by work of this Section may be coordinated with other work and other openings may be provided for in advance.
    b. In case of failure to provide necessary and sufficient information in proper time, trade involved will be required to do cutting and patching or have same done, at own expense and to full satisfaction of Engineer.
6. Notify Engineer of location and extent of existing piping and equipment, which interferes with new construction.
    a. In coordination with and with approval of Engineer, relocate such piping and equipment to permit new work to be provided as required by Contract Documents.
    b. With approval of Engineer, remove non-functioning or abandoned piping and equipment.
    c. If requested by Engineer, remove non-functioning or abandoned piping and equipment, which does not interfere with new work.
    d. Dispose of or store items as requested by Engineer.

B. Maintenance of equipment and systems: Provide maintenance for Plumbing equipment and systems until final acceptance by the Engineer and the Owner, and take such measures as necessary to ensure adequate protection of equipment and material during delivery, storage, installation and shutdown conditions.
1. This responsibility shall include provisions required to meet conditions incidental to delays pending final test of systems and equipment under seasonal conditions.
2. Use of Premises: Use of premises shall be restricted as directed by the Engineer and the Owner and as required below.
3. As required, during progress of work, remove and properly dispose of resultant dirt and debris, and keep premises reasonably clean.
    a. Upon completion of work, remove equipment and unused material provided for work, and put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Engineer, and as specified in General Conditions.
4. Conduct work so as not to interfere with functioning of existing sewers and water mains.
    a. Extreme care shall be observed to prevent debris from entering piping. Confer with Engineer as to disruption of water service or other utilities due to testing or connection of new work to existing.

C. Superintendence: Keep superintendent or foreman on site during progress of work. Instructions given to such representative by Engineer shall be binding of Contractor.
1. Do not change representative without prior notification to Engineer.

D. Inspections by Engineer: Undertaking of periodic inspections by Engineer, Engineer, or designated agent shall not be construed as supervision of actual construction, nor make either responsible for providing safe place for performance of work of various trades or suppliers, or for visitors or occupants, or make either responsible for omission of safety devices called for by codes, ordinances, or specifications of manufacturer of equipment supplied.

E. Surveys and Measurements
1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.

2. In event of discrepancy between actual measurements and those indicated, notify Engineer in writing and do not proceed with work until written instructions have been issued by Engineer.

F. Firestopping and proofing:

1. Coordinate the work of this section with fire stopping provided by others for all new penetrations at fire rated partitions.

2. Fire stopping for all new penetrations at fire-rated partitions made by this contractor shall be provided by the GC.

3. Provide a marked plan set for reference by the GC indicating all penetrations that require fire stopping.

4. Patching and repairing of spray fireproofing due to cutting or damaging to fireproofing during course of work specified under this Section shall be performed by installer of fireproofing and paid for by trade responsible for damage and shall not constitute grounds for an extra to Owner.

3.2 MATERIALS AND WORKMANSHIP

A. Work shall be executed in workmanlike manner and shall present neat and mechanical appearance when completed.

1. Piping shall run concealed except in unfinished basement, mechanical rooms and areas where no finished ceiling exists.

2. Material and equipment shall be installed according to manufacturer's recommended best practice such that completed installation shall operate safely and without leakage, undue wear, noise, vibration, corrosion, or water hammer.

3. Use of dielectric couplings between dissimilar materials is mandatory. Work shall be properly and effectively protected, and pipe openings shall be temporarily closed to prevent obstruction and damage prior to completion.

B. Fully insure workmen and work as required by law and General Conditions.

C. Except as otherwise noted, material or equipment mentioned in these Specifications or on Drawings shall be furnished new.

1. Provide supplies, appliances and connections necessary for complete and operational installation.

2. Equipment shall be provided with components required or recommended by OSHA and applicable NFPA documents, and shall be UL approved where applicable.

3. Protection facilities including expanded metal cloth guards over belt drives and couplings shall be provided in conformance with OSHA standards and all other applicable regulations.

D. Notwithstanding any reference in Specifications or on Drawings to material or piece of equipment by name, make or catalog number, such reference shall be interpreted as establishing type, function, and standard of quality desired and shall not be construed as limiting competition.

E. Finish of materials, components and equipment shall not be less than industry good practice.

1. When material or equipment is visible or subject to corrosive or atmospheric conditions, finish shall be as approved by Engineer.

F. Owner shall not be responsible for material and equipment prior to testing and acceptance.

3.3 BULLETINS, MANUALS AND INSTRUCTIONS

A. Obtain at time of purchase of equipment, three copies of operation, replacement and maintenance manuals for all items.

1. Assemble literature in coordinated manuals.
2. In addition to literature listed above manual shall contain the following:
   a. Names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment.
   b. Valve charts
   c. Copies of all extended warranties filled out for the owner.
   d. Testing reports.

B. Furnish three copies of manuals to Engineer for approval and distribution to Owner.

1. Deliver manuals no less than 30 days prior to acceptance of equipment to permit Owner's personnel to become familiar with equipment and operation prior to acceptance.

C. Operating instructions: Upon completion of installation or when Owner accepts portions of building and equipment for operational use, instruct Owner's operating personnel in any or all parts of various systems.

1. Make adjustments under actual operating condition.
2. Provide a minimum of three separate training sessions.

3.4 PIPE HANGERS AND SUPPORTS

A. Hangers shall be arranged to maintain the required grading and pitch of piping, to prevent vibrations, and to provide free, guided, expansion and contraction between anchors.

B. Support riser piping independently of connected horizontal piping.

C. Place a hanger within 12 inches of each horizontal elbow.

D. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Trapeze hangers shall be spaced according to the smallest pipe size, or install intermediate supports according to schedule in this section.

E. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.

F. Piping shall be supported at no greater than the following intervals:

PIPE MATERIAL/SIZE	HORIZONTAL SPACING	VERTICAL SPACING
Copper (1-1/4" or less)	6'-0"	At each story (10'-0" max)
Copper (1-1/2" or greater)	10'-0"	At each story (10'-0" max)
Cast Iron	5'-0"	At base and each floor (15'-0" max)
PVC	4'-0"	At each story (10'-0" max)
PEX	32"	At each story
Steel (gas, 1/2")	6'-0"	At each story (10'-0" max)
Steel (gas, 3/4" and 1")	8'-0"	At each story (10'-0" max)
Steel (gas, 1-1/4" and greater)	10'-0"	At each story (10'-0" max)

G. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non adhesive isolation. Galvanized felt isolators sized for copper tubing may also be used.

H. Do not support piping from other pipes, ductwork or other equipment that is not building structure

3.5 ACCESS AND ACCESS PANELS

A. Perform work required so as to provide proper access to material or equipment, which may need inspection, replacement, repair or service.

1. If proper access cannot be provided, confer with Engineer as to best method of approach to minimize effect of reduced access, which may result.

B. Supply access panels for installation under other Sections where shut-off valves, control valves, check valves, or any items requiring access which are installed under this Section and concealed in floor, wall, furred space or above the ceiling.

1. Access panels shall have same fire rating classification as surface penetrated.

3.6 SLEEVES, PLATES, AND INSERTS

A. Lay out chases, openings and partitions before installation to permit coordinated installation. Coordinate with other trades.

1. Sleeves and inserts shall be set in forms before concrete is poured.
2. Sleeves set in floors or fire walls but not used in final installation shall be filled with concrete or grout flush with floor or wall to ensure proper fire stop.
3. Necessary sleeves in floors or fire walls not provided because of omission or change may be core drilled except where watertight sleeves are required.

B. Provide sleeves for piping between floors and through fire walls or smoke partitions. Provide approved packing between sleeves and piping to provide fire stop.

1. Piping passing through slab on grade shall not require sleeves.
2. Sleeves shall be 12 gauge or heavier steel, first pipe size or larger than outside diameter of pipe to be sleeved.

C. Sleeves through outside walls shall be schedule 40 black steel pipe with 150 pound black steel slip-on welding flanges, welded at center of sleeve, painted with one coat of bitumastic paint inside and outside.

1. Space between sleeve and pipe shall be packed with oakum to within two inches of each wall face.
2. Remaining space shall be packed and made watertight with waterproof mastic.

D. Watertight sleeves through floors shall be schedule 40 black steel pipe, set no less than one inch above finished floor surfaces.

E. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation.

1. Inserts shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete.

F. Sleeves under footings.

1. Sleeves shall be a minimum of 6'-0" long. Sleeves shall extend 2'-0" beyond barring area of footing.

3.7 ESCUTCHEONS

A. Escutcheons shall be installed around exposed pipe passing through finished floor, wall, ceiling, or cabinet.

1. Escutcheons shall be heavy cast brass, chromium-plated, unless otherwise noted, adjustable, and shall be of sufficient outside diameter to cover sleeve opening and shall fit snugly around pipe.

3.8 JOINTS AND CONNECTIONS

A. Joints and connections shall be permanent and shall be gas- and water-tight. Jointing shall be types specified for service indicated.

1. Joints and connections shall meet requirements of manufacturers best recommended practice.
2. Provide isolation valves for all fixtures and appliances whether shown on drawings or not
3. All transitions between different piping materials shall be made using approved adapters.
4. Adapters for transitions between two types of piping materials shall be manufactured for purpose intended.

3.9 INTERIOR WATER SUPPLY SYSTEM

A. Water supply piping shall be run as indicated on Drawings, including mains and supplies to indicated equipment.

1. Piping shall be pitched at least 1 inch in 40 feet so that it can be drained completely at low points with drain valves which shall be provided wherever necessary.

B. Shut-off and control valves on main distribution and branch lines shall be located for easy access and operation.

3.10 INTERIOR SANITARY WASTE, AND VENT PIPING

A. Waste, drainage and vent lines shown in building shall be installed as indicated on Drawings; vents shall extend through roof and be increased to 3 inches minimum size.

1. Piping shall be assembled and installed without undue strains and stresses, and provision shall be made for expansion, contraction, and structural settlement.

B. Interior horizontal sanitary waste and storm drainage piping shall be installed in practical alignment at uniform grade of 1/8 inch per foot minimum but 1/4 inch per foot where possible, and as shown on Drawings.

C. Protect piping against breakage when passing under or through wall by means of pipe sleeves.

3.11 TESTING, BALANCING AND ADJUSTING

A. Scope

1. Provide testing, balancing, and adjusting of plumbing systems as shown on Drawings, as specified herein and as required by authorities having jurisdiction, including Owner and Engineer.
    a. Perform tests recommended by manufacturers of materials and equipment; this requirement may be waived by Engineer.
2. Testing, balancing and adjusting shall in no way relieve guarantee requirements.
3. Test shall be conducted as part of Work of this Section and shall include labor by qualified personnel, equipment, apparatus and services required to perform tests.

4. Provide letter to engineer stating what system has been tested, a brief description of testing procedure and results of tests.

B. Prior to date of acceptance, furnish Engineer with certificates of testing and inspection for Plumbing systems indicating approval of authorities having jurisdiction and conformance with requirements of Contract Documents.

C. General

1. Submit proposed test procedures, recording forms, and test equipment for review prior to testing.
2. Notify Engineer and authorities involved at least 48 hours prior to testing and inspection.
3. Do not paint, cover or conceal work prior to testing, inspecting and obtaining approval; this includes backfilling and application of insulation.
4. Costs of repairs and restoration of work of other trades and existing building surfaces or material damaged during cleaning or testing shall be borne by trade performing such cleaning or testing.

D. No tests shall be started until systems have been cleaned as described under paragraph "CLEANING".

1. Provide temporary piping and connections for testing, flushing, or draining systems to be tested.
2. Leaks, damage or defects discovered or resulting from tests shall be repaired or replaced to like-new condition.
    a. Leaking pipe joints, fittings, fixtures, etc. shall be removed and replaced with acceptable materials.
3. Piping must be absolutely tight before it will be accepted and joints shall be made tight without caulking.
    a. Tests shall be continued until systems operate without adjustments and repair to equipment or piping.
4. Provide testing instruments, force pumps, gauges, equipment and labor necessary to properly conduct tests.
    a. Instruments used for testing and balancing shall have been calibrated within six months prior to balancing.
    b. Instrument calibration shall be certified.

E. Waste & Vent Piping

1. Final test shall be made after vertical and horizontal pipes and roughing-in have been run and before sewer or fixture connection is made.
2. After soils, wastes, and storm lines, etc. have been installed, outlets shall be temporarily plugged.
3. Fill pipes with water to top of vertical lines and allow to remain so filled for twenty-four hours.
4. Retesting after leaks are repaired shall be at no additional cost.

F. Gas Piping

1. Conduct static leak tests of all new piping.

2. Test system to 1.5 times working pressure, but not less than 5 psig. Pipe shall be capable of holding test pressure for a minimum of thirty (30) minutes with no perceivable pressure reduction.
    a. Test shall be conducted using compressed air.
3. Where more than one pipe is being installed and tested, testing shall be performed individually unless otherwise approved by Engineer.
4. Leaks discovered during testing shall be repaired at no cost to Owner; retest system.

G. Potable Water System Test
1. Certification of the potable water system integrity shall be required where separate systems of potable and non-potable water are provided to supply plumbing fixtures.
2. The following method shall be employed: The potable water system shall be filled to its capacity with clean, clear water.
    a. The water shall be introduced at the top of the piping system (hot and cold).
    b. During the filling operation a proportion of green food coloring dye shall be introduced into the piping system.
    c. A floor-by-floor survey shall be conducted.
    d. Each outlet (hot and cold) connected to the potable water system shall be operated until the coloring has been observed.
    e. A method of maintaining the level of water and coloring shall be employed in order to make-up the drawn off amounts.
    f. A survey sheet shall indicate each floor and the room number sequentially.
3. This survey is required to be performed after all pressure testing and flushing of the piping system but before sterilization, further it is required that all fixtures connected to the potable water system be installed prior to the test.

H. DHW recirculation system balancing
1. Each branch of the DHW recirculation system shall be balanced to maintenance a 10 degree temperature drop from DHW tank to recirculation pump. The thermometers provided at each balancing valve shall be used in conjunction with the tank temperature to set the balancing valve.

3.12 CLEANING

A. Upon completion of work but prior to final system testing, all parts of installation shall be thoroughly cleaned.
1. Fixtures, equipment, pipe, valves, and fittings shall be completely cleaned of grease, metal cuttings, dirt, etc.
2. Protective covers shall be removed and fixtures (including lavatories, water closets, etc.) shall be cleaned and ready for use.

B. Stoppage, discoloration or damage to parts of building, finish or furnishings due to failure to properly clean piping system shall be repaired by trade responsible at no cost to Owner.

3.13 PIPE CLEANING AND STERILIZATION

A. Domestic water piping shall be thoroughly flushed and then treated and sterilized with liquid chlorine gas, water solution, or direct chlorine gas placed in upstream side in amounts to give dosage of 50 ppm chlorine calculated on volume of water piping will contain.

1. Minimum residual of 5-ppm chlorine shall remain in entire system for minimum of 24 hours.
2. After sterilizing, flush lines thoroughly. In accordance with EPA, National Primary Drinking Water Regulations, concentration of chlorine shall not exceed 4 mg/L Maximum Residual Disinfectant Level (MRDL).

B. Foregoing shall be considered minimum requirements.
   1. Sterilization shall be in strict accordance with City Water Department requirements.

C. Under no circumstances shall any portion of domestic water system be used until it has been properly sterilized and certified same by City Water Department.

D. Provide temporary piping and connections required for cleaning, testing, flushing, draining of systems.

E. Replace any filters prior to final inspection and testing.

END OF SECTION

SECTION 15500

MECHANICAL
(Filed Sub Bid)

PART 1: GENERAL

1.1 GENERAL REQUIREMENTS

A. Include the General Conditions of the Contract and Division 1, General Requirements, as part of this Section.

B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work of this Section with that of all other trades affecting, or affected by, this Section. Cooperate with such trades to assure the steady progress of all work under the contract.

1.2 FILED SUB-BID (D&S & NSE STANDARD ENGINEER TO DECIDED TO REMOVE OR KEEP)

A. Bidding procedures shall be in accordance with the latest edition of Massachusetts General Laws, Chapter 30; Section 39M, and Chapter 149, Section 4; as modified by Chapter 484 (1984) and Chapter 30B, Uniform Procurement Act (1990). Time and place for submission of sub-bids is given in Advertisement for Bids.

B. Sub-Bids for work under this section shall be for complete work and shall be filed in a sealed envelope with Awarding Authority, at time and place specified in Advertisement for Bids. Following shall appear on face of envelope:

TOWN OF PLYMOUTH
SIMES HOUSE RENOVATIONS
[NAME OF SUB-BIDDER]
SECTION 230001- MECHANICAL

C. Every sub-bid submitted for work under this section shall be on forms furnished by Awarding Authority, as required by Section 44F of Chapter 149 of General Laws, and specified in Advertisement for Bids.

D. Sub-bids filed with Awarding Authority shall be accompanied by bid deposits in the form of a bid bond, cash, certified check, or a treasurer's or cashier's check, issued by a responsible bank or trust company, payable to the awarding authority in compliance with Chapter 149, Section 44B. Amount of bid deposit shall be 5 percent of value of bid.

E. Work to be done under this section is shown on the following drawings. : (*Engineer to insert drawing #'s*).

M0.1, M0.2, M1.1, M1.2, M1.3, M2.1, M2.2

Remaining contract drawings are included for reference and coordination.

F. Sub-Sub-Bid Requirements:

1. Sub-bidder's attention is directed to Massachusetts GL Chapter 149, Section 44H as amended, which provides in part as follows.

2. Each sub-bidder shall list in Paragraph E of the "Form for Sub-Bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which (the Section of the Specifications for that sub-trade) required such listing;

provided that,- in the absence of a contrary provisions in the Specifications, any sub-bidder may, without listing any bid price, list his own name in said Paragraph E for any such class of work or part thereof and perform that work with persons on his own payroll, if such sub- bidder, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work or part thereof with persons on his own payroll and is qualified so to do. This Section requires that the following class(es) of work shall be listed in Paragraph E under the conditions indicated herein.

Classes of Work	Drawing Reference
Sheet Metals	M0.1, M0.2, M1.1, M1.2, M1.3, M2.1, M2.2

1.3 SCOPE OF WORK

A. Included in this Section is the furnishing of all labor, materials, equipment and accessories required to provide a complete installation of the work described herein and on the Drawings. Build the work of other trades into the work of this Section as required.

B. Give notices, file plans, obtain permits and licenses, pay fees and backcharges and obtain necessary approvals from authorities having jurisdiction, as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda, all of which are part of Contract Documents.

C. The work under this Section consists of

1. Mini-split condensing units & fan coils
2. Gas Furnace
3. Evaporator Coils
4. Condensing unit
5. Air Filters
6. Exhaust Fans
7. Ductwork
8. Vibration Isolation
9. Insulation
10. Test and Balance for all Mechanical systems
11. Supply Access Panels
12. Equipment Pads
13. Mechanical Identification
14. Automatic Temperature controls
15. Provide Close-Out procedures per Division 1.

1.4 ALTERNATES

A. Refer to Division 1 Alternates for work that may affect the work of this Section.

B. Alternate 1:

1.5 MECHANICAL SYSTEM NARRATIVE

A. The following narrative describes the Heating Ventilating and Air Conditioning (Mechanical) systems and their function. The intent of this narrative is to comply with the requirements of Section 1301.1.1 of the Massachusetts State Building Code 780 CMR (7th Edition), as amended to adopt the International Energy Conservation Code (IECC 2009), Section 104.2 Information on Construction Documents.

B. Design Intent

1. Heating: Heating for the building will be provided by a gas fired furnace, mini-split heat pumps, and a small number of electric heaters used for minimal heating to prevent freezing in basement, attic and back stair spaces.

2. Ventilating: Bathroom exhausts are provided for all bathrooms both in the commercial spaces and the residential spaces. Residential spaces include continuous low level operation which induce air infiltration to provide ASHRAE 62.2 recommended ventilation rates.

3. Cooling:

a. All spaces but back stair, central stair at top floor and back hallway are cooled with DX cooling and air handling systems.

C. Basis of Design

1. This project involves renovation of multi-family housing located with Climate Zone #5a, (Norkolk County, Massachusetts)

2. The following Thermal Design Criteria were used to calculate the capacities and parameters for the building as required by Section 302 of the IECC.

a. Interior Design Conditions

1) 72 deg. F occupied heating, 60 deg. F unoccupied heating

2) 78 deg. F occupied cooling

b. Outdoor Design Conditions

1) 7 deg. F winter

2) 87 deg. F db, 74 deg. F wb

3. System Intent: The intent of the heating system is to satisfy the minimum indoor temperature requirements as defined by 105 CMR, Section 410.

a. Habitable rooms shall maintain least 68°F between 7:00 A.M. and 11:00 P.M. and at least 64°F between 11:01 P.M. and 6:59 A.M. every day, other than during the period from June15th to September 15th.

b. The indoor temperature shall be met at a height of five feet above floor level on a wall any point more than five feet from the exterior wall

D. Sequence of Operations and Interactions

1. The Mechanical system shall be controlled by discreet temperature controls.

a. 7 day programmable thermostats are used for control of the cooling systems and central heating systems.

b. Thermostats mounted to the small electrical heating units are used for heat only control to protect these spaces from freezing.

E. Testing

1. The contractor shall provide complete testing and balancing for all ducted air systems.

F. Operation Manuals and Maintenance Manuals

1. When the building is completed and ready for occupancy, the contractor shall provide operation manuals and maintenance manuals as required by the contract documents.

G. Record Drawings and Control Documents

1. When the building is completed and ready for occupancy, the contractor shall provide Record Drawings and Test and Balance reports as required by the contract documents.

H. Future Maintenance: Recommended maintenance includes but is not limited to:

1. All maintenance recommended by the various equipment manufacturers.
2. Each fan coil and air handler should be inspected twice per year, filters changed and the condensate drain pan cleaned with a bleach solution at the end of the cooling season (late fall).
3. Condensing units outdoors should be inspected once per year prior and condenser coils should be cleaned.

1.6 RELATED WORK IN OTHER SECTIONS

A. The following work is not included in this Section and will be performed under other Sections:

1. Fire Protection, Section 15300
2. Plumbing, Section 15400
3. Electrical, Section 16000

1.7 ITEMS SUPPLIED UNDER OTHER SECTIONS FOR INSTALLATION BY THIS SECTION

A. Duct smoke detectors.

1.8 ITEMS SUPPLIED UNDER THIS SECTION FOR INSTALLATION BY OTHER SECTIONS

A. Access Panels

B. Motor Starters & Heaters

C. Disconnects

D. Control Transformers for low voltage controls.

1.9 QUALITY ASSURANCE

A. Perform work in strict accordance with rules, regulations, standards, codes, ordinances, and laws of local, state, and Federal governments, and other authorities having lawful jurisdiction, and be responsible for compliance therewith. Such authorities include but are not limited to the following:

1. Local and state building, plumbing, Mechanical, electrical, fire, and health department and public safety codes.
2. International Energy Conservation Code (IECC 2009)
3. The International Mechanical Code (IMC 2009)
4. National Fire Protection Association (NFPA).
5. American Insurance Association (A.I.A.)
6. Occupational Safety and Health Act (OSHA).
7. Factory Mutual Association (FM).

8. Sheet Metal and Air Conditioning National Contractors Association (SMACNA).
9. Material and equipment shall be Underwriter's Laboratory (UL), ASME and AGA approved, as applicable, for intended service.

B. When two or more codes, regulations, etc. conflict with each other or with Contract Documents, the more severe requirement shall govern conduct of work. The Engineer may relax this requirement at his sole discretion when such relaxation does not violate ruling of any authority having jurisdiction. Approval for such relaxation must be obtained in writing.

C. Most recent editions of applicable specifications and publications of the following organizations form part of the Contract Documents.

1. American National Standards Institute (ANSI).
2. American Society of Mechanical Engineers (ASME).
3. National Electric Manufacturers Association (NEMA).
4. American Society for Testing and Materials (ASTM).
5. American Society for Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
6. Sheet Metal and Air Conditioning National Contractors Association (SMACNA).
7. National Insulation Manufacturers Association (NIMA).

1.10 SUBMITTALS

A. Submit the following in accordance with Conditions of the Contract and Division-1 Specification Sections.

B. Material and equipment requiring Shop Drawings or Product Data submittal shall include but shall not be limited to:

1. Mini-split condensing units & fan coils
2. Gas Furnace
3. Evaporator Coils
4. Condensing unit
5. Air Filters
6. Exhaust Fans
7. Ductwork
8. Diffusers & Grilles
9. Vibration Isolation
10. Insulation
11. Access Panels
12. Automatic Temperature controls
13. Test & Balance forms and certificates

C. Submit manufacturer's installation instructions, service manuals, parts lists. under applicable provisions.

D. Submit a line item schedule of values for review prior to equipment submittals and for use in the requisition process.

E. Submit a schedule for the work in coordination with the GC's schedule.

F. Submit lead-time requirements for any equipment with more than a three-week lead-time.

G. Submit blank test and balance report forms.

H. At substantial completion prepare a set of as built drawings.

1.11 OPERATION AND MAINTENANCE MANUALS

A. The following paragraphs supplement Division 1.

B. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data under applicable provisions.

C. Provide O&M Manual, three copies in three ring binders marked on the cover with the name of the project and the date of final completion. Each binder shall be divided with labeled tab dividers for the following:

1. Contact information for the installing contractor and the 24-hour service provider.
2. Equipment Warranties,
3. Approved submittals,
4. Operations and maintenance manuals parts lists.

1.12 GUARANTEES AND WARRANTIES

A. The provisions under Conditions of the Contract and Division 1 are included.

B. Guarantee work of this Section in writing for one year from date of Substantial Completion.

1. Defects in materials, equipment, workmanship or installation that develop within this period shall be repaired and replaced promptly to the Engineer's satisfaction at no cost to owner.
2. Written guarantee shall stipulate that damage caused in making necessary repairs and replacements shall be corrected at no cost to Owner.
3. The Mechanical systems will be considered substantially complete only after the system has been fully tested and balanced and the engineer has signed off on the completed test and balance forms.

C. Guarantee shall include provision of 24-hour service for complete system during guarantee period at no cost to Owner.

1. Choice of service organization shall be subject to Owner's approval.

D. Submit written guarantee to the Engineer through Contractor before final payment.

E. Transfer individual equipment and material guarantees, which are still in force to Owner at end of guarantee period.

1.13 CONTRACT DOCUMENTS

A. Work to be performed under this Section is shown on the accompanying drawings.

B. Listing of drawings does not limit responsibility of determining full extent of work required by Contract Documents.

1. Refer to Architectural, Plumbing, Electrical, Structural and other drawings on file, as well as other specifications sections, which indicate type of construction in which the work must be installed.
2. Locations shown on Drawings shall be checked against general and detailed drawings of the construction proper.

C. Drawings are diagrammatic and indicate general arrangements of systems and work included in Contract.

1. Drawings are not intended to specify or to show every offset, fitting, or component; however, Contract Documents require components and materials, whether or not indicated or specified, as necessary to make installations fully complete and operational.

D. Questions regarding drawings or specifications shall be addressed to the Engineer in writing prior to Award of Contract.

1. Otherwise the Engineer's interpretation of meaning and intent of drawings and specifications shall be final.

1.14 DISCREPANCIES IN DOCUMENTS

A. Where Drawings or Specifications indicate discrepancies or ambiguities, advise the Engineer in writing before Award of Contract.

1. Otherwise, the Engineer's interpretation of documents shall be final; no additional compensation shall be permitted due to discrepancies or ambiguities thus resolved.

B. Where drawings or specifications do not coincide with recommendations of manufacturer of material or piece of equipment, alert the Engineer in writing before installation of item in question.

1. Otherwise, make changes in installation, as the Engineer requires without additional cost to owner.

C. When specifications and drawings are in conflict with each other, or with Contract Documents, the more severe (costly) requirement shall be provided as part of the base bid work.

1. The Engineer may relax this requirement at his sole discretion when such relaxation does not violate ruling of any authority having jurisdiction.

2. Approval for such relaxation must be obtained in writing.

1.15 RECORD DRAWINGS

A. Provide Record and Drawings per Division 1 and requirements below.

B. As work progresses and for duration of Contract, maintain complete and separate sets of prints of Contract Drawings at job site at all times.

1. Record work completed and all changes from original Contract Drawings clearly and accurately. Record valve tags as they are installed.

2. Drawings must be available for review during all engineering site visits.

C. At completion of work, Owner shall furnish set of CAD, AutoCAD Vrs:2011 originals to Contractor.

1. Contractor's professional draftsman shall transfer changes to CAD, AutoCAD Vrs:2011; submit hard copy drawings and zip files to the Engineer for review and approval.

D. Upon approval of Record Drawings, print 3 full size sets and 2 half size sets; submit to Engineer.

PART 2: PRODUCTS

2.1 MINI-SPLIT SYSTEMS

A. The system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller, or low profile ducted fan coil, and a slim silhouette horizontal discharge outdoor unit with constant speed compressor, charged with R410A refrigerant.

B. System efficiency shall meet or exceed 13.0 SEER.

C. Indoor Units

1. Coil: The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing. Tubing shall have inner groves for high efficiency heat exchange. All tube joints shall be brazed with PhosCopper or silver alloy.

2. Fan: The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor unit fan motor shall operate in three (3) selectable speeds, High, Medium and Low.

D. Outdoor Unit

1. The outdoor unit shall have horizontal discharge airflow.

2. The outdoor unit must have the ability to operate with a maximum height difference of 35 feet between indoor and outdoor units.

3. Case: The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.

4. Fan: The unit shall be furnished with a direct drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.

5. Coil: The condenser coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing.

6. Compressor: The compressor shall be high performance, hermetic, rolling piston, rotary type. Compressor shall be mounted using rubber isolating bushings. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

E. Refrigerant Lines

1. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and outdoor units without the need for line size changes, traps or additional oil.

2. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.

F. Controls

1. This system shall have a wireless remote controller to perform input functions necessary to operate the system. The controller shall consist of a Power On/Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector. There shall be a 24 hour On/Off timer. The system shall be capable of automatic restart when power is restored after power interruption.

G. Where required to make a fully functioning system provide the following options: condensing unit mounting pad, condensate pump, precharged refrigerant piping.

H. The units shall have a manufacturer's parts and defects warranty for a period one (1) year from the date of the original installation. The compressor shall have a warranty of 6 years from date of installation.

I. System shall be as manufactured by Mitsubishi Electric or equivalent unit by Fujitsu or Sanyo.

2.2 FURNACES

A. Provide sealed combustion, condensing furnace meeting the capacity and efficiency identified on the equipment schedule. Units shall be certified by CSA International with ratings certified by GAMA.

B. Heat exchanger assembly consists of primary heat exchanger and secondary condenser coil assembly. Main 3-pass clamshell type heat exchanger constructed of heavy-gauge, aluminized steel. Secondary heat exchanger condenser coil constructed of aluminum fins fitted to stainless steel tubes. Coil is factory tested for leaks.

C. Aluminized steel inshot burners provide efficient, trouble-free operation.

D. Hot Surface Mini-Nitride Ignitor constructed with non-porous, high strength ceramic material and low mass element and high temperature Teflon® insulated ignition lead wires.

E. Gas control valve shall be 24 volt redundant combination gas control valve with manual shut off valve (On-Off), automatic electric valve (dual) and gas pressure regulator. (Alternate M2: Gas valve shall provide two stage.).

F. Combustion Air Inducer shall include shaded pole heavy-duty blower. Control functions shall include prepurge of heat exchanger and safety pressure switch to proves blower operation before allowing gas valve to open. Integrated Furnace Control Board Solid-state board contains all necessary controls and relays to operate furnace.

G. Indoor blower shall be a multi-speed, direct drive blower. Statically and dynamically balanced.

H. Plumber to provide direct vent termination kit to facilitate installation of combustion air intake pipe and flue exhaust pipe.

I. Provide accessory Return Air Base to raise unit height and accommodate single side return air duct with high efficiency air filter rack.

J. Furnace shall be as manufactured by Lennox

2.3 CASED DX EVAPORATOR COILS

A. Provide cased Direct Expansion (DX) evaporator coil per equipment schedule.

B. Coil shall be tested with matching condensing unit and furnace and rated in accordance with ARI Standard 210/240-94 conditions and DOE test procedures.

C. Coil shall be A-type configuration and shall include copper tubing and ripple-edged aluminum fins. Sweat connections on both liquid and suction lines.

D. Non-corrosive, UV-resistant polymer drain pan with dual drain connections.

E. Cabinet shall be pre-painted heavy gauge steel with thick fiberglass insulation. Cabinet shall include a flanged outlet to facilitate connection to ductwork and engaging holes for alignment with furnace. Cabinet shall include removable panels provide access to coil.

F. Thermal Expansion Valve (TXV) refrigerant control shall be compatible with condensing unit.

2.4 AIR FILTERS

A. Furnace shall have a separate filter section at the air inlet side.

B. Filter housing shall either be fabricated of 18 gauge-galvanized steel reinforced with corner gussets and supports.

1. Doors shall be fully gasketed and fitted with quick action positive pressure latches.

2. Metal to metal interfaces shall be sealed with silicone compound.

3. Filters shall be sealed by the use of extruded aluminum tracks combined with a woven nylon pile seal.
4. Housing to be constructed such that the filter elements are accessible from the access side of the unit.

C. Provide air filters for air handling equipment according to schedules and drawings.

D. Replacement schedule:

1. Just prior to occupancy, provide a new set of filters for all fan coils.
2. In addition to the original filters and the set installed just prior to occupancy, provide two full sets of disposable panel filters as extra for future maintenance purposes. Store at the direction of the Owner's representative.

2.5 AIR COOLED CONDENSING UNITS

A. Provide new condensing units to serve selected air handling units, see equipment schedule.

B. Refrigerant shall be R-410A.

C. Provide self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use. The unit shall consist of cabinet, compressors, condensing coils and fans, controls, liquid receiver, and screens. The energy efficiency rating shall be not less than that prescribed by ANSI/ASHRAE

D. Without limiting the generality thereof, the work shall include the following:

1. Packaged condensing unit
2. Charge of refrigerant and oil
3. Controls and control connections.
4. Refrigerant piping and connections
5. Control wiring and connections.
6. Line voltage electrical connections and outdoor rated disconnect.

E. Starters and disconnects shall be included and provided with weatherproof enclosures.

F. Compressor construction shall be of the scroll type with heat treated forged steel or cast iron shaft, statically and dynamically balanced rotating parts, and be mounted on vibration isolators. Internally isolate units on springs.

G. Provide refrigerant circuit factory supplied and piped and in addition provide the following for each refrigerant circuit:

1. Filter dryer
2. Liquid line sight glass and moisture indicator.
3. Thermal expansion valve for maximum operating pressure.
4. Insulated suction line. (Insulate both lines for heat pump systems.)
5. Exterior grade insulation with uv barrier.
6. Suction and liquid line service valves, and gauge ports.
7. Charging valve.
8. Compressor discharge service valve.
9. Condensing unit pressure relief valve.

H. For ground mount units, coordinate with GC regarding dimensional requirements for concrete pads.

I. Condensing units shall be as manufactured by Lennox, Mitsubishi, or Fujitsu.

2.6 DUCTWORK

A. General

1. Material, construction and installation shall meet requirements of most recent editions of the following standards and references, except as otherwise specified or shown on Drawings:

Standard	As Applicable To
SMACNA Low Pressure duct Construction Standards (SMACNA-LPDS)	Low Pressure Duct
NFPA 90A	Fire Dampers; Fire Resistance Standard for Ducts and Liners
ADC Test Code 106 R4	Ratings of Diffusers, Registers, Grilles

2. Provide supporting and hanging devices necessary to attach entire Mechanical system including ductwork and equipment, and to prevent vibration.

3. Provide vertical and horizontal supports as required by codes to meet minimum earthquake resistance standard for geographical area.

B. General - Sheet Metal Ductwork

1. Ductwork shall be free from vibration under all conditions of operation.

2. Pipe or conduit crossing duct:

   a. No pipe or conduit shall pass through duct without approval of Engineer.

   b. Where it is impossible to re-route pipe or conduit and when written approval has been obtained, increase duct size to maintain constant cross-sectional area at point of interference.

   c. Provide streamlined enclosure for pipe or conduit, as illustrated in SMACNA LPDS.

3. When making offsets and transformations necessary to accommodate structural conditions, preserve full cross-sectional area of ductwork shown on Drawings.

4. Ductwork shall have the following pressure-velocity classifications:

Duct Class	Static Pressure Rating	Pressure	SMACNA Seal Class	Velocity
Low Pressure	2 in.	Pos or Neg	B	2500 fpm of less

5. Sealants

   a. Seal all duct joints and joints between fittings and ducts with 3M, United Sheet metal or approved equal sealant as required by manufacturer's instructions.

   b. Make and seal duct joints properly. Apply sealant over joint lines and screws. Coverage shall be 1-inch wide on each side of joint. When joint is inaccessible for sealing from outside, cut hand-hole in duct to seal joint form inside. Where possible, sealing shall be on inside of ductwork.

c. Before assembling fittings and joints, apply sealer to rivets, grooved seams and top-off collars on inside of ductwork. Flood Pittsburgh lock pocket and the zoning plants with sealer.

d. Brush sealer around washers, corners, notches and top-off collars after assembling ducts.

e. Coat inside of connecting lap of slip joints and duct surface with sealer.

f. Do not use tape to seal sheet metal ducts.

6. Provide volume damper, or other approved air balancing device, with indicating and locking quadrant at each branch from main duct, at each duct take-off and at each neck to individual diffuser or register in supply, return or exhaust ducts.

7. Support

   a. Support vertical duct on each floor or slab it penetrates.

   b. Supports for ductwork and equipment shall be galvanized unless specified otherwise.

8. Connections

   a. Provide flexible connections at all RTU connections. Flexible connections shall be fire retardant fabric, by Vent fabrics or approved equal.

9. Construction

   a. No sharp metal edges shall extend into air streams.

   b. Install slip on air-leaving side of duct with sheet metal screws on 6-inch centers.

10. 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.

11. Elbows and Bends

    a. Elbows and bends for rectangle ducts shall have centerline radius of 1½ times duct width wherever possible.

    b. Where centerline radius is less than 1 ½ times duct width (on supply and return duct work), supply air elbows shall have single thickness turning vanes. Fasten vanes to runners in installed operating position. Install vanes in accordance with SMACNA LPDS.

12. Duct Termination

    a. End of duct sections shall be notched and lapped on. Connect ends with bar slips, S-slip and drive caps. Slips shall be made in form of frames, mitered and riveted at corners to prevent leakage.

13. Leakage

    a. Test ducts before applying exterior insulation. Correct leaks. Leakage noise shall not be audible from any point in ductwork at distance of 3 feet, as determined by Engineer.

14. Materials

    a. Sheet metal ducts shall be constructed of hot-dipped galvanized sheet metal with G90 commercial costing according to ASTM 525 unless specified otherwise.

C. Low Pressure Ductwork - Rectangular

1. Ducts wider than 19 inches with more than 10 square feet of unbraced panel shall be beaded or cross-broken, unless they have nonconductive covering or acoustical liner.
2. Use internal stiffening struts where required and where directed by Engineer.
3. Make changes in duct size with tapered connections as required by SMACNA LPDS.
4. Transverse joints shall be made with sip joints; use flat or standing seam according to SMACNA LPDS. Where duct size requires standing seam but space restrictions dictate flat seam, flat seam may be used if shown and approved on shop drawings.

D. Low Pressure Ductwork – Round

1. Construct per SMACNA.
2. Seal all joints with liquid sealer.

E. Low Pressure Ductwork – Bathroom Exhausts

1. All ductwork shall be rigid Aluminum.
2. Provide liquid sealant for all joints and seems.
3. All longitudinal seams shall be oriented up. Avoid dips and sags in which condensate can collect.

F. Flexible ductwork is not allowed

G. Fire Dampers

1. Provide automatic fire dampers throughout air duct system as shown on Drawings and as required by applicable codes, standards and authorities. Provide duct access door for each fire damper.
2. Dampers shall be approved fusible link self-closing type. Damper blades shall be minimum 24-gauge steel and frames shall be minimum 20 gauge galvanized steel channel. Fire dampers shall be installed as indicated in the following table:

Maximum Side Dimension	Angles	1/2 inch Welds	1/8 inch Bolts	#10 S.M. Screws	Sleeves
0 to 48 inches	1-1/2" x 1-1/2" x 12 Ga..	8" oc	8" oc	6" oc	18 ga.

3. Frame shall be fitted with angle iron stop and stainless steel spring latch, and shall be securely fastened to building construction.
4. Seal spaces between damper frames and walls and between damper frames and floors with approved fire-retardant material.
5. Blades of dampers shall be out of air steam and shall not reduce free area of duct.
6. Samples for fire dampers shall be submitted to and approved by local authorities having jurisdiction.
7. Dampers shall bear 1½ hour UL-rating Fire Damper Label and shall be constructed and installed as required by UL 555.
8. Fire dampers shall be Ruskin IBD2 Style B (rectangular duct), or approved equal.

2.7 GRILLES, DIFFUSERS, LOUVERS AND AIR TERMINATIONS

A. Shall be ADC certified and tested and shall be rated in accordance with ADC.

B. Shall handle air quantities at operating velocities with maximum diffusion within space supplied or exhausted.

C. Shall operate without objectionable air movement as determined by Engineer.

D. Shall operate with sound pressure levels not to exceed NC 25.

E. Return grilles shall be provided for return inlets and shall be sized, at no greater than 300 feet per minute face velocity.

F. Diffusers, registers and grilles shall be furnished with gaskets and installed with faces set level and plumb, tightly against mounting surface. See drawings for schedule. All air terminations shall be white.

G. All supply diffusers shall be supplied with opposed blade volume damper operable through the face of the diffuser.

H. Exterior Louver supplied by MC installed by GC.

1. Louvers to be extruded aluminum construction. With 45 degree angle blade.
2. Louver to be 2" depth.
3. Provide bird screen for all louvers.
4. Provide anodized aluminum finish. Color to be chosen by architect from manufacturers standard color chart. Provide color palette as part of louver submittal.
5. Coordinate frame type with wall construction. Coordinate rough opening size with GC.

2.8 DUCT INSULATION

A. Duct liner: Provide duct liner, for both supply and return rectangular ducting connected to air handlers, ducted fan coils, and heat exchangers.

1. Duct liner shall be flexible glass fiber; ANSI/ASTM c553, class 1; 'k' value of 0.24 at 75 degrees f; 24 lb/cu.ft. minimum density; coated air side for maximum 4,000 ft/min. air velocity.
2. Use one-inch thick insulation.
3. Secure duct liner with Mechanical fasteners on 15-inch centers on top and side of ductwork with any dimension exceeding 20 inches. Seal and smooth joints do not use nail type fasteners.
4. Ductwork dimensions indicated are net inside dimensions required for airflow. Increase outside ductwork dimensions as required allowing for insulation thickness.
5. Materials and installation shall meet following standards, as applicable:
   a. NFPA-90A
   b. Fire hazard classifications of 25-flame spread, 50 smoke developed, and 50 fuel contributed according to ASTM E-84, NFPA 255, UL 723 Class I.

B. Exterior duct insulation: Insulate the exterior of all concealed supply duct work that is not lined, duct that runs in unconditioned space, attics, and outside air intake ducts.

1. Duct Insulation: Flexible glass fiber; ANSI/ASTM C553, Class 1; 'K' value of 0.30 per inch at 75 degrees F; covered with foil faced vapor barrier.
2. Use thickness to achieve a minimum of R-3 in conditioned spaces.
3. Use thickness to achieve a minimum of R-3 for outside air intake ductwork and outside air plenums.
4. Use thickness to achieve a minimum of R-8 in unconditioned spaces.

5. Secure duct insulation with manufacturers tapes and methods. Assure continuous vapor barrier.
6. Materials and installation shall meet following standards, as applicable:
   a. NFPA-90A
   b. Fire hazard classifications of 25-flame spread, 50 smoke developed, and 50 fuel contributed according to ASTM E-84, NFPA 255, UL 723 Class I.

2.9 VIBRATION ISOLATION

A. For each element of rotating Mechanical equipment, provide vibration isolation to reduce the transmission of vibration from the equipment to the supporting building member.

B. Provide ribbed neoprene and cork pads for mounting of floor mounted air handling and fan coil units.

C. Provide spring and neoprene hangers for horizontal air handlers, fan coils, exhaust fans, supply fans, and air to air heat exchanger units.

D. Provide spring and neoprene hangers for isolating the piping in the boiler room from any attachment to the ceiling. Rack pipes and suspend racks with isolation hangers.

2.10 AUTOMATIC TEMPERATURE CONTROLS

A. Provide 7-day programmable thermostats to control each of the separate heating and cooling systems.

B. Supply and install all materials necessary to connect control components factory supplied as part of equipment controlled, unless specified otherwise. Eg; transformers, relays, wiring, etc.

C. Wiring (General): All line voltage automatic temperature control wiring shall be run in EMT (above 30 VAC). All low voltage control wiring shall be run in EMT in Mechanical rooms and run using independently supported plenum rated cable in areas above dropped ceilings or other concealed locations where damage to the wiring will not occur. Conduit is required wherever wiring would be exposed to public view.

PART 3: EXECUTION

3.1 SPECIAL RESPONSIBILITIES

A. Coordination: Cooperate and coordinate with other trades in executing work of this section as described hereunder.

1. Perform work so that progress of entire project including work of other trades whether involved in work of this or other Sections shall not be interfered with or delayed.
2. Provide information as requested on items furnished under this Section which shall be installed under other Sections.
3. Obtain detailed information from manufacturers of equipment to be provided under this Section as to proper methods of installation.
4. Obtain final roughing dimensions or other information as needed for complete installation of all items furnished under other Sections or by Owner.
5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections.
   a. Give full information so that openings required by work of this Section may be coordinated with other work and other openings may be provided for in advance.

b. In case of failure to provide necessary and sufficient information in proper time, trade involved will be required to do cutting and patching or have same done, at own expense and to full satisfaction of Engineer.

6. Notify Engineer of location and extent of piping, ductwork and equipment of other trades which interferes with the work of this section.

a. In coordination with and with approval of Engineer, relocate such piping, wiring and equipment to permit new work to be provided as required by Contract Documents.

B. Maintenance of equipment and systems: Provide maintenance for Mechanical equipment and systems until final acceptance by Engineer and Owner, and take such measures as necessary to ensure adequate protection of equipment and material during delivery, storage, installation and shutdown conditions.

1. This responsibility shall include provisions required to meet conditions incidental to delays pending final test of systems and equipment under seasonal conditions.

C. Use of Premises: Use of premises shall be restricted as directed in Division 1 and as required below.

1. As required, during progress of work, remove and properly dispose of resultant dirt and debris, and keep premises reasonably clean.

a. Upon completion of work, remove equipment and unused material provided for work, and put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Engineer, and as specified under paragraph "CLEANING".

2. Conduct work so as not to interfere with functioning of existing sewers and water and gas mains.

a. Extreme care shall be observed to prevent debris from entering piping. Confer with Engineer as to disruption of water service or other utilities due to testing or connection of new work to existing.

D. Superintendence: Keep superintendent or foreman on site during progress of work. Instructions given to such representative by Engineer shall be binding of Contractor.

1. Do not change representative without prior notification to Engineer.

E. Inspections by Engineer: Undertaking of periodic inspections by Engineer or designated agent shall not be construed as supervision of actual construction, nor make either responsible for providing safe place for performance of work of various trades or suppliers, or for visitors or occupants, or make either responsible for omission of safety devices called for by codes, ordinances, or specifications of manufacturer of equipment supplied.

F. Surveys and Measurements

1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.

2. In event of discrepancy between actual measurements and those indicated, notify Engineer in writing and do not proceed with work until Engineer has issued written instructions.

G. Firestopping and fireproofing:

1. Coordinate the work of this section with fire stopping provided by others for all penetrations at fire rated partitions.

2. The GC shall provide fire stopping for all new penetrations at fire-rated partitions made by this contractor.

3. Provide a marked plan set for reference by the GC indicating all penetrations that require fire stopping.

4. Patching and repairing of spray fireproofing due to cutting or damaging to fireproofing during course of work specified under this Section shall be performed by installer of fireproofing and paid for by trade responsible for damage and shall not constitute grounds for an extra to Owner.

3.2 PIPE HANGERS AND SUPPORTS

A. Hangers shall be arranged to maintain the required grading and pitch of piping, to prevent vibrations, and to provide free, guided, expansion and contraction between anchors.

B. Support riser piping independently of connected horizontal piping.

C. Place a hanger within 12 inches of each horizontal elbow.

D. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Trapeze hangers shall be spaced according to the smallest pipe size, or install intermediate supports according to schedule in this section.

E. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.

F. Horizontal piping shall be supported in accordance with MSS SP-69 and as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
½ to 1-1/4 inch	6'-0"	3/8"
1-1/2 to 2 inch	10'-0"	3/8"
2-1/2 to 3 inch	10'-0"	1/2"
4 to 6 inch	10'-0"	5/8"
8 to 12 inch	14'-0"	7/8"

G. Support vertical piping at each floor but no more than ten-foot intervals.

H. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non adhesive isolation. Galvanized felt isolators sized for copper tubing may also be used.

I. Do not support piping from other pipes, ductwork or other equipment that is not building structure.

3.3 MATERIALS AND WORKMANSHIP

A. Work shall be executed in workmanlike manner and shall present neat and Mechanical appearance when completed.

1. Ductwork and piping shall run concealed except in Mechanical rooms and areas where no hung ceiling exists unless otherwise shown on drawings.

2. Material and equipment shall be installed according to manufacturer's recommended best practice such that completed installation shall operate safely and without leakage, undue wear, noise, vibration, corrosion, or water hammer.

3. Use of dielectric couplings between dissimilar materials is mandatory. Work shall be properly and effectively protected, and pipe openings shall be temporarily closed to prevent obstruction and damage prior to completion.

B. Fully insure workmen and work as required.

C. Except as otherwise noted, material or equipment mentioned in these Specifications or on Drawings shall be furnished new.

1. Provide supplies, appliances and connections necessary for complete and operational installation.

2. Equipment shall be provided with components required or recommended by OSHA and applicable NFPA documents, and shall be UL approved where applicable.

3. Protection facilities including expanded metal guards over belt drives and couplings shall be provided in conformance with OSHA standards and all other applicable regulations.

D. Notwithstanding any reference in Specifications or on Drawings to material or piece of equipment by name, make or catalog number, such reference shall be interpreted as establishing type, function, and standard of quality desired and shall not be construed as limiting competition.

E. Finish of materials, components and equipment shall not be less than industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, finish shall be as approved by Engineer.

F. Owner shall not be responsible for material and equipment prior to testing and acceptance.

3.4 BULLETINS, MANUALS AND INSTRUCTIONS

A. Obtain at time of purchase of equipment, three copies of operation, lubrication and maintenance manuals for all items.

1. Assemble literature in coordinated manuals with additional information describing combined operation of field-assembled units, including as-built wiring diagrams.

2. Manual shall contain names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment.

B. Furnish three copies of manuals to Engineer for approval and distribution to Owner.

1. Deliver manuals no less than 30 days prior to acceptance of equipment to permit Owner's personnel to become familiar with equipment and operation prior to acceptance.

C. Operating instructions: Upon completion of installation or when Owner accepts portions of building and equipment for operational use, instruct Owner's operating personnel in any or all parts of various systems.

1. Such instructions shall cover period of control such as will take Mechanical equipment through complete cycle.

2. Make adjustments under actual operating condition. Provide a minimum of three separate training sessions, each of up to one days duration.

3.5 ACCESS AND ACCESS PANELS

A. Perform work required so as to provide proper access to material or equipment, which may need inspection, replacement, repair or service.

1. If proper access cannot be provided, confer with Engineer as to best method of approach to minimize effect of reduced access, which may result.

B. Supply access panels for installation under other Sections where shut-off valves, control valves, check valves, or any items requiring access which are installed under this Section and concealed in floor, wall, furred space or above the ceiling.

1. Access panels shall be by Knapp, Milcor, Way Loctor, or approved equal; coordinate selection with other trades supplying similar access panels.

C. Ceiling consisting of lay-in or removable splined tiles do not require access panels.

1. Valves above the ceiling shall have locations marked with thumb tacks on finished ceiling panels; locations shall be noted on record drawings.

D. Access panels shall have same fire rating classification as surface penetrated.

3.6 INSTALLATION OF EQUIPMENT

A. Install equipment so as to avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways, to satisfaction of Engineer and in accordance with code requirements.

B. Install equipment so as to properly distribute equipment loads in building structural members provided for equipment support under other Sections.

1. Roof-mounted equipment shall be installed and supported on separate supports as previously specified.

C. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall or ceiling mounting of equipment provided under this Section (e.g. heating and ventilating units, fans, ducts and piping) as indicated on Drawings and in Specifications.

D. Provide steel supports and hardware for proper installation of hangers, anchors, guides, etc.

E. Provide cuts, weights, and other pertinent data required for proper coordination of equipment support provisions and installation.

F. Structural steel and hardware shall conform to Standard Specifications of ASTM; use of steel and hardware shall conform to requirements of Section Five of Code of Practice of American Institute of Steel Construction.

G. Verify site electrical conditions prior to purchase of equipment. Coordinate voltage of all equipment requiring electrical connections with EC prior to purchase. Notify engineer of any discrepancies.

H. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly, which will void warranty.

1. Report in writing to Engineer, prior to purchase or shipment of equipment involved, on conditions, which may prevent proper installation.

3.7 ADJUSTING

A. Provide start-up service, make any required adjustments and efficiency tests.

B. Once systems are compete run all systems through all functionalities and confirm that systems are operating properly prior to providing training to the Owner's representative.

C. Provide one, minimum two -hour instruction periods to owner's representative at the site.

D. Include the cost of providing one additional, separate visit to the site after the instruction session to assist in assuring that controls are functioning properly and occupants know how to use them.

3.8 JOINTS AND CONNECTIONS

A. Joints and connections shall be permanent and shall be gas-and water-tight. Jointing shall be types specified for service indicated. Joints and connections shall meet requirements of manufacturers best recommended practice. All transitions between different piping materials shall be made using approved adapters. Adapters for transitions between two types of piping materials shall be manufactured for purpose intended.

3.9 SYSTEM CLEANING

A. Ductwork

1. Only required if air moving equipment is operated without filters in place.

3.10 TESTING, INSPECTION, BALANCING AND ADJUSTING

A. General

1. Provide the services of an independent test and balance company certified by the ABA who shall supply qualified personnel, equipment, apparatus and services for testing, inspection, balancing and adjusting of Mechanical systems, to performance data shown in schedules, as specified, and as required by codes, standards, regulations and authorities having jurisdiction including City Inspectors, Owner and Engineer.
    a. Notify Engineer and involved authorities at least 48 hours prior to testing or inspection.
    b. Do not cover work (this includes application of insulation) prior to testing or inspection.
2. Testing, inspection, balancing and adjusting shall in no way relieve or reduce guarantee requirements.
3. The Mechanical systems are not to be considered substantially complete until the test and balance work is complete and the submitted paper work detailing results has been approved by the engineer.
4. Submit proposed test procedures, recording forms and test equipment for review prior to testing and balancing.
5. Notify Engineer and authorities involved at least 48 hours prior to testing.
6. Do not cover or conceal work prior to testing and inspection and obtaining approval.
7. Prior to date of acceptance, furnish Engineer with certificates of testing and inspection for Mechanical systems indicating approval of authorities having jurisdiction and conformance with requirements of Contract Documents.
    a. Instruments used for testing and balancing shall have been calibrated with six months prior to testing or balancing.
    b. Calibration shall be certified.
8. Leaks, damage and defects discovered or resulting from tests shall be repaired or replaced to like-new condition with acceptable materials.
    a. Tests shall be continued until system operates without adjustments or repairs.
9. Report on standard reporting forms.
10. Submit copies of testing and balancing reports to Engineer for approval.
11. Prove capacity and performance of equipment by field testing. Install equipment and instruments required for testing, thermo-wells and gauge connections at no additional cost to Owner.
12. Qualified representative of equipment manufacturer shall be present at test.

B. Duct System Testing

1. Adjust all air handling equipment to provide required or design supply, return and ventilation air quantities.

2. Test duct leakage in accordance with Energy Star for Home Indoor Air Package and requirements below.
    a. Duct system leakage shall be measured at 25 Pascals and shall be no greater than 6 cfm per 100 sq ft of conditioned space.
3. Measure air quantities at all risers and adjust related manual balancing damper. (Airflow shall be balanced between 100% and 120% of specified flow rate.)
4. Measure air quantities at all inlets and outlets.
    a. Adjust distribution system to obtain indicated airflows, uniform space temperatures, and free from objectionable drafts and noise. (Airflow shall be balanced between 100% and 120% of specified flow rate.)
5. Use volume control devices to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
6. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
7. Measure static air pressure conditions on AHU's, including filter and coil pressure drops, and total pressure across the fan. Make allowance for 50% loaded filter.

C. Test of Air Handlers
1. Measure air quantities at all inlets and outlets.
2. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
3. Measure static air pressure conditions at AHU's, including filter and coil pressure drops, and total pressure across the fan.
    a. Make allowance for 50 percent loaded filter.

END OF SECTION

SECTION 16100
ELECTRICAL
(Filed Sub Bid)

PART 1 – GENERAL

1. GENERAL REQUIREMENTS

A. The CONDITIONS OF THE CONTRACT and DIVISION 1. General Requirements shall be part of this section.

2. FILED SUB-BID REQUIREMENTS

A. Bidding procedures shall be in accordance with latest edition of Massachusetts General Laws, Chapter 149, Section 44; and Chapter 30, Section 39M. Time and place for submission of sub-bids is given in Advertisement for Bids.

B. Sub-bids for work under this Section shall be for complete work and shall be filed in a sealed envelope with Awarding Authority, at time and place specified in Advertisement for Bids. The following shall appear on face of envelope:

TOWN OF PLYMOUTH
RENOVATIONS TO THE
SIMES HOUSE
[NAME OF SUB-BIDDER]
SUB-BID FOR SECTION 14202, LIMITED USE LIMITED APPLICATION ELEVATOR

C. Every sub-bid submitted for work under this Section shall be on forms furnished by Awarding Authority, as required by Section 44 of Chapter 149 of General Laws, and specified in Advertisement for Bids.

D. Sub-bids filed with Awarding Authority shall be accompanied by bid deposits in form of a bid bond, or cash, or a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company, payable to the Town of Plymouth; in compliance with Chapter 149, Section 44B. Amount of bid deposit shall be as specified in the advertisement for bids.

E. Work of this Section is shown on the following drawings: SE-1, E1.1, E1.2, E1.3, E1.4, E3.1, FA1.1, FA1.2, FA3.1.

F. Examine all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this section.

G. 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.

3. SCOPE OF WORK

A. The scope of work consists of the installation of all materials to be furnished under this Section, and without limiting the generality thereof, includes all equipment, labor, and services required for the furnishing, delivering, and installing the principal items of work hereinafter and all items incidental thereto as specified herein and as shown on the drawings.

B. The itemization of work hereinafter specified does not in any way limit the responsibility to perform all work and furnish all the equipment, labor, and materials necessary for completion and satisfaction of operation of the installations described in the Specifications and shown on the Contract Drawings. In addition to the principal and miscellaneous items of work specifically mentioned and/or indicated, to be responsible for furnishing and installing all incidental and collateral materials such as supporting hardware for panelboards, conduit hangers, fastening devices, insulating tape and the like, which constitute essential components of the grade of Electrical Trade Practices and Workmanship acceptable to the Architect.

(1.) Disconnect switches.
(2.) Junction boxes and pull boxes.
(3.) Motor wiring.
(4.) Building electrical distribution equipment and associated metering equipment.
(5.) Feeders.
(6.) Installation and wiring of magnetic starters.
(7.) Branch circuit wiring.
(8.) Entry intercom system.
(9.) Emergency batteries and lighting fixtures.
(10.) Telephone system wiring and associated raceways.
(11.) Cable television system wiring and associated raceways.
(12.) Panelboards and dwelling unit load centers.
(13.) Secondary electric service.
(14.) Central station fire alarm service.
(15.) Wiring and connections of electrical equipment supplied bu the Owner and other Subcontractors.
(16.) Luminaires and associated branch circuit wiring.
(17.) Fire alarm system.
(18.) Fire alarm system master box.
(19.) Wiring devices and device plates.
(20.) Dwelling unit smoke detectors.
(21.) Carbon monoxide detectors.
(22.) Nameplates and labels.
(23.) Backcharges by the Plymouth Fire Department and/or their agent for testing the building fire alarm system.
(24.) Changes for "UL" fire alarm test.
(25.) Photocells and time clocks.
(26.) Lighting contactors.
(27.) Temporary lighting and power during construction.
(28.) Electrical metering and distribution equipment.
(29.) Bidirectional Amplifier System.

3, RELATED WORK

A. The following work is not included in this Section and is to be performed under the designated Sections:

(1.) All temperature control wiring including thermostat wiring shall be furnished and installed by the HVAC Contractor.
(2.) Painting (except for factory-finished items) specified under Section 090007 "Painting".
(3.) Access panels, where required, are furnished under this Section, but shall be installed under the related trades of the surface in which they are installed.
(4.) Starters shall be furnished by the HVAC Contractor, installed and wired by the Electrical Contractor.
(5.) Site television distribution system cables and associated distribution equipment shall be performed by COMCAST.
(6.) Backcharges by Verizon for telephone service installation shall be paid by the Owner.
(7.) Backcharges by COMCAST for Cable television system service installation shall be paid by the Owner.
(8.) Backcharges by NSTAR shall be paid by the Owner.
(9.) Telephone system and cable television system plywood backboards shall be furnished and installed by the General Contractor.
(10.) All trenching and backfill required for the installation of the building electric service systems shall be performed by the General Contractor.
(11.) Signage which may be required by the Plymouth Fire Department shall be furnished be the General Contractor

4, BREAKDOWN

A. This Contractor must submit a breakdown of his contract price to aid the Architect in determining the value of work installed as the job progresses.

B. No requisition will be paid to this Contractor until after the breakdown is delivered to the Architect.

X. Breakdown shall consist of, not less than the following items. The figure for each item shall include costs of material, labor, markup, and all other costs applicable to the item.

(1.) Raceway installation.
(2.) Wires and cables.
(3.) Electrical distribution equipment and panelboards.
(4.) Motor wiring.
(5.) Branch circuit wiring.
(6.) Fire alarm system.
(7.) Telephone system and associated wiring.
(8.) Cable television system and associated wiring.
(9.) Emergency batteries, luminaires, and associated branch wiring.
(10.) Door entry intercom systems.
(11.) Secondary electric service.
(12.) Telephone service
(13.) Cable television system service.
(14.) Interior luminaires and associated branch circuit wiring.
(15.) Electrical metering and distribution equipment.

(16.) Photocells, time clocks, and lighting contactors.
(17.) Secondary electric, telephone service, cable television system service, and municipal fire alarm system service raceways and pull ropes.
(18.) Carbon monoxide detection equipment.
(19.) Feeders to the dwelling unit load centers.
(20.) Dwelling unit telephone system and associated wiring
(21.) Dwelling unit cable television system and associated wiring
(22.) Dwelling unit branch circuit wiring.
(23.) Feeders.
(24.) Entry intercom system.

1.5 SHOP DRAWINGS

A. This Contractor shall refer to Division No. 01.33.00 Submittal Requirements for additional shop drawing requirements.

B. Shop drawings shall be submitted for the following:

(1.) Cables and conductors.
(2.) Raceway systems.
(3.) Anchoring equipment.
(4.) Emergency batteries luminaires.
(5.) Electrical metering and distribution equipment.
(6.) Fire alarm system.
(7.) Panelboards, distribution equipment and dwelling unit load centers.
(8.) Outlet boxes.
(9.) Lighting fixtures, ballasts, and lamps.
(10.) Door entry intercom system.
(11.) Telephone equipment and cables.
(12.) Cable television equipment and cables.
(13.) Disconnect switches.
(14.) Tandem wired dwelling unit smoke detectors.
(15.) Carbon monoxide system detection equipment.
(16.) Wiring devices and device plates.
(17.) Junction boxes and pull boxes.
(18.) Circuit breakers.
(19.) Fuses.
(20.) Contactors.
(21.) Time clocks.
(22.) Photocells.
(23.) Electrical metering and distribution equipment.
(24.) Entry intercom system.

6. SCHEDULING AND PROGRESS

A. This Contractor shall refer to Division No. 1 013200 for Scheduling and Progress requirements.

7. TEMPORARY FACILITIES

A. This Contractor shall refer to Division No. 1 Section 015000 for Temporary Facility requirements.

8. PRODUCT OPTIONS AND SUBSTITUTIONS

A. This Contractor shall refer to Division No. 1 Section 013300 for requirements.

9. PROJECT CLOSEOUT

A. This Contractor shall refer to Division No. 1 Section 017700 for Project Closeout requirements.

10. PROJECT RECORD DOCUMENTS

A. This Contractor shall refer to Division No. 1 Section 017839 for Project Record Document requirements.

11. OPERATION AND MAINTENANCE REQUIREMENTS

A. This Contractor shall refer to Division No. 1 Section 017700 for Operation and Maintenance requirements.

12. PROJECT COORDINATION

A. This Contractor shall refer to Division No. 1 Section 013100 for Project Coordination requirements.

13. COORDINATION DRAWINGS AND PROCEDURES

A. This Contractor shall refer to Division No. 1 Section 014000 for Regulatory Requirements.

14. LAWS, ORDINANCES, CODES, AND PERMITS

A. This Contractor shall give all necessary notices, obtain all permits, and pay all taxes, fees, and other costs in connection with his work; file all necessary plans, prepare all necessary documents and obtain all necessary approvals of state authorities, all local, town, city, or county departments having jurisdiction; obtain all required certificates of inspection for his work.

B. This Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings in addition to Contract Drawings and Documents, in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on the drawings and/or specified.

X. All materials furnished and all work installed shall comply with the rules and recommendations of the Massachusetts Electrical Code, the Massachusetts Board of Fire Underwriters', all requirements of the local utility company, recommendations from the fire insurance rating organizations having jurisdiction, and with the requirements of all local, town, city, or county departments having jurisdiction.

15. DEFINITIONS

A. "This Contractor" means specifically the Contractor working under this Section of the Specifications.

B. "Furnish and Install" means to supply, erect, install and connect up, complete for regular operation, the particular work referred to unless otherwise specified. "Piping" includes in addition to pipe, all fittings, boxes, hangers and other accessories relating to such piping. "Concealed" means hidden from sight as in trenches, chases, furred spaces, shafts, hung ceilings, embedded into construction, ground or concealed as defined above.

16. INSPECTION AND TEST

A. All work will be subject to the inspection of the Architect and such other inspections are may have jurisdiction.

B. As the various part of the works are installed and/or revised, insulation resistance test shall be made to insure that the new systems are free from short circuits and grounds and that all connections, switches, controls and equipment are in proper operating condition.

X. The installation resistance between conductors and between conductors and grounds, for the distribution systems shall be not less than the requirements of the Massachusetts Electrical Code.

Δ. All testing equipment necessary shall be provided. The tests shall incur no additional expense to the Owner.

E. Failure or defects in workmanship or materials revealed by tests shall be corrected promptly and retested. Defective materials furnished under this contract shall be replaced at no additional expense to the Owner.

17. EXAMINATION OF SITE AND CONTRACT DOCUMENTS

A. Before submitting prices or beginning work, thoroughly make an examination of the site and the Contract Documents in accordance with General and Supplementary Conditions. No claim for extra compensation will be recognized if difficulties are encountered which an examination of the site conditions and Contract Documents prior to executing the contract would have revealed.

B. The right to make any reasonable change in the location of outlets, apparatus, and equipment to the time of roughing in is reserved by the Architect without involving any additional expense to the Owner.

X. The drawings show layout of the systems indicates the approximate location of apparatus and equipment. The runs of conduit as shown on the drawings are schematic only, and are not intended to show the exact routing of the wire; the final determination as to the routing shall be governed by existing utilities, new utilities and other obstructions. This shall not be construed to mean that the design of the system may be changed; it merely refers to the exact run of a duct bank between given points.

Δ. The Drawings and the specifications are complementary with one another, and any labor or materials called for by either, whether or not by both, or necessary for the successful operation

of any of the particular types or equipment furnished under this contract, shall be furnished and installed.

E. Before installing any work, see that it does not interfere with the clearance required for finished columns, pilasters, partitions, or walls, as shown on the Contract Architectural Drawings and Details.

Φ. Be responsible for all materials delivered to the site in connection with the work and pay all charges for cartage, scaffolds, planking, rigging, and erecting. Take every precaution necessary to protect equipment and installation in addition to plugging and protecting open ends of all pipes, outlet boxes, panelboxes, and junction boxes. All equipment must be stored in a clean dry place to preserve the quality of materials being used. Equipment and/or materials damaged during the construction period shall be replaced at no additional cost to the Owner.

Γ. All materials and equipment required by this Electrical Specification shall be new, clean, and free of defects at the time of installation. The manufacturer's and Underwriters' label shall be on all materials and equipment unless otherwise approved, in writing, by the Architect.

18. DAMAGE TO OTHER WORK

A. Each Contractor shall be held responsible for and shall pay for all damage to other work caused by his work or workmen.

B. Repairing of such damage shall be done by this Contractor who installed the work, and so directed by the Architect.

PART 2 – PRODUCTS

1. PVC RIGID NON-METALLIC CONDUIT

A. This Contractor shall furnish and install Schedule 40 PVC conduit underground as herein specified and indicated on the Drawings. The Schedule PVC conduit shall be manufactured by Carlon, Canron, and Sloan or approved equal.

B. PVC Type 40 conduit for application in underground, encased and exposed applications in accordance with the Massachusetts Electrical Code (Article 347).

X. Conduit shall be Carlon Plus 40, 90 degrees C, UL rated or approved equal. Material shall comply with NEMA Specification TC-2 Conduit, TC-3 (Fittings-UL-514) and UL- 651 (Standard for rigid non-metallic conduit).

Δ. The conduit and fittings shall carry a UL label (on each 10-foot length) of conduit and stamped or molded on every fitting).

E. Conduit and fittings shall be identified for type and manufacturer and shall be traceable to location of plant and date manufactured. The markings shall be legible and permanent.

Φ. The conduit shall be made from polyvinyl chloride C-300 compound, which includes inert modifiers to improve weatherability, heat distortion. Clean re-work material, generated by the manufacturer's own conduit production, may be used by the same manufacturer, provided the end products meet the requirements of this specification.

Γ. The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes, or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections that could mar conductors or cables.

H. Conduit, fittings, and cement shall be produced by the same manufacturer to assure system integrity.

I. Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-2, NEMA TC-3, and UL-651 and UL-514 (fittings). The acceptance criteria shall be as given in the same standards.

9. All conduit and fittings shall be solvent cemented in applications in accordance with instructions from the manufacturer using cement equal to Carlon all weather "quick set clean solvent cement with recommended installation temperature or 5 degrees to 100 degrees F and set-up time (evaporation rate) at 10 degrees - 30 degrees F of 4 - 5 minutes.

2. ELECTRICAL METALLIC TUBING

A. Electrical metallic tubing may be used for sprinkler system flow and tamper switch wiring to a junction box on wall and liquid tight flexible metallic conduit between junction box and respective switches.

B. Tubing shall be continuous between outlets, making a continuous electrical system for bonding.

X. Connector and couplings shall be setscrew type.

3. RIGID STEEL CONDUIT

A. All rigid steel conduits shall be standard IPS, galvanized or sheradized, threaded conduit equal to Plymouth Standard, J & L, or Youngstown.

B. Changes in direction of conduit, where concealed, shall be made by means of standard radius bends, and where exposed, or by means of galvanized, or sheradized threaded condulets as manufactured by Crouse-Hinds or equal.

X. Conduits shall be continuous from outlet, and from outlets to cabinets, junction or pull boxes 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. Terminals of all conduits shall be furnished with double lock nuts and grounding bushings.

4. LIQUID TIGHT FLEXIBLE METAL CONDUIT

A. Liquid tight flexible metallic conduit shall be used for short connections to flow and tamper switches.

5. ARMORED CABLE

A. For all armored cable branch circuits as called for elsewhere in these specifications and noted on the plans, furnish, and install the indicated sizes with copper conductors. Armored cable shall be as manufactured by the Plymouth Insulated Wire Company or approved equal as manufactured by American or Collyer and shall be type "MC".

6. WIRES AND CABLES

A. All conductor wire and cable shall consist of thoroughly tinned 98% conductivity copper, with 600 volt insulation, manufactured in strict accordance with the requirements of the Board of Underwriters' and AIEE.

B. No wires smaller than No. 12 shall be used for any branch circuit unless noted on plans for special system circuits. Larger sizes shall be used where so indicated on the Drawings.

X. All 600-volt wire and cables shall be single conductor suitable for use in wet areas and dry locations; shall have an insulation that is moisture and heat resistant cross-linked thermosetting polyethylene without an outer jacket, shall be type "THHN" as manufactured by General Electric, Collyer, or Rome Cable. Wire sized No. 12 and No. 10 AWG shall be solid. Sizes 8 and larger shall be stranded.

7. OUTLET BOXES (STEEL)

A. Furnish and install all required outlet boxes as manufactured by Appleton, National, or Steel City.

B. All outlet boxes for concealed work with armored cable shall be galvanized, stamped steel; those for fixtures, furnished with a fixture stud.

X. Outlet boxes shall be of size and type to accommodate (1) structural conditions, (2) size and number of raceways, conductors, or cables entering, and (3) devices or fixtures for which required.

Λ. Wall outlets shall be 4" sq. x 1-1/2" deep with plaster covers to suit, or Standard "new work" wall case boxes. Wall boxes shall be designed for rigid metallic conduit and shall be the best type for the wall construction involved.

E. Install blank plates on all outlet boxes, in which no apparatus is installed, which do not integrally provide a cover for the box.

Φ. Special care shall be taken to set all boxes correctly square and true with the building finish. As far as possible, all wall and switch outlets shall be erected in advance of furring and fireproofing, and shall be secured to the building structure or steel by adjustable strap iron supports, which shall be buried in.

Γ. The exact location of all outlets and switches in finished rooms shall be obtained from the Architect and from the Scale Drawings of interior details and finish. Final correct readjustment shall be made to the outlets if necessary to give proper centering.

H. In centering of outlets and location of outlet boxes, allow for overhead pipes, and thickness of fireproofing and plastering; also for window trim, paneling, hung ceilings, and the like. Any inaccuracy resulting from failure to do so must be corrected under this Section of the Specifications without expense to the Owner. confer with the Architect and other Subcontractors and find out where hung ceilings occur and piping and ductwork run before signing the Contract and include in proposal what ever costs of the electrical work these conditions necessitate.

I. The locations given or designated on the Drawings for the outlets are subject to modification. In the case of local wall switches established by the swing of the door. In all cases, the switch shall be on the side of the door opposite the hinges.

8. JUNCTION AND PULL BOXES

A. Junction or pull boxes shall be furnished and installed under this Section of the Specifications where indicated on the Drawings and wherever else such a box may be deemed necessary to facilitate the pulling or splicing of wires or cables.

B. All such boxes must be made accessible and shall be built only from approved detail Working Drawings. Conduits shall enter these boxes through tight fitting clearance holes.

X. The covers of the boxes shall be designed for quick removal. Where junction boxes are required for a splicing box for special recessed fixtures, consult the Architect before installing boxes for these fixtures and determine the exact location of the boxes.

A. Each feeder passing through a pull box shall be tagged or designated in some other approved manner. If tags are used, they shall be of fireproof material.

E. Locations of junction boxes and pull boxes shall meet the approval of the Architect. Generally, junction boxes and pull boxes shall not be exposed in finished spaces; where necessary re-route conduits or make other arrangements to meet the approval of the Architect.

9. NAMEPLATES

A. Nameplates consisting of black mica with white center, lettering to be 1/4" high engraved through to white layer and properly fastened with brass screws shall be provided for the following equipment:

(1.) Switchgear.
(2.) Disconnect switches.
(3.) Junction or terminal boxes.
(4.) Starters, which are furnished by other trades.
(5.) Panelboards.

10. SLEEVES, INSERTS, AND SUPPORTS

A. This Contractor shall furnish and install all inserts, conduit hangers, anchors, and steel supports necessary for the support and installation of all electrical and mechanical equipment.

B. This Contractor shall be responsible for all openings required in walls or floors for the installation of mechanical equipment, ductwork, or louvers. Such openings shall be by this Contractor in such a manner so as not to interfere with the fireproof integrity of the building or the room.

X. This Contractor will be held responsible for the location of and maintaining in proper position, sleeves, inserts, and anchor bolts supplied and/or set in place by him.

11. EXPANSION FITTINGS

A. Expansion fittings shall be as manufactured by O. Z. Electrical Manufacturing Co., Inc. or approved equal as manufactured by Crouse-Hinds or Appleton.

B. Expansion fittings shall be O. Z. Type "AX" or "TX", as required for conduit installation. Expansion fittings shall be supplied with bonding jumper.

12. PULL BOXES AND WIREWAYS

A. Pull boxes shall be code gauge galvanized steel with screw covers to match. Pull boxes and wireways shall be as shown on contract Drawings and/or as required by the Massachusetts Electrical Code and/or job conditions, with steel barriers separating systems.

B. Wireways shall be code gauge galvanized steel, manufactured standard sections and fittings, with combination hinged and screw covers.

13. MOTORS, CONNECTIONS, AND CONTROLS

A. Motors will be furnished and installed under the respective sections of the Specifications under which the equipment is specified.

B. Motors less than ½ H.P. will be 115 volts, single phase, 60 hertz, except specifically noted equipment.

X. Motors ½ H. P. and larger will be 230V, 1 phase, 60 hertz; motors less than 2 H.P. will be 115 volts, single phase, 60 hertz, except specifically noted equipment.

14 DISCONNECT SWITCHES

A. Furnish and install fused safety switches as required by plans and specifications. All fused safety switches shall be NEMA Heavy Duty Type HD and Underwriters' Laboratories listed. Square D Class 3110 or approved equal as manufactured by Siemens or General Electric.

B. All fused safety switches shall have switchblades, which are fully visible in the OFF position with the door open. All current-carrying parts shall be plated through electrolytic processes to resist corrosion and promote cool operation.

X. Fused safety switches shall be quick-make and quick-break such that, during normal operation of the switch, the operation of the contacts shall be not capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The handle and mechanism shall be an integral part of the box, not the cover, with positive padlocking provisions in the OFF position.

A. Fused safety switches shall be furnished in NEMA 1 general purpose enclosures unless NEMA 3R (raintight) as indicated on the plans. Enclosures shall be of code gauge (UL 98) sheet steel (NEMA 1) or code gauge phosphate treatment and gray baked enamel finish.

E. Switches shall be fused type and horsepower rated for 600 volts AC.

14. FIRE ALARM SYSTEM

A. 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, Ethernet and/or digital alarm communications to central stations and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

(1.) The Secondary Power Source of the fire alarm control panel will be capable of providing at least 60 hours of backup power with the ability to sustain 15 minutes in alarm at the end of the backup period.

C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

D. The FACP and peripheral devices shall be manufactured or supplied 100% by a single U.S. manufacturer (or division thereof).

E. Underwriters Laboratories Inc. (UL) - USA:

(1.) No. 38 Manually Actuated Signaling Boxes

(2.) No. 50 Cabinets and Boxes

(3.) No. 864 Control Units for Fire Protective Signaling Systems

(4.) No. 268 Smoke Detectors for Fire Protective Signaling Systems

(5.) No. 346 Waterflow Indicators for Fire Protective Signaling Systems

(6.) No. 464 Audible Signaling Appliances

(7.) No. 521 Heat Detectors for Fire Protective Signaling Systems

(8.) No. 1971 Visual Notification Appliances

F. 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 system integrity.

G. The FACP shall meet requirements of UL ANSI 864 Ninth Edition

H. SCOPE:

(1.) An intelligent, microprocessor-controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings.

(2.) Basic Performance:

a. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.
b. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) as part of an addressable device connected by the SLC Circuit.
c. All circuits shall be power-limited, per UL864 requirements.

d. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
e. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.

(3.) Basic system functional operation

a. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
1) The system Alarm LED on the FACP shall flash.
2) A local sounder with the control panel shall sound.
3) A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4) In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send events to a central alarm supervising station via either dial-up over PSTN or Internet or Intranet via PSDN or virtual private network.

I. Submittal

(1.) General:

a. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
b. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
c. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

(2.) Shop Drawings:

a. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
b. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
c. Show annunciator layout, configurations, and terminations.

(3.) Manuals:

a. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
b. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.

c. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

(4.) Software Modifications

a. Provide the services of a qualified 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 system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

J. Guaranty:

(1.) All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

K. Applicable Standards and Specifications:

(1.) The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

a. National Fire Protection Association (NFPA) - USA:

1) No. 13 Sprinkler Systems
2). No. 70 National Electric Code (NEC)
3) No. 72 National Fire Alarm Code
4) No. 101 Life Safety Code
5) No. 38 Manually Actuated Signaling Boxes
6) No. 217 Smoke Detectors, Single and Multiple Station
7) No. 228 Door Closers–Holders for Fire Protective Signaling Systems
8) No. 268 Smoke Detectors for Fire Protective Signaling Systems
9) No. 268A Smoke Detectors for Duct Applications
10) No. 346 Waterflow Indicators for Fire Protective Signaling Systems
11) No. 464 Audible Signaling Appliances
12) No. 521 Heat Detectors for Fire Protective Signaling Systems
13) No. 864 Control Units for Fire Protective Signaling Systems
14) No. 1481 Power Supplies for Fire Protective Signaling Systems
15) No. 1610 Central Station Burglar Alarm Units

16) No. 1638 Visual Signaling Appliances
17) No. 1971 Visual Signaling Appliances
18) No. 2017 General-Purpose Signaling Devices and Systems
19) CAN/ULC S524-01 Standard for Installation of Fire Alarm Systems

b. The FACP shall be ANSI 864, 9th Edition Listed. Systems listed to ANSI 864, 8th edition (or previous revisions) shall not be accepted.

(2.) 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 the installation shall be in compliance with the UL listing.

(3.) Local and State Building Codes.

(4.) All requirements of the Authority Having Jurisdiction (AHJ).

L. Approvals:

(1.) The system shall have proper listing and/or approval from the following nationally recognized agencies:

a. FM Factory Mutual
b. MEA Material Equipment Acceptance (NYC)
c. CSFM California State Fire Marshal

M. 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 fire protective signaling system, meeting the National Fire Alarm Code.

(2.) All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

(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.

(4.) All equipment must be available "over the counter" through the Security Equipment Distributor (SED) market and can be installed by dealerships independent of the manufacturer.

N. Conduit And Wire:

(1.) Conduit:

a. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
b. Where required, 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 DC 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 the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
f. Conduit shall be 3/4 inch (19.1 mm) minimum.

(2.) Wire:

a. All fire alarm system wiring shall be new.
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 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 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. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
e. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.
f. All field wiring (with exception of external communications Ethernet) shall be electrically supervised for open circuit and ground fault.
g. The fire alarm control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., is not acceptable.
h. Terminal Boxes, Junction Boxes and Cabinets:
20) All boxes and cabinets shall be UL listed for their use and purpose.
i. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

O. Main Fire Alarm Control Panel:

(1.) The FACP shall be a Fire-Lite Model MS-9600UDLS or equal as manufactured by Gamewell or Fire Control Instruments and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, Digital Dialer and Ethernet Communicators and other system controlled devices.

(2.) Operator Control

a. Acknowledge Switch:

1) Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.

2) Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

b. Alarm Silence Switch:

1) Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto- silence timers,

c. Alarm Activate (Drill) Switch:

1) The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

d. System Reset Switch:

1) Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

e. Lamp Test:

1) The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

(3.) System Capacity and General Operation

a. The control panel shall provide, or be capable of, expansion to 636 intelligent/addressable devices.

b. The control panel shall include Form-C Alarm, Trouble and Supervisory relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include programmable Notification Appliance Circuits (NACs) capable of being wired as NFPA Style Y (Class B) or NFPA Style Z (Class A).

c. The fire alarm control panel shall include an operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.

d. All programming or editing of the existing program in the system shall be

achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The control unit will support the ability to upgrade its operating program using FLASH memory technology. The unit shall provide the user with the ability to program from either the included keypad, a standard PS2-style PC keyboard or from a computer running upload/download software.

e. The system shall allow the programming of any input to activate any output or group of outputs. Systems which have limited programming (such as general alarm), have complicated programming (such as a diode matrix), are not considered suitable substitutes.

f. The FACP shall provide the following features:

1) Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.

2) Detector sensitivity test, meeting requirements of NFPA 72, Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

3) The ability to display or print system reports.

4) Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.

5) Positive Alarm Sequence (PAS presignal), meeting NFPA 72 requirements.

6) Rapid manual station reporting.

7) Non-alarm points for general (non-fire) control.

8) Periodic detector test, conducted automatically by the software.

9) Walk test, with a check for two detectors set to same address.

g. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72), and California Code. Main panel notification circuits shall also automatically synchronize any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, or Gentex with no need for additional synchronization modules

(4.) Central Microprocessor

a. The microprocessor shall be a state-of-the-art and it shall communicate with, monitor and control all external interfaces. A "watch dog" timer circuit to detect and report microprocessor failure.

b. The microprocessor shall contain and execute all specific actions to be taken in the condition of an alarm. Control programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

c. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file.

d. A special program check function shall be provided to detect common

operator errors.

e. An auto-programming capability (self-learn) shall be provided to quickly identify devices connected on the SLC and make the system operational.

f. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download. This program shall also have a verification utility which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

(5.) Local Keyboard Interface

a. In addition to an integral keypad, the fire alarm control panel will accept a standard PS2-style keyboard for programming, testing, and control of the system. The keyboard will be able to execute the system functions ACKNOWLEDGE, SIGNALS SILENCED, DRILL and RESET.

(6.) Display

a. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

b. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.

c. The display shall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, SUPERVISORY, TROUBLE, MAINTENANCE, ALARM SILENCED, DISABLED, BATTERY, and GROUND conditions.

d. The display keypad shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

e. The display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, DRILL (alarm activate), and SYSTEM RESET.

(7.) Signaling Line Circuit (SLC)

a. The SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) addressable Beam Detectors, and 159 addressable pull stations, intelligent modules (monitor or control) for a system capacity of 636 devices (2 SLC). Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.

b. The CPU shall receive information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.

c. The detector software shall meet NFPA 72, Chapter 10 requirements and be certified by UL as a calibrated sensitivity test instrument.

(8.) Serial Interfaces

a. The system shall provide a means of interfacing to UL Listed Electronic Data Processing (EDP) peripherals using the EIA-232 communications standard.

b. One EIA-232 interface shall be used to connect an UL-Listed 80-column printer.

c. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.

(9.) The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.

(10.) Digital Alarm Communicator Transmitter (DACT). The DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.

(11.) Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24-volt power supply or as a booster for powering Notification Appliances.

a. The FCPS shall offer up to 8.0 amps (6.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 18.0 amp hour batteries.

b. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a control relay. Four NAC outputs, wired NFPA Style Y or Z, shall be available for connection to the Notification devices.

c. The FCPS shall optionally provide synchronization of all connected strobes or horn strobe combinations when either System Sensor, Wheelock or Gentex devices are installed.

d. The FCPS shall function as a sync follower as well as a sync generator.

e. The FCPS shall include a surface mount backbox.

f. The Field Charging Power Supply shall include the ability to delay the reporting of an AC fail condition per NFPA requirements.

g. The FCPS shall provide 24 VDC regulated and power-limited circuitry per UL standards.

(12.) Power Supply:

a. The main power supply for the fire alarm control panel shall provide 7.0 amps of available power for the control panel and peripheral devices.

b. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

c. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.

d. The main power supply shall continuously monitor all field wires for earth ground conditions.

e. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

(13.) Programmable Electronic Sounders:

a. Electronic sounders shall operate on 24 VDC nominal.

b. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.

c. Electronic sounders shall be flush or surface mounted as shown on plans.

(14.) Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

a. The maximum pulse duration shall be 2/10 of one second.

b. Strobe intensity shall meet the requirements of UL 1971.

c. The flash rate shall meet the requirements of UL 1971.

(15.) Audible/Visual Combination Devices:

a. Shall meet the applicable requirements of Section A listed above for audibility.

b. Shall meet the requirements of Section B listed above for visibility.

(16.) Specific System Operations

a. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently programmed for verification of alarm signals. The alarm verification time period shall not exceed 2 minutes.

b. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.

c. Point Read: The system shall be able to display the following point status diagnostic functions:

1) Device status

2) Device type

3) Custom device label

4) Device zone assignments

d. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.

e. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 1000 events. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.

f. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent 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 above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display. 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.

g. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.

h. The fire alarm control panel shall include Silent and Audible Walk Test functions - Silent and Audible. It shall include the ability to test initiating device circuits and Notification Appliance Circuits from the field without returning to the panel to reset the system. The operation shall be as follows:

1) The Silent Walk Test will not sound NACs but will store the Walk Test information in History for later viewing.

2) Alarming an initiating device shall activate programmed outputs, which are selected to participate in Walk Test.

3) Introducing a trouble into the initiating device shall activate the programmed outputs.

4) Walk Test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for Walk Test shall continue to provide fire protection and if an alarm is detected, will exit Walk Test and activate all programmed alarm functions.

5) All devices tested in walk test shall be recorded in the history buffer.

6) All devices not tested in walk test shall be recorded in the history buffer.

i. Supervisory Operation

1) An alarm from a supervisory device shall cause the appropriate indication on the control panel display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

j. Signal Silence Operation

%M□□□B孯a袖XĀX□ ♦袖X榹ﾌ袖ょó The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.

k. Non-Alarm Input Operation

1) Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

P. System Components:

(1.) Addressable Pull Box (manual station)

a. 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.

b. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
c. Manual pull 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 (44 mm) or larger.
d. Exhaust Fire Alarm pull box (manual station)

(2.) Intelligent Photoelectric Smoke Detector

a. 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.
b. The detectors shall be ceiling-mounted and available in an alternate model with an integral fixed 135-degree heat-sensing element.
c. Each detector shall contain a remote LED output and a built-in test switch.
d. Detector shall be provided on a twist-lock base.
e. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
f. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall periodically flash to indicate that the detector is in communication with the control panel.
g. The detector shall not go into alarm when exposed to air velocities of up to 1500 feet per minute (fpm).
h. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
i. All field wire connections shall be made to the base through the use of a clamping plate and screw.

(3.) Intelligent Thermal Detectors

a. 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.

(4.) Addressable Dry Contact Monitor Module

a. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
b. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
c. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
d. 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 (70 mm) x 1-1/4

inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

(5.) Two-Wire Detector Monitoring

a. Means shall be provided for the monitoring of conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).

b. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).

c. The monitoring module will be compatible, and listed as such, with all devices on the supervised circuit.

d. The IDC zone may be wired for Style D or Style B (Class A or 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.

e. The monitoring module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in an surface mount backbox.

(6.) Addressable Control Relay Module

a. Addressable control relay modules shall be provided to control the operation of fan shutdown and other auxiliary control functions.

b. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.

c. The control relay module will provide a dry contact, Form-C relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.

d. The control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

(7.) Six Output Addressable Control Relay Module

a. Up to 6 Addressable intelligent control relay modules combined on one circuit board shall be provided to control the operation of fan shutdown and other auxiliary control functions.

b. Using rotary address switches, the first module shall be addressed from 01 to 154 while the remaining modules shall be automatically assigned to the next five higher addresses. Note, binary dip switches for setting address are not acceptable.

c. Provision shall be included for disabling a maximum of three unused modules

d. A single isolated set of dry relay form C contacts shall be provided for each of the 6 module addresses, which shall be capable of being wired for either a normally-open or normally-closed operation.

e. The module shall allow an addressable control panel to switch these contacts on command.

f. The module shall contain removable plug in terminal blocks capable of supporting 12 AWG to 18 AWG wire.

g. The control relays mounted on the module shall be suitable for pilot duty applications and rated for a maximum of 3.0 amps at 30 VDC, resistive, non- coded and 2.0 amps at 30 VDC maximum, resistive, coded.

(8.) Six-Zone Interface Module

a. A six zone interface module shall be provided as an interface between the addressable panel and two-wire conventional detection zones.

b. A common SLC input shall be used for all modules, and the initiating device circuits shall share a common external supervisory supply and ground.

c. The first address on the interface module shall be addressed from 01 to 154 while the remaining modules are automatically assigned to the next five higher addresses.

d. Address shall be set using decimal encoded rotary address switches. Binary address switches are not acceptable.

e. Provision shall be included for disabling a maximum of two unused addresses of the six available.

f. All two-wire detectors being monitored shall be two-wire compatibility listed with the six zone input module.

g. The six zone input module shall transmit the status of a zone of two-wire detectors to the fire alarm control panel. Status shall be reported as normal, open or alarm.

h. Removable plug-in terminals shall be provided capable of ccepting from 18 AWG up to 12 AWG wire.

(9.) Multiple Two-Wire Detector Monitoring

a. A single multi input module shall be provided for the monitoring of up to 10 conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).

b. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable point. The module will supervise the IDC for alarms and circuit integrity (opens).

c. The first address on the 10 input boards shall be set from 01 to 150 and the remaining module addresses shall be automatically assigned to the next nine higher addresses.

d. Provision shall be included for disabling a maximum of two unused addresses.

e. The supervised state (normal, open, or short) of the monitored device shall be sent back to the panel. A common SLC input shall be used for all modules, and the initiating device loops shall share a common supervisory supply and ground.

f. The IDC zone may be wired for Style D or Style B (Class A or B) operation. A green LED for each circuit shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. LEDs shall latch on when a circuit is in alarm.

(10.) Isolator Module

a. Isolator modules shall be provided to automatically isolate wire-to-wire short

circuits on an SLC Style 6 (Class A) or Style 4 (Class B branch). 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 segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.

b. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
c. 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.
d. The isolator module shall mount in a standard 4-inch (101.6 mm) 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.

(11.) ACS Serially Connected Annunciator

a. The annunciator shall communicate with the fire alarm control panel via a two wire EIA 485 (multi-drop) communications circuit.
b. The annunciator shall require no more than four wires for operation. Annunciation shall include: intelligent addressable points, system software zones, control relays, and notification appliance circuits. The following operations shall also be provided:
   2) Up to 32 annunciators, each with up to 64 points may be installed on the system.
   3) The annunciator shall include a single electrical key switch to disable all switch functions.
   4) The annunciator shall provide alarm and trouble resound, with flash for new conditions.
   5) This unit shall provide for each zone: alarm indications, using a red alarm and yellow trouble LEDs, and switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.
   6) Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.
c. This system shall provide a means of interfacing to a graphic style annunciator.
d. The graphic annunciator interface will possess the capability of individually annunciating each individual addressable device in the system.

(12.) Alphanumeric LCD Type Annunciator (terminal mode):

a. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
b. The LCD annunciator shall display all alarm and trouble conditions in the

system.

c. An audible indication of alarm shall be integral to the alphanumeric display.
d. The display shall be UL listed for fire alarm application.
e. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
f. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.

(13.) Alphanumeric LCD Type Annunciator (Ann-Bus Mode):

a. The alphanumeric display annunciator shall be a supervised, remotely located back-lit eighty (80) characters LCD display for alarm annunciation in clear English text.
b. The LCD annunciator shall display all alarm and trouble conditions in the system.
c. An audible indication of alarm shall be integral to the alphanumeric display.
d. It shall be possible to connect up to 8 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
e. Up to 8 total devices of any kind, LCD, printer gateway, LED, Relay or I/O module may be installed on the ANN-BUS.

Q. System Components - Addressable Devices

(1.) Addressable Devices - General

a. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
b. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signaling line circuits.
c. Addressable smoke and thermal (heat) 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. An output connection shall also be provided in the base to connect an external remote alarm LED.
d. 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 10.
e. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a base with a built-in (local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.
f. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.
g. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
h. Detectors shall provide address-setting means using decimal switches.

R. Batteries:

(1.) Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time (24 or 60 hours) followed by 5 minutes of alarm.

(2.) The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

(3.) If necessary to meet standby requirements, external battery/charger systems may be used.

S. Installation:

(1.) Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

(2.) All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

(3.) All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

(4.) Manual pull stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

T. Test

(1.) The service of a competent, NICET level II technician shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 10.

(2.) Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

(3.) Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

(4.) Verify activation of all waterflow switches.

(5.) Open initiating device circuits and verify that the trouble signal actuates.

(6.) Open and short signaling line circuits and verify that the trouble signal actuates.

(7.) Open and short notification appliance circuits and verify that trouble signal actuates.

(8.) Ground all circuits and verify response of trouble signals.

(9.) Check presence and audibility of tone at all alarm notification devices.

(10.) Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

(11.) Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

(12.) When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

U. Final Inspection

(1.) At the final inspection, a minimum NICET Level II technician shall demonstrate that the system functions properly in every respect.

V. Instruction

(1.) Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

(2.) The contractor or installing dealer shall provide a user manual indicating "Sequence of Operation."

15. MASTER BOX

A. Furnish and install a Type M34-92 flush mount, approved local energy type box, with Fire Department lock. The Master Box shall be equipped with a micro switch for the purpose of operating the interior alarm system, should the master box be used to initiate the alarm rather than an interior station. The inner case and movement shall be sent to the Fire Department for cutting the code wheel, testing and adjusting the movement for operation. The charge for this service shall be the responsibility of the Electrical Contractor.

B. Ground Connection: A ground connection shall be installed from the ground terminal of the fire alarm box of the electrical equipment ground of the building.

X. Notice to the Fire Alarm Division: The Fire Alarm Division shall be notified at least 48 hours in advance so that representatives of the division may be present to supervise the installation of cable.

Δ. Final Connection: The Fire Alarm Division will make all final connections to the Municipal System.

E. Location of Master Fire Alarm Box: The master fire alarm box shall be located inside the building, at a location approved by the Superintendent of Fire Alarm of the Fire Department.

Φ. Where the cable is run in pipe or tubing, all pull boxes shall be painted red an red stripe four (4) inches wide shall be painted in the pipe or tubing every ten (10) feet where such pipe or tubing is exposed. Fire Alarm cable in raceways shall be tagged every twenty (2) feet and shall have the legend "Municipal Fire Alarm Cable".

16. PHOTO CELLS

A. This Contractor shall furnish and install photoelectric controls as herein described and indicated on the plans. Photoelectric controls shall be a Tork Model 2101 or approved equal as manufactured by Intermatic or Paragon.

B. The photoelectric control shall be heavy duty, specification grade, suitable for 1/2" conduit mounting.

X. On/off adjustment shall be easily done by moving a light level selector without the use of tools. Turn on shall be 1.5 to 5.5 foot-candles. Turn off shall be approximately 3 times the turn on setting. A delay of up to two minutes shall prevent false switching.

Δ. The photoelectric control shall have an operating temperature range of -40E to 140E F. Power consumption shall average under 1 watt.

E. The enclosure shall be die cast, gasketed for maximum weatherproofing.

Φ. The cell shall be cadmium sulphide, 1" diameter.

Γ. The contacts shall be single pole single throw normally closed. Snap action prevents chatter. (Fail in the on position.)

H. The photocell shall include a 5 year manufacturer=s warranty.

17. TIME CLOCKS

A. Furnish and install all time clocks as indicated on the Drawings. Time clocks shall be as manufactured by Tork, Intermatic, or Paragon and shall contain Astronumerical dial.

18. PANELBOARDS (120/240V)

A. Panels shall be type "NQOD", bolted as manufactured by Square "D", General Electric, Siemens Electrical Products, or Cutler Hammer.

B. The electrical drawings indicate the details as to size, voltage, capacity and number of circuits necessary, including spares.

X. The panelboard shall conform to the requirements of the Underwriters' label.

Δ. Circuit breakers 1 and 2 pole for 120/240 volt application shall be type "QOB-VH" switch rated 22,000 amps interrupting capacity as indicated on drawings. Circuit breakers shall be bolt-on type.

E. All locks of all panels shall be operated by a common master key.

Φ. Furnish and install on the inside cover of all light and power panels, a neatly typed index, giving the circuit number; and opposite each number the area of equipment which that particular circuit serves or controls.

Γ. In connecting branch circuits to panels, care shall be taken to insure balance; and circuit numbering shown on plans shall be changed to prevent same circuits on same phase being connected to a common neutral.

19. DWELLING UNIT LOAD CENTERS

A. Dwelling unit load centers shall be located in each dwelling unit as indicated on the drawings.

B. Load centers shall be as manufactured by Cutler Hammer class type load center or Square D. No other manufacturers shall be installed on the project. (Homelite type is not acceptable.)

X. Provide separately mounted ground copper bus in each loadcenter, bonded to enclosure.

A. Provide snap-in, molded case circuit breakers with thermal magnetic trips. Multiple pole breakers shall be single handle, common trip (handle ties not permitted). Circuit breakers shall be Square D type "QD", Cutler Hammer type "CH-CH", or General Electric.

E. Loadcenter shall be capable of supporting additional snap in circuit breakers without modifications up to the frame size indicated on the drawings, 12 spaces minimum.

Φ. Provide fully rated circuit breakers equal to short circuit current available – series rated breakers not acceptable.

Г. Provide type name care in each loadcenter. Card shall indicate the equipment served and the dwelling unit served. Exterior marking of loadcenter shall comply with NSTAR labeling requirements for multi-dwelling services by indicating unit served on panel.

H. Provide padlock for all exterior load centers, all keyed alike to match existing maintenance department locks: ABUS KA 8302 Rust free No. T84MB/3030m. No substitutions.

I. Load center bussing shall be copper.

20. SEALED MAINTENANCE BATTERY SYSTEM

A. Equipment shall be a 12-volt emergency lighting unit of selected capacity maintenance free, medium life, sealed lead battery, and solid-state fully automatic voltage regulated charger able to recharge the battery in accordance with U.L. Standard 924. Series units shall include such controls as: "Push-to-test" switch, 120/277 dual voltage transformer; low voltage disconnect circuit; load relay with one or two fused distribution circuit; "brownout" circuit, lockout feature and two-color LED charge monitor. Equipment shall be available in two cabinet sizes...decorator compact with wood grain vinyl front and standard type...both constructed of 20-gage steel with standard beige baked enamel finish, keyhole mounting slots, removable charger and control chassis, and shall be able to accommodate the mounting of up to two tungsten halogen or sealed beam heads on unit. Equipment shall be U.L. Listed.

B. Equipment shall be manufactured by Emergilite, Chloride and Surelite. Battery capacity shall be as indicated on the Drawings.

21. LIGHT SWITCHES

A. All local wall switches shall be of the flush tumbler type, ivory, single-pole, double-pole, 3-way, or 4-way as required, as manufactured by Pass & Seymour, Hubbell, or Arrow-Hart.

B. Local switches shall be installed in such a position that they shall bear evenly and true and be secured on the axis of the supporting members.

X. Under no circumstances are wooden wedges, shims or blocks to be used in truing up local switches. Should the outlet box, in any case, come too far back of the finished surface, recess

boxes and screws of the proper length to reach the box shall be used of such a size as to form a shoulder at exactly the proper point to retain the switch in position.

Δ. Dwelling unit single-pole switches shall be Pass & Seymour CSB115-I, Leviton CSB115-I, or Hubbell CS115I.

E. Dwelling unit three-way switches shall be Pass & Seymour CSB315-I, Leviton CSB315-I or Hubbell CS315I.

Φ. Dwelling unit four-way switches shall be Pass & Seymour CSB415-I Leviton CSB415-I or Hubbell CS1224I.

Γ. Public area single pole switches shall be Pass & Seymour CSB120BI, Leviton CSB120-I or Hubbell CS120I.

H. Public area three-way switches shall be Pass & Seymour CSB320-I, Leviton CSB320-I or Hubbell CS320I.

I. Public area four-way switches shall be Pass & Seymour CSB420-I Leviton CSB420-I or Hubbell CS1224I.

22. RECEPTACLES

A. All convenience outlets shall be of the single or duplex type, back or side-wired. T-slot or polarized slot type, grounded as required, as manufactured by Pass & Seymour, Hubbell, or Arrow -Hart.

B. In general, convenience outlet circuits shall be independent of light circuits and shall not be controlled by light circuit breaker switches or light switches.

X. Duplex receptacles shall be Leviton T5320WH or equal as manufactured by Pass & Seymour, or Hubbell.

Δ. Single duplex receptacle installed on a 20-ampere branch circuit shall be Leviton TBR20-WH or equal as manufactured by Pass & Seymour, or Hubbell.

E. Receptacles for dryer shall be Pass & Seymour 3864, Leviton 278, or Hubbell 9430A.

Φ. Ground fault receptacles shall be Pass & Seymour 2091-I, Leviton 8599, or Hubbell GF5362I.

Γ. Receptacles for electric ranges shall be Pass & Seymour 3894, Leviton 279, or Hubbell HBL8450A.

23. WIRING DEVICE PLATES

A. All device plates shall be smooth ivory nylon '6" construction. Plates shall be of appropriate type and size for all wiring and control devices, signal and telephone outlets.

B. Plates shall be set so that all edges are in contact with the mounting surface. Plaster fillings will not be allowed. Multi-device locations shall have one common device plate.

X. Telephone outlet plate shall be of a similar material and finish as wiring device plates and shall be provided with a bushed hole.

Δ. Device plates shall be by the same manufacturer as devices.

E. Plates for surface type boxes shall not overlap boxes and shall be designed for use with surface boxes.

24. LIGHTING FIXTURES

A. This Contractor shall furnish and install the lighting fixtures, complete for each and every light outlet in the type, quality, and size of fixture indicated on the Drawings in the fixture schedule unless called specifically to be omitted herein. It shall be the responsibility of this Contractor to check the Drawings with the schedule for completeness, as the schedule is made up for the convenience of the bidders. In the schedule, catalog numbers are used and size of fixture that will be required.

B. This Contractor shall include all fixtures, wiring, hanging, uncrating, connecting up and making ready for operation. All fixture wires for fixtures shall not be less than #16 gauge, but larger if capaTown of fixture requires it, and furnished with type "THHN" insulated covered wire where exposed to excessive heat.

X. This Contractor shall include the cost of furnishing and installing all lamps for all fixtures under this Contract throughout.

Δ. This Contractor shall check structural and architectural details of all locations where fixtures are to be installed so that he can properly provide for installation of the fixture.

25. ELECTRONIC BALLASTS

A. Electronic Ballasts where specified as electronic shall be Triad-Utrad Ballastar electronic type for straight or "U" lamps.

B. Ballast manufacturers shall have been producing electronic ballasts for at least 10 years with a low failure rate.

X. Ballasts shall operate at an input frequency of 60 Hz rated for 108-132 volts (120V circuit).

Δ. The ballasts shall operate the lamps at a frequency of 20 to 35 KHz and have no detectable flicker.

E. Ballasts that operate as a parallel circuit shall permit other lamps to continue functioning after one lamp has failed.

Φ. Ballasts are to have fewer than 32 components to assure safe and long operation.

Γ. Ballasts shall be of the high-power factor type of 90 percent or higher, sound rated "A" or better, contain no PCB and be listed by UL.

H. Ballasts shall be marked with manufacturer's name, part number, supply voltage, sound rating, power factor, open circuit voltage, current draw for each lamp type and UL listing.

I. Ballasts shall comply with FCC and NEMA limits as to EMI or RFI and not interfere with the operation of other normal electrical equipment.

9. Ballasts shall have independent lab test reports and meet any applicable ANSI standards.

K. Ballasts shall not be affected by lamp failure and deliver normal lamp life.

Λ. Rapid Start ballasts shall provide for soft/stable start of rapid-start lamps and maintain cathode heat during operation.

M. Ballasts to be potted and in steel case.

N. Ballasts to be surge and transit protected to 6000 volts.

O. The operating temperature of ballasts is not to exceed 60 degrees centigrade at any point on case during normal operation.

26. CABLE TELEVISION DISTRIBUTION SYSTEM

A. This Contractor shall furnish and install the cable television distribution service entrance conduits and distribution of sizes indicated on the drawings.

B. It is intended that this Contractor shall install all CATV distribution system cables and outlets. Outlets and cables shall be furnished by the television system supplier and installed by the Electrical Contractor.

X. Soft iron pull wires shall be left in all empty CATV distribution system conduits for use by the owner.

Δ. Construction Details:

(1.) Belden 1829A RA6 cable shall be used to prewire television outlets in dwelling units.
(2.) The longest drop shall not exceed 150'.
(3.) The longest drops will be home run from dwelling unit closet to electric room as indicated on the plans.
(4.) All drops will be tagged with the apartment number at the lockbox location.
(5.) Do not kink, form tight (90E) ninety degree angles, pieces the plastic jacket, damage or mishandle the cable in any way.
(6.) Do not use staples, nails, tacks, etc. to secure the drop cables. Roka or Hiat cable clips or tywraps will be provided upon request.
(7.) Leave eight (8) inch tails in the television system outlet box. Leave six (6) foot tails at the lockbox location.
(8.) Proper clearance from heating or hot water pipes is to be maintained.
(9.) Cable TV finished wall plates will be installed by the Electrical Contractor.
(10.) Upon completion of the pre-wiring and final inspection by COMCAST, active plant will be brought to the building and spliced into servicing equipment.
(11.) COMCAST must be given timely notice if system (hard line) must be brought into the building prior to the completion of the finish work.
(12.) At least three inch (3") PVC conduit is to be used for all underground feeds. Timely notice must be given so that correct size can be determined.
(13.) Any conduit is to be buried at a depth no less than eighteen inches (18").
(14.) No ninety degree (90E) sweeps or bends in conduit are permissible. The most acute angle acceptable is forty-five (45E) degrees.
(15.) Nylon pull lines are to be provided for future use. The conduit is to be capped at either end. Any damaged or poorly installed conduit will be the responsibility of the owner/contractor.

27. TELEPHONE SYSTEM

A. The Electrical Subcontractor shall furnish and install all wall phone outlets, and associated wiring so as to provide a complete and working telephone system between all telephone outlets, telephone network interface units and the building main telephone backboard.

B. The Electrical Subcontractor shall be responsible for all telephone system wiring between wall phone outlet, telephone network interface unit and the building main telephone backboard. Telephone outlet wiring shall be cat. 5e cable.

X. The Electrical Contractor shall not daisy chain telephone outlet wiring.

Δ. The Electrical Subcontractor shall be responsible for all telephone system cables between telephone backboards on respective floors.

E. The Electrical Subcontractor shall be responsible for providing all telephone wall plates and phone jacks.

Φ. The Electrical Subcontractor shall be responsible for furnishing and installing 110 punch blocks for tenant telephone cable terminal. The Electrical Subcontractor shall be responsible to punch down telephone cables on the punch block. The Electrical Subcontractor shall coordinate termination with Verizon.

28. ACCESS PANELS

A. Furnish for installation by the appropriate trades, all metal access panels, if required, for access to services provided under this Section.

B. Panels shall be of the type described under section 083100 "Access Doors and Panels".

X. The exact locations and sizes of all access panels shall be coordinated with the General Contractor.

29. MULTI-METERING EQUIPMENT

A. Multi-metering equipment shall be Siemens Electrical Products, Square "D", General Electric, or Cutler Hammer. All components shall have been tested and Underwriters' laboratories listed for use as an integral part of the multi-metering system. This equipment shall be manufactured according to NEMA standards. Installation shall be made a herein specified and shown on the Drawings.

B. Enclosure shall be constructed of formed and welded code gauge sheet metal, finished with gray baked enamel over a rust-inhibiting phosphate primer and suitable for indoor surface mounting. Mounting holes shall be provided in the back of each device for attaching to walls or other vertical support. All devices must be bonded together with bolted connection. Meter units shall be provided with individual removable covers for each meter position. All compartments containing unmetered circuits shall be provided with sealing means. Each circuit breaker shall be provided with sealing means. Each circuit breaker position shall be provided with means for sealing or padlocking each individual breaker in the OFF position. Equipment shall be series rated for 65,000 amperes.

X. All components shall be factory assembled with all current carrying parts constructed of plated bus bars. components shall be constructed of such design as to require only main inter-connecting cross bus to provide a complete bussed meter center. Meter units must be connected in a "hot" sequence arrangement.

A. Meter-breaker components must be of such design to permit arrangement to allow load conduits to enter at the top or bottom in the same assembly.

E. Meter sockets shall be 125 amp 5-jaw non-circuit closing type.

30. MULTI-TENANT ENTRY SECURITY SYSTEM

A. The Electrical Contractor shall furnish and install an audio/visual entryphone intercom system as herein described.

B. SYSTEM DESCRIPTION – ENTRANCE STATION

(1.) Calling Tenant Station:

a. Direct Selection:
   1) Press call button for residence you want to call.
   2) You will hear muted-volume call tone at entrance station.

b. Entrance light will turn on if you push call button that has been programmed to activate a light.

c. Digital Name Scrolling:
   1) Display tenant name you want to call and press call button.
   2) You will hear muted-volume call tone at entrance station.
   3) Make call by one of the following:
      a) Name scrolling.
      b) Entering room number.
      c) Entering letters and selecting corresponding name.

d. Calling Security Guard Station:
   1) Press call button once.
   2) You will hear muted-volume call tone at entrance station.

e. Door Release:
   1) Enter access code.
   2) Tenant and security guard can release door associated with entrance station when called, by pressing their "key" button. Not just released at entrance by access code.
   3) Door release function will activate at entrance station.

X. SYSTEM DESCRIPTION – TENANT STATION

(1.) Responding to Call:

a. When call is from entrance station or security guard station, call tone will ring at tenant station for approximately 10 seconds. Image will be displayed on tenant monitor station.

b. On tenant station, press talk button within set time to respond and talk hands free.

c. If you press and hold talk button for 1 second before speaking, beep will be emitted and you can communicate by press-to-talk communication.

d. In press-to-talk communication, press talk button to talk and release it to listen.

e. When you are done talking, press and hold down talk button.
f. Communication will be ended automatically after approximately 1 minute when hands free communication is used at tenant station or after approximately 3 minutes when handset is used.

(2.) Door Release:
a. Press door release button while in communication.
b. Door release function will activate on entrance station that is in communication.
c. Depending on electric door release system that is used, door release may be active only while door release button is pressed.
d. Door release timer can be set to activate from 0.5 to 20 seconds or momentary.

Δ. Entrance Monitoring:

(1.) With monitor station, you can monitor entrance stations if you press door release button while system is in standby mode. (System settings required to enable this feature.)
(2.) You can switch between entrance stations by pressing door release button.
(3.) Entrance monitoring is possible for only one tenant station at a time.
(4.) If you press talk button while monitoring, you can communicate with that entrance station.
(5.) If a call is received while monitoring, monitoring is terminated.
(6.) Monitoring lasts for 30 seconds. If you press door release button within 30 seconds, monitor screen will switch to next entrance station and 30-second monitoring timer will restart.

E. SUBMITTALS

(1.) Comply with Section 01330 (01 33 00) – Submittal Procedures.

Φ. MANUFACTURER

(1.) The audio/visual entryphone system shall be manufactured by Aiphone Corporation, 1700 130th Avenue NE, Bellevue, Washington 98005 or approved equal. Toll Free (800) 692-0200. Phone (425) 455-0510. Fax (425) 455-0071. Website www.aiphone.com. E-mail info@aiphone.com.

Γ. MULTI-TENANT ENTRY SECURITY SYSTEM

(1.) Multi-Tenant Entry Security System: Aiphone "GH Series".
a. Power Supply: 24 V DC, supplied by [Model PS-2410LC, 110 V AC]
b. Current Consumption:
1) Model GH-BC: 0.9 A.
2) Model GH-VBC: 0.9 A.
3) Model GH-NS: 0.15 A.
4) Model GH-MK: 0.18 A.
5) Model GH-BCX: 0.35 A.
c. Call Tones: Different types of call tones:
1) From entrance station.
2) From security guard station.
3) From doorbell button.
d. Talk and Video Path: Single channel, non-open.

e. Communication: Hands-free, voice-actuated communication or push-to-talk communication.
f. Door Release:
   1) Connecting Terminals: Between ELM-ELC (N/O) and ELB-ELC (N/C).
   2) Less than 4 A (resistance load), 24 V AC/DC, dry-closure contact.
g. Wiring: Two conductor cables.
h. Type of Cables:
   1) Pair cable (solid wire, not stranded).
   2) Polyethylene insulated.
   3) Mid capacitance.
   4) Diameter: 20 AWG to 18 AWG.
i. Operating Temperatures:
   1) Entrance Station: 14 degrees F to 140 degrees F (minus 10 degrees C to 60 degrees C).
   2) Tenant Station: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).
   3) Security Guard Station: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).
   4) Control Unit: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).

(2.) Station Capacity:
a. Standard System:
   1) Tenant Stations: 48.
   2) Tenant Stations in Same Residence: 4. 2 video and 2 audio stations, or 4 audio stations.
   3) Entrance Stations: 5.
   4) Security Guard Stations: 2.
b. Expanded System:
   1) Tenant Stations: 500.
   2) Tenant Stations in Same Residence: 4. 2 video and 2 audio stations, or 4 audio stations.
   3) Entrance Stations: 16.
   4) Security Guard Stations: 4.

H. TENANT STATIONS

(1.) Tenant Station: Model GH-1KD.
a. Hands free.
b. Video Monitor: 3.5-inch, color, LCD.
c. Color: White.
d. Microphone.
e. Speaker.
f. Door release button/monitor button.
g. Talk button.
h. Talk LED.
i. Call tone off LED.
j. Monitor brightness control.
k. Receive volume control.

l. Call tone volume control.

I. ENTRANCE STATIONS

(1.) Direct-Select Call-Button Entrance Station:
a. Flush-mount box.
b. Postal lock module.
(2.) Digital Name Scrolling Entrance Station:
a. Camera Module GH-VA:
1) Camera.
(3.) CCTV interface module GH-VAX.
(4.) Speech Module GH-DA:
a. Speaker.
b. In-use LED.
c. Microphone.
(5.) Digital Name Scrolling Module GH-NS:
a. Display.
b. Cancel button (or set and return).
c. Back search button (or move cursor to left).
d. Forward search button (or move cursor to right).
e. Call button (or set and move forward).
(6.) Digital Keypad Module GH-10K:
a. 10-key (0-9, *, #) pad.
(7.) Card Reader Module: [GF-HID ProxPoint Plus embedded HID card reader] [GF-HID-I iCLASS embedded HID card reader].
a. Flush-mount box.
b. Postal lock module.

9. INSTALLATION

(1.) Install multi-tenant entry security system in accordance with manufacturer's instructions at locations indicated on the Drawings.
(2.) Mount equipment plumb, level, square, and secure.
(3.) Program system in accordance with manufacturer's instructions using supplied software set-up tool.

K. ADJUSTING

(1.) Adjust multi-tenant entry security system for proper operation in accordance with manufacturer's instructions.

A. DEMONSTRATION AND TRAINING

(1.) Demonstration:
a. Demonstrate that multi-tenant entry security system functions properly.
b. Perform demonstration at final system inspection by qualified representative of manufacturer.
(2.) Instruction and Training:
a. Provide instruction and training of Owner's personnel as required for operation of multi-tenant entry security system.

b. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.
c. Provide instruction and training by qualified representative of manufacturer.

M. PROTECTION

(1.) Protect installed multi-tenant entry security system from damage during construction.

31. ELECTRIC HEATING EQUIPMENT

A. The Electrical Contractor shall install and wire all electric heating equipment as specified and indicated on the Drawings and HVAC schedules.

B. Heaters shall be of the size and voltage indicated by schedule on the Drawings.

32. FIRE PROOF SEAL MATERIAL

A. Fire Stop Foam:

(2.) The fire stopping sealant shall be a one-part, neutral curing silicone sealant. The sealant shall be completely water resistant and shall contain neither solvents nor inorganic fibers of any kind. The through-penetration firestop sealant shall allow movement of +25% and shall be UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479). The firestop joint sealant shall allow movement up to + 50% and shall be UL Classified and tested to the requirements of UL2079.

B. Firestop Mortar:

(3.) The fire stopping material shall be a lightweight, fast drying Portland cement based material. The density of the wet mortar shall be < 45 lb./cu.ft. The specified mortar shall be approved for a wide range of applications including combustible and non-combustible penetrants when used by itself or in combination with other products from the same manufacturer. The firestop mortar shall be UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479).

33. PHOTOELECTRIC SMOKE DETECTORS

A. The Electrical Contractor shall furnish and install a single station photoelectric smoke detector as indicated on the drawings.

B. The smoke alarm shall be a BRK Model 701B or equal battery and shall provide at a minimum the following features and functions:

(1.) A photo electric smoke sensing chamber.
(2.) The unit shall be capable of self restoring.
(3.) Fully screened sensing chamber to resist entry of small insects thereby reducing the probability of unwanted alarms.
(4.) Powered by a 120V AC, 60 Hz and have a monitored 9V battery backup model (7010B only), and a solid state piezo horn rated at 85dB at 10 ft.
(5.) A visual green LED power-on indicator to confirm unit is receiving power or it in alarm.

(6.) A full function test button should check all alarm functions by simulating a smoke condition, causing the unit to alarm.
(7.) Silence feature – Temporarily silence unwanted nuisance alarm.
(8.) Two locking features – tamper resistant locking pins that lock battery drawer and/or alarm to mounting bracket.
(9.) The unit shall be capable of operating between 40°F (4°C) and 100°F (38°C) and relative humidity between 10% and 90%.
(10.) The unit shall have a gasketless base for easy installation and be capable of keeping alarm secure over a wide rotation range to allow for true alarm alignment.
(11.) The unit shall have a plug in connection and be capable of interconnection of up to 18 alarms, 12 of which can be smoke alarms.
(12.) The unit shall at a minimum meet the requirements of UL217, CSFM, NFPA 72, NFPA 101, ICC.

34. COMBINATION SMOKE/CARBON MONOXIDE DETECTORS

(1.) A photoelectric sensing chamber and electrochemical CO sensor.
(2.) A Voice Warning of danger detected (Smoke or Carbon Monoxide) in addition to speaking one of 11 pre-programmed locations, e.g. "Warning, Evacuate, Smoke in Basement".
(3.) The unit shall have a lower and varying horn frequency to to make it easier for the elderly with normal age related hearing loss to better hear the horn and be rated 85db at 10 ft.
(4.) The unit shall be capable of self restoring.
(5.) A fully screened smoke sensing chamber to prevent entry of small insects thereby reducing the probability of unwanted alarms.
(6.) Powered by 120V AC, 60Hz and have a monitored battery backup (two 1 .5V Alkaline AA batteries).
(7.) Two Latching features: Alarm Latch to easily identify initiating alarm after alarm condition has subsided by displaying a blinking red light by corresponding alarm indicators. Low battery latch to visually identify which unit is in low battery condition by displaying a blinking green light by the Power indicator.
(8.) Two Silence Features: Alarm Silence to temporarily silence nuisance alarms. Low Battery Silence to silence low battery chirp for up to 8 hours
(9.) Optipath 360 technology that provides 360 (degree symbol) of direct access to the smoke sensor
(10.) A visual LED (green) power-on indicator to confirm unit is receiving power. A visual LED (red) power-on indicator to confirm unit has switched to battery backup.
(11.) A single button test/silence feature. Test button should check all alarm functions by simulating a smoke or CO condition, causing the unit to alarm.
(12.) The unit shall be capable of operating between 40°F (4°C) and 100°F (38°C) and relative humidity between 10% and 95%.
(13.) The unit shall mount to any standard electrical box up to 4" size without screw removal and shall be listed for wall or ceiling mounting.
(14.) The unit shall have a locking mechanism to deter battery removal and/or theft of the unit.
(15.) Feature a quick-connect wiring harness and be capable of interconnecting up to 18 devices, 12 of which can be smoke alarms.

(16.) The unit shall at a minimum meet the requirements of UL21 7, UL 2034, CSFM, NFPA 72, NFPA 720, NFPA 101, ICC.

PART 3 – EXECUTION

1. DRAWINGS

A. The drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangements of equipment, ducts, conduits, and fixtures. The locations of all items shown on the drawings or called for in the Specifications that are not definitely fixed by dimensions are approximate only. The exact location necessary to secure the best conditions and results must be determined at the project and shall have the approval of the Architect before being installed. This Contractor shall follow drawings in laying out work and checking drawings of other trades to verify spaces in laying out work to be installed.

B. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Architect shall be notified before proceeding with the installation. If directed by the Architect, this Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work. The Architect shall be the sole judge of what a "reasonable modification" in the layout is.

2. COORDINATION OF TRADES

A. This Contractor shall give cooperation to other trades and shall furnish (in writing, with copies to the Architect) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay and in accordance with General and Supplementary Conditions.

B. Refer to Section 013000 Coordination Drawings.

3. PROCEDURE

A. This Contractor shall provide all labor and materials necessary for the complete and substantial execution of the work, including all transportation, scaffolding, apparatus, utensils, tools, etc., requisite for the faithful performance of the work to the true intent and meaning of the Specifications, Drawings, and in accordance with General and Supplementary Conditions. All workmanship and materials shall be of the best of their respective kinds.

B. This Contractor shall store his material and equipment prior to installation only where designated by the Owner. He shall be responsible for all his property stored on the premises and shall hold the Owner free from liability for loss by theft or carelessness of employees of the Owner, or of other Contractors. This Contractor must take particular care to protect any finished work from injury caused thereto by his operations. After completion of the work, this Contractor shall remove all waste, rubbish and other materials left as a result of his operations and leave the premises in clean condition.

4. FIELD MEASUREMENTS

A. This Contractor shall verify in the field all measurements necessary for his work and shall assume responsibility for this accuracy.

5. WORKMANSHIP

A. The entire work provided in this Specification shall be constructed and finished in every respect in a workmanlike and substantial manner. It is not intended that the drawings shall show every pipe, fitting and appliance, but this Contractor shall furnish and install all such parts as may be necessary to complete the systems in accordance with the best trade practice and satisfaction of the Architect.

6. CLEANING AND PROTECTION

A. All materials and equipment shall be carefully protected during shipment and protected during installation and properly handled and stored at the job site so as to prevent damage. This Contractor shall assume full responsibility for protection of work until its completion and final acceptance.

B. Upon completion of this work, this Contractor shall clean all fixtures and equipment and replace damaged parts. Upon failure of this Contractor to fulfill his obligation, this work will be taken care of at his expense.

7. INSTALLATION OF WIRING AND CONDUIT

A. In general, all conduits shall be run concealed unless otherwise indicated to be run exposed.

B. Exposed conduits shall be run parallel to, or at right angles to, the walls of the building, and all bends shall be made with standard conduit ells or conduits bent to, not less than, the same radius. Horizontal runs of exposed conduits shall be close to ceiling beams, passing over water or other piping where possible and shall be supported by pipe straps or by other approved means, not more than 5' apart. Installation of exposed conduits in finished areas of the building shall be checked with the Architect for layout before installation to conform to the pattern of the structural members, an when completed, is to present the most unobtrusive appearance possible. No exposed conduits will be permitted on walls or partitions in public areas.

X. In no place shall a conduit be run within 3" of hot water pipes, or appliances, except where crossing is unavoidable and, in that case, the conduit shall be kept at least 1" from covering or pipe crossed.

Δ. Conduits shall be supported on approved type if galvanized wall brackets, ceiling trapeze, strap hangers or pipe straps, secured by means of toggle bolts on hollow masonry units or expansion bolts in concrete or brick, matching screws on metal surfaces and wood screws on wood construction. No nails shall be used as a means of fastening boxes or conduits.

E. In general, no splices or joints will be permitted in either feeder or branches except at outlets or accessible junction boxes.

Φ. All splices in wire #8 AWG and smaller shall be standard pigtail, made mechanically tight, soldered and insulated with proper thickness of insulating tape. Wire splicing nuts as manufactured by Minnesota Mining Company (Scotch Lock) or Ideal wire nuts may be used, subject to the local wire inspector.

F. Wire #6 and larger shall be connected to panels and apparatus by means of approved lugs or connectors. Connectors shall be solderless type, sufficiently large to enclosure all strands of the conductors and securely fastened.

8. CUTTING, PATCHING AND DRILLING

A. It shall be the duty of the General Contractor to provide all cutting, patching, and drilling for electrical installation in accordance with General and Supplementary Conditions.

9. GROUNDING

A. This Contractor shall furnish all fittings, clamps, conduits and wire of proper size to make ground connections between all apparatus and conduit and the water piping as required by the latest edition of the Massachusetts Electrical Code and as indicated on the Drawings. Any ground wires shall be run in conduit of size required by the Massachusetts Electrical Code.

10. QUIET OPERATION

A. All equipment and material furnished by this Contractor shall operate under all conditions of load without objectionable noises or vibrations, which, in the opinion of the Architect, is objectionable. Where sound or vibration conditions arise which is considered objectionable by the Architect, this Contractor shall eliminate same in a manner approved by the Architect.

11. FINAL INSPECTION AND TEST

A. Prior to test, feeders and branches shall be continuous from service contact point to each outlet; all panels, feeders and devices connected and fuses in place. Test system free from short circuits and grounds with insulation resistances not less than outlined in the Massachusetts Electrical Code. Provide testing equipment necessary and conduct test in presence of the Owner's authorized representative.

12. GUARANTEE

A. All materials, items of equipment and workmanship furnished under this Section shall carry the standard warranty against all defects in materials and workmanship for a period of not less than one (1) year from the date of final acceptance of the work and in accordance with General and Supplementary Conditions.

13. SLEEVES AND OPENINGS

A. Sleeves and openings for piping through walls, floors and other parts of the structure shall be provided at all points shown on the Contract Drawings and where indicated by the Architect. The conduit shall go through the sleeve consisting of the next size conduit that will provide clearance. Sleeve ends shall be flush with surfaces.

14. WIRING METHODS

A. Fire alarm system wiring shall be installed concealed and shall be installed in electrical metallic tubing where wiring is to be installed exposed or as indicated on the electrical drawings.

B. Fire alarm system initiation circuit wiring shall be twisted pair non-shielded cable as required by the manufacturer.

X. Branch circuit wiring installed exposed shall be installed in electrical metallic tubing where exposed in non public areas.

A. Branch circuit wiring shall be armored cable type "MC" cable.

E. Feeders to the dwelling unit load centers and the office panelboard from the electrical distribution system shall be armored cable (copper) between electrical metering and distribution equipment and respective dwelling unit load centers.

Φ. Feeders to house panelboards shall be installed in electrical metallic tubing.

Γ. Site utility services and raceways shall be installed in Schedule A40" PVC conduit encased in concrete as indicated on the Drawings..

H. All service equipment wiring shall be installed in rigid steel conduit.

I. The site cable television distribution system shall be installed in Schedule A40" PVC conduit encased in concrete as indicated on the Drawings.

9. The site telephone distribution system shall be installed in Schedule A40" PVC conduit encased in concrete as indicated on the Drawings.

K. Building cable television distribution system shall be installed concealed.

Λ. The building entry intercom system wiring shall be installed concealed.

M. Telephone system wiring shall be installed concealed.

N. Cable television system shall be installed concealed..

15. SUPERINTENDENCE OF WORK

A. This Contractor shall give his personal superintendence to the work and shall retain at the job site during the period of construction, a competent foreman, satisfactory to the Architect, who shall be in full charge of the work under this Section in accordance with General and Supplementary Conditions.

16. SITE VISITATION

A. This Contractor shall be required to visit the site and to have examined the existing conditions which may affect his work under this Contract and in accordance with General and Supplementary Conditions. Failure to do so shall be his responsibility and no claims for extra compensation or extension of time shall be allowed because of lack of compliance herewith.

17. CONFLICT BETWEEN PLANS AND SPECIFICATIONS

A. In case of conflict between contract plans and the specifications the Architect will decide which takes precedence.

18. PROTECTION

A. This Contractor shall be responsible for his work and equipment until finally inspected, tested and accepted; careful storage of materials and equipment which are not immediately installed after delivery to site; and closure of open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material and in accordance with General and Supplementary Conditions.

19. SECONDARY ELECTRICAL SERVICE

A. Secondary services will be 120/208 volts, 3-phase, 4-wire, originating at building pad-mounted transformer.

B. NSTAR will furnish and install meters, current transformers and test switches for installation by this Contractor.

X. The Contractor shall make final connection to the secondary terminals of the building pad mounted transformer.

Δ. The Owner shall pay all backcharges assessed by NSTAR for electric service installation.

END OF SECTION

JOSEPH SIMES HOUSE
PHASE 2
ELECTRICAL / 16100-478

ATTACHMENT 2

Commonwealth of Massachusetts Prevailing Wage Rates and Certificate of Compliance

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The Massachusetts Prevailing Wage Law
M.G.L. ch. 149, §§ 26 - 27

NOTICE TO AWARDING AUTHORITIES

- The enclosed wage schedule applies only to the specific project listed at the top and will remain in effect for the duration of the project.
- You should request an updated wage schedule from the Division of Occupational Safety if you have not opened bids or selected a contractor within 90 days of the date of issuance of the enclosed wage schedule.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project for which it has been issued.
- Once a contractor has been selected by the awarding authority, the wage schedule shall be made a part of the contract for that project.

NOTICE TO CONTRACTORS

- The enclosed wage schedule must be posted in a conspicuous place at the work site during the life of the project.
- The wages listed on the enclosed wage schedule must be paid to employees on public works projects regardless of whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.
- The enclosed wage schedule applies to all phases of the project including the final clean-up. Contractors whose only role is to perform final clean-up must pay their employees according to this wage schedule.
- All apprentices must be registered with the Massachusetts Division of Apprentice Training in order to be paid at the reduced apprentice rates. If a worker is not registered with the Division of Apprentice Training, they must be paid the "total rate" listed on the wage schedule regardless of experience or skill level. For further information, please call (617) 727-3486 or write to the Division of Apprentice Training, 399 Washington Street, 4th Floor, Boston, MA 02108

WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE

In accordance with Massachusetts General Law c. 149, §27B, a true and accurate record must be kept of all persons employed on the public works project for which the enclosed rates have been provided. A Payroll Form is available from the Department of Labor Standards (DLS) at www.mass.gov/dols/pw and includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the contract.

On a weekly basis, every contractor and subcontractor is required to submit a certified copy of their weekly payroll records to the awarding authority; this includes the payroll forms and the Statement of Compliance form. The certified payroll records must be submitted either by regular mail or by e-mail to the awarding authority. Once collected, the awarding authority is required to preserve those records for three years from the date of completion of the project.

Each such contractor and subcontractor shall furnish weekly **and** within 15 days after completion of its portion of the work, to the awarding authority directly by first-class mail or e-mail, a statement, executed by the contractor, subcontractor or by any authorized officer thereof who supervised the payment of wages, this form, accompanied by their payroll:

STATEMENT OF COMPLIANCE

_____, 20_____

I,_____,_____
(Name of signatory party) (Title)

do hereby state:

That I pay or supervise the payment of the persons employed by

_____ on the _____
(Contractor, subcontractor or public body) (Building or project)

and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty nine of the General Laws.

Signature _____

Title _____

MASSACHUSETTS WEEKLY CERTIFIED PAYROLL REPORT FORM

Company's Name:	Address:	Phone No.:	Payroll No.:

Employer's Signature:	Title:	Contract No:	Tax Payer ID Number	Work Week Ending:

Awarding Authority's Name:	Public Works Project Name:	Public Works Project Location:	Min. Wage Rate Sheet Number

General / Prime Contractor's Name:	Subcontractor's Name:	"Employer" Hourly Fringe Benefit Contributions

Employee Name & Complete Address	Work Classification:	Employee is OSHA 10 certified (?)	Appr. Rate (%)	Hours Worked Su.	Mo.	Tu.	We.	Th.	Fr.	Sa.	Project Hours (A) All Other Hours	Hourly Base Wage (B)	Health & Welfare Insurance (C)	ERISA Pension Plan (D)	Supp. Unemp. (E) (B+C+D+E)	Total Hourly Prev. Wage (F) (A x F)	Project Gross Wages Total Gross Wages	Check No. (H)

Are all apprentice employees identified above currently registered with the MA DLS's Division of Apprentice Standards? YES ☐ NO ☐

For all apprentices performing work during the reporting period, attach a copy of the apprentice identification card issued by the Massachusetts Department of Labor Standards / Division of Apprentice Standards. No apprentices are identified above ☐

NOTE: Pursuant to MGL c. 149, s. 27B, every contractor and subcontractor is required to submit a **true and accurate** copy of their certified weekly payroll records to the awarding authority by first-class mail or e-mail. In addition, each weekly payroll must be accompanied by a statement of compliance signed by the employer. Failure to comply may result in the commencement of a criminal action or the issuance of a civil citation.

Date Received by Awarding Authority
/ /

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

RONALD L. WALKER, II
Secretary

WILLIAM D MCKINNEY
Director

Awarding Authority: Town of Plymouth

Contract Number: 21611 **City/Town:** PLYMOUTH

Description of Work: Simes House General Construction, includes selective demolition, site work, site utilities, elevator installation, new finishes, mechanical systems, electrical systems, plumbing systems & misc. items.

Job Location: 29 Manomet Point Rd

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. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on 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 authority 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

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	06/01/2016	$32.15	$10.41	$10.08	$0.00	$52.64
	08/01/2016	$32.15	$10.91	$10.08	$0.00	$53.14
	12/01/2016	$32.15	$10.91	$10.89	$0.00	$53.95
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	06/01/2016	$32.22	$10.41	$10.08	$0.00	$52.71
	08/01/2016	$32.22	$10.91	$10.08	$0.00	$53.21
	12/01/2016	$32.22	$10.91	$10.89	$0.00	$54.02
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	06/01/2016	$32.34	$10.41	$10.08	$0.00	$52.83
	08/01/2016	$32.34	$10.91	$10.08	$0.00	$53.33
	12/01/2016	$32.34	$10.91	$10.89	$0.00	$54.14
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$88.29	$9.80	$19.23	$0.00	$117.32
AIR TRACK OPERATOR *LABORERS - ZONE 2*	06/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50
	12/01/2016	$33.15	$7.45	$12.65	$0.00	$53.25
For apprentice rates see "Apprentice- LABORER"						
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2015	$34.38	$10.40	$5.95	$0.00	$50.73
ASPHALT RAKER *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 2*	06/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50
	12/01/2016	$33.15	$7.45	$12.65	$0.00	$53.25
For apprentice rates see "Apprentice- LABORER"						
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2016	$41.62	$6.97	$16.21	$0.00	$64.80
	01/01/2017	$42.92	$6.97	$16.21	$0.00	$66.10

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$27.05	$6.97	$10.54	$0.00	$44.56
2	65	$27.05	$6.97	$10.54	$0.00	$44.56
3	70	$29.13	$6.97	$11.35	$0.00	$47.45
4	75	$31.22	$6.97	$12.16	$0.00	$50.35
5	80	$33.30	$6.97	$12.97	$0.00	$53.24
6	85	$35.38	$6.97	$13.78	$0.00	$56.13
7	90	$37.46	$6.97	$14.59	$0.00	$59.02
8	95	$39.54	$6.97	$15.40	$0.00	$61.91

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$27.90	$6.97	$10.54	$0.00	$45.41
2	65	$27.90	$6.97	$10.54	$0.00	$45.41
3	70	$30.04	$6.97	$11.35	$0.00	$48.36
4	75	$32.19	$6.97	$12.16	$0.00	$51.32
5	80	$34.34	$6.97	$12.97	$0.00	$54.28
6	85	$36.48	$6.97	$13.78	$0.00	$57.23
7	90	$38.63	$6.97	$14.59	$0.00	$60.19
8	95	$40.77	$6.97	$15.40	$0.00	$63.14

Notes:

Apprentice to Journeyworker Ratio:1:5

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (QUINCY)*	02/01/2016	$49.86	$10.18	$19.14	$0.00	$79.18
	08/01/2016	$50.76	$10.18	$19.22	$0.00	$80.16
	02/01/2017	$51.33	$10.18	$19.22	$0.00	$80.73

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 Quincy*

Effective Date - 02/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.93	$10.18	$19.14	$0.00	$54.25
2	60	$29.92	$10.18	$19.14	$0.00	$59.24
3	70	$34.90	$10.18	$19.14	$0.00	$64.22
4	80	$39.89	$10.18	$19.14	$0.00	$69.21
5	90	$44.87	$10.18	$19.14	$0.00	$74.19

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.38	$10.18	$19.22	$0.00	$54.78
2	60	$30.46	$10.18	$19.22	$0.00	$59.86
3	70	$35.53	$10.18	$19.22	$0.00	$64.93
4	80	$40.61	$10.18	$19.22	$0.00	$70.01
5	90	$45.68	$10.18	$19.22	$0.00	$75.08

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$37.20	$7.45	$13.75	$0.00	$58.40
	12/01/2016	$38.20	$7.45	$13.75	$0.00	$59.40
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$36.05	$7.45	$13.75	$0.00	$57.25
	12/01/2016	$37.05	$7.45	$13.75	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$36.05	$7.45	$13.75	$0.00	$57.25
	12/01/2016	$37.05	$7.45	$13.75	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	03/01/2016	$37.10	$9.80	$16.82	$0.00	$63.72
	09/01/2016	$38.08	$9.80	$16.82	$0.00	$64.70
	03/01/2017	$39.05	$9.80	$16.82	$0.00	$65.67
	09/01/2017	$40.06	$9.80	$16.82	$0.00	$66.68
	03/01/2018	$41.06	$9.80	$16.82	$0.00	$67.68
	09/01/2018	$42.10	$9.80	$16.82	$0.00	$68.72
	03/01/2019	$43.13	$9.80	$16.82	$0.00	$69.75

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.55	$9.80	$1.63	$0.00	$29.98
2	60	$22.26	$9.80	$1.63	$0.00	$33.69
3	70	$25.97	$9.80	$11.93	$0.00	$47.70
4	75	$27.83	$9.80	$11.93	$0.00	$49.56
5	80	$29.68	$9.80	$13.56	$0.00	$53.04
6	80	$29.68	$9.80	$13.56	$0.00	$53.04
7	90	$33.39	$9.80	$15.19	$0.00	$58.38
8	90	$33.39	$9.80	$15.19	$0.00	$58.38

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.04	$9.80	$1.63	$0.00	$30.47
2	60	$22.85	$9.80	$1.63	$0.00	$34.28
3	70	$26.66	$9.80	$11.93	$0.00	$48.39
4	75	$28.56	$9.80	$11.93	$0.00	$50.29
5	80	$30.46	$9.80	$13.56	$0.00	$53.82
6	80	$30.46	$9.80	$13.56	$0.00	$53.82
7	90	$34.27	$9.80	$15.19	$0.00	$59.26
8	90	$34.27	$9.80	$15.19	$0.00	$59.26

Notes:

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (QUINCY)*	01/01/2016	$46.44	$10.90	$18.71	$1.30	$77.35

Apprentice - *CEMENT MASONRY/PLASTERING - Eastern Mass (Quincy)*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.22	$10.90	$12.21	$0.00	$46.33
2	60	$27.86	$10.90	$13.71	$1.30	$53.77
3	65	$30.19	$10.90	$14.71	$1.30	$57.10
4	70	$32.51	$10.90	$15.71	$1.30	$60.42
5	75	$34.83	$10.90	$16.71	$1.30	$63.74
6	80	$37.15	$10.90	$17.71	$1.30	$67.06
7	90	$41.80	$10.90	$18.71	$1.30	$72.71

Notes:

Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

Apprentice to Journeyworker Ratio:1:3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CHAIN SAW OPERATOR *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$45.23	$10.00	$15.15	$0.00	$70.38
	12/01/2016	$46.48	$10.00	$15.15	$0.00	$71.63
	06/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
	12/01/2017	$48.48	$10.00	$15.15	$0.00	$73.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$30.40	$10.00	$15.15	$0.00	$55.55
	12/01/2016	$31.27	$10.00	$15.15	$0.00	$56.42
	06/01/2017	$31.96	$10.00	$15.15	$0.00	$57.11
	12/01/2017	$32.65	$10.00	$15.15	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2016	$49.51	$7.85	$16.10	$0.00	$73.46
	07/01/2016	$50.46	$7.85	$16.10	$0.00	$74.41
	01/01/2017	$51.41	$7.85	$16.10	$0.00	$75.36

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.76	$7.85	$0.00	$0.00	$32.61
2	55	$27.23	$7.85	$3.66	$0.00	$38.74
3	60	$29.71	$7.85	$3.99	$0.00	$41.55
4	65	$32.18	$7.85	$4.32	$0.00	$44.35
5	70	$34.66	$7.85	$14.11	$0.00	$56.62
6	75	$37.13	$7.85	$14.44	$0.00	$59.42
7	80	$39.61	$7.85	$14.77	$0.00	$62.23
8	90	$44.56	$7.85	$15.44	$0.00	$67.85

Effective Date - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.23	$7.85	$0.00	$0.00	$33.08
2	55	$27.75	$7.85	$3.66	$0.00	$39.26
3	60	$30.28	$7.85	$3.99	$0.00	$42.12
4	65	$32.80	$7.85	$4.32	$0.00	$44.97
5	70	$35.32	$7.85	$14.11	$0.00	$57.28
6	75	$37.85	$7.85	$14.44	$0.00	$60.14
7	80	$40.37	$7.85	$14.77	$0.00	$62.99
8	90	$45.41	$7.85	$15.44	$0.00	$68.70

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 2*	12/01/2015	$35.50	$7.45	$13.55	$0.00	$56.50

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER"						
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2015	$36.50	$7.45	$13.55	$0.00	$57.50
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 2*	12/01/2015	$36.25	$7.45	$13.55	$0.00	$57.25
For apprentice rates see "Apprentice- LABORER"						
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 2*	12/01/2015	$36.50	$7.45	$13.55	$0.00	$57.50
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2015	$36.25	$7.45	$13.55	$0.00	$57.25
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 2*	12/01/2015	$35.50	$7.45	$13.55	$0.00	$56.50
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$58.86	$9.80	$19.23	$0.00	$87.89
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$63.06	$9.80	$19.23	$0.00	$92.09
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$88.23	$9.80	$19.23	$0.00	$117.26
For apprentice rates see "Apprentice- PILE DRIVER"						
ELECTRICIAN *ELECTRICIANS LOCAL 223*	09/01/2015	$38.31	$8.40	$11.28	$0.00	$57.99
	09/01/2016	$39.21	$8.90	$11.51	$0.00	$59.62

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 223*

Effective Date - 09/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$15.32	$0.00	$0.46	$0.00	$15.78
2	42	$16.09	$0.00	$0.48	$0.00	$16.57
3	45	$17.24	$8.40	$0.52	$0.00	$26.16
4	48	$18.39	$8.40	$3.36	$0.00	$30.15
5	50	$19.16	$8.40	$3.47	$0.00	$31.03
6	55	$21.07	$8.40	$3.75	$0.00	$33.22
7	60	$22.99	$8.40	$4.03	$0.00	$35.42
8	65	$24.90	$8.40	$4.31	$0.00	$37.61
9	70	$26.82	$8.40	$5.28	$0.00	$40.50
10	75	$28.73	$8.40	$4.86	$0.00	$41.99

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$15.68	$0.00	$0.47	$0.00	$16.15
2	42	$16.47	$0.00	$0.49	$0.00	$16.96
3	45	$17.64	$8.90	$0.53	$0.00	$27.07
4	48	$18.82	$8.90	$3.42	$0.00	$31.14
5	50	$19.61	$8.90	$3.55	$0.00	$32.06
6	55	$21.57	$8.90	$3.83	$0.00	$34.30
7	60	$23.53	$8.90	$4.12	$0.00	$36.55
8	65	$25.49	$8.90	$4.39	$0.00	$38.78
9	70	$27.45	$8.90	$4.68	$0.00	$41.03
10	75	$29.41	$8.90	$4.96	$0.00	$43.27

Notes:
Steps are 750 hours

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2016	$54.53	$14.43	$14.96	$0.00	$83.92
	01/01/2017	$55.86	$15.28	$15.71	$0.00	$86.85

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELEVATOR CONSTRUCTOR - Local 4*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.27	$14.43	$0.00	$0.00	$41.70
2	55	$29.99	$14.43	$14.96	$0.00	$59.38
3	65	$35.44	$14.43	$14.96	$0.00	$64.83
4	70	$38.17	$14.43	$14.96	$0.00	$67.56
5	80	$43.62	$14.43	$14.96	$0.00	$73.01

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.93	$15.28	$0.00	$0.00	$43.21
2	55	$30.72	$15.28	$15.71	$0.00	$61.71
3	65	$36.31	$15.28	$15.71	$0.00	$67.30
4	70	$39.10	$15.28	$15.71	$0.00	$70.09
5	80	$44.69	$15.28	$15.71	$0.00	$75.68

Notes:
Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2016	$38.17	$14.43	$14.96	$0.00	$67.56
	01/01/2017	$39.10	$15.28	$15.71	$0.00	$70.09
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"						
FENCE & GUARD RAIL ERECTOR *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2016	$41.03	$10.00	$14.90	$0.00	$65.93
	11/01/2016	$41.62	$10.00	$14.90	$0.00	$66.52
	05/01/2017	$42.50	$10.00	$14.90	$0.00	$67.40
	11/01/2017	$43.23	$10.00	$14.90	$0.00	$68.13
	05/01/2018	$43.94	$10.00	$14.90	$0.00	$68.84
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2016	$42.47	$10.00	$14.90	$0.00	$67.37
	11/01/2016	$43.07	$10.00	$14.90	$0.00	$67.97
	05/01/2017	$43.96	$10.00	$14.90	$0.00	$68.86
	11/01/2017	$44.69	$10.00	$14.90	$0.00	$69.59
	05/01/2018	$45.41	$10.00	$14.90	$0.00	$70.31
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2016	$21.88	$10.00	$14.90	$0.00	$46.78
	11/01/2016	$22.23	$10.00	$14.90	$0.00	$47.13
	05/01/2017	$22.76	$10.00	$14.90	$0.00	$47.66
	11/01/2017	$23.18	$10.00	$14.90	$0.00	$48.08
	05/01/2018	$23.61	$10.00	$14.90	$0.00	$48.51
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 223*	09/01/2015	$38.31	$8.40	$11.28	$0.00	$57.99
	09/01/2016	$39.21	$8.90	$11.51	$0.00	$59.62
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING*ELECTRICIANS LOCAL 223* For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"	09/01/2015	$32.56	$8.40	$9.59	$0.00	$50.55
	09/01/2016	$33.33	$8.90	$9.78	$0.00	$52.01
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$36.71	$10.00	$15.15	$0.00	$61.86
	12/01/2016	$37.75	$10.00	$15.15	$0.00	$62.90
	06/01/2017	$38.59	$10.00	$15.15	$0.00	$63.74
	12/01/2017	$39.42	$10.00	$15.15	$0.00	$64.57
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER *LABORERS - ZONE 2*	06/01/2016	$20.50	$7.45	$12.65	$0.00	$40.60
	12/01/2016	$20.50	$7.45	$12.65	$0.00	$40.60
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE I*	03/01/2016	$42.13	$9.80	$17.62	$0.00	$69.55

Apprentice - *FLOORCOVERER - Local 2168 Zone I*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.07	$9.80	$1.79	$0.00	$32.66
2	55	$23.17	$9.80	$1.79	$0.00	$34.76
3	60	$25.28	$9.80	$12.25	$0.00	$47.33
4	65	$27.38	$9.80	$12.25	$0.00	$49.43
5	70	$29.49	$9.80	$14.04	$0.00	$53.33
6	75	$31.60	$9.80	$14.04	$0.00	$55.44
7	80	$33.70	$9.80	$15.83	$0.00	$59.33
8	85	$35.81	$9.80	$15.83	$0.00	$61.44

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$30.40	$10.00	$15.15	$0.00	$55.55
	12/01/2016	$31.27	$10.00	$15.15	$0.00	$56.42
	06/01/2017	$31.96	$10.00	$15.15	$0.00	$57.11
	12/01/2017	$32.65	$10.00	$15.15	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	01/01/2016	$39.01	$7.85	$16.10	$0.00	$62.96
	07/01/2016	$39.96	$7.85	$16.10	$0.00	$63.91
	01/01/2017	$40.91	$7.85	$16.10	$0.00	$64.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *GLAZIER - Local 35 Zone 2*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.51	$7.85	$0.00	$0.00	$27.36
2	55	$21.46	$7.85	$3.66	$0.00	$32.97
3	60	$23.41	$7.85	$3.99	$0.00	$35.25
4	65	$25.36	$7.85	$4.32	$0.00	$37.53
5	70	$27.31	$7.85	$14.11	$0.00	$49.27
6	75	$29.26	$7.85	$14.44	$0.00	$51.55
7	80	$31.21	$7.85	$14.77	$0.00	$53.83
8	90	$35.11	$7.85	$15.44	$0.00	$58.40

Effective Date - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.98	$7.85	$0.00	$0.00	$27.83
2	55	$21.98	$7.85	$3.66	$0.00	$33.49
3	60	$23.98	$7.85	$3.99	$0.00	$35.82
4	65	$25.97	$7.85	$4.32	$0.00	$38.14
5	70	$27.97	$7.85	$14.11	$0.00	$49.93
6	75	$29.97	$7.85	$14.44	$0.00	$52.26
7	80	$31.97	$7.85	$14.77	$0.00	$54.59
8	90	$35.96	$7.85	$15.44	$0.00	$59.25

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 06/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$24.33	$10.00	$0.00	$0.00	$34.33
2	60	$26.54	$10.00	$15.15	$0.00	$51.69
3	65	$28.75	$10.00	$15.15	$0.00	$53.90
4	70	$30.96	$10.00	$15.15	$0.00	$56.11
5	75	$33.17	$10.00	$15.15	$0.00	$58.32
6	80	$35.38	$10.00	$15.15	$0.00	$60.53
7	85	$37.60	$10.00	$15.15	$0.00	$62.75
8	90	$39.81	$10.00	$15.15	$0.00	$64.96

Effective Date - 12/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$25.01	$10.00	$0.00	$0.00	$35.01
2	60	$27.29	$10.00	$15.15	$0.00	$52.44
3	65	$29.56	$10.00	$15.15	$0.00	$54.71
4	70	$31.84	$10.00	$15.15	$0.00	$56.99
5	75	$34.11	$10.00	$15.15	$0.00	$59.26
6	80	$36.38	$10.00	$15.15	$0.00	$61.53
7	85	$38.66	$10.00	$15.15	$0.00	$63.81
8	90	$40.93	$10.00	$15.15	$0.00	$66.08

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2016	$43.31	$10.70	$21.95	$2.28	$78.24
	08/01/2016	$44.46	$10.70	$21.95	$2.28	$79.39
	02/01/2017	$45.56	$10.70	$21.95	$2.28	$80.49
	08/01/2017	$46.66	$10.70	$21.95	$2.28	$81.59
	02/01/2018	$47.81	$10.70	$21.95	$2.28	$82.74
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 223*	09/01/2015	$38.31	$8.40	$11.28	$0.00	$57.99
	09/01/2016	$39.21	$8.90	$11.51	$0.00	$59.62
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2016	$43.31	$10.70	$21.95	$2.28	$78.24
	08/01/2016	$44.46	$10.70	$21.95	$2.28	$79.39
	02/01/2017	$45.56	$10.70	$21.95	$2.28	$80.49
	08/01/2017	$46.66	$10.70	$21.95	$2.28	$81.59
	02/01/2018	$47.81	$10.70	$21.95	$2.28	$82.74
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PLUMBERS & PIPEFITTERS LOCAL 51*	03/01/2016	$37.38	$11.00	$16.10	$0.00	$64.48
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC MECHANIC *PLUMBERS & PIPEFITTERS LOCAL 51* For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"	03/01/2016	$37.38	$11.00	$16.10	$0.00	$64.48
HYDRAULIC DRILLS *LABORERS - ZONE 2* For apprentice rates see "Apprentice- LABORER"	06/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50
	12/01/2016	$33.15	$7.45	$12.65	$0.00	$53.25
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2015	$43.81	$11.50	$13.80	$0.00	$69.11
	09/01/2016	$45.81	$11.50	$13.80	$0.00	$71.11
	09/01/2017	$47.81	$11.50	$13.80	$0.00	$73.11
	09/01/2018	$50.06	$11.50	$13.80	$0.00	$75.36
	09/01/2019	$52.56	$11.50	$13.80	$0.00	$77.86

Apprentice - *ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston*

Effective Date - 09/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.91	$11.50	$10.05	$0.00	$43.46
2	60	$26.29	$11.50	$10.80	$0.00	$48.59
3	70	$30.67	$11.50	$11.55	$0.00	$53.72
4	80	$35.05	$11.50	$12.30	$0.00	$58.85

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.91	$11.50	$10.05	$0.00	$44.46
2	60	$27.49	$11.50	$10.80	$0.00	$49.79
3	70	$32.07	$11.50	$11.55	$0.00	$55.12
4	80	$36.65	$11.50	$12.30	$0.00	$60.45

Notes:

Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (BOSTON AREA)*	03/16/2016	$43.40	$7.80	$20.85	$0.00	$72.05
	09/16/2016	$44.05	$7.80	$20.85	$0.00	$72.70
	03/16/2017	$44.65	$7.80	$20.85	$0.00	$73.30

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Boston*

Effective Date - 03/16/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.04	$7.80	$20.85	$0.00	$54.69
2	70	$30.38	$7.80	$20.85	$0.00	$59.03
3	75	$32.55	$7.80	$20.85	$0.00	$61.20
4	80	$34.72	$7.80	$20.85	$0.00	$63.37
5	85	$36.89	$7.80	$20.85	$0.00	$65.54
6	90	$39.06	$7.80	$20.85	$0.00	$67.71

Effective Date - 09/16/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.43	$7.80	$20.85	$0.00	$55.08
2	70	$30.84	$7.80	$20.85	$0.00	$59.49
3	75	$33.04	$7.80	$20.85	$0.00	$61.69
4	80	$35.24	$7.80	$20.85	$0.00	$63.89
5	85	$37.44	$7.80	$20.85	$0.00	$66.09
6	90	$39.65	$7.80	$20.85	$0.00	$68.30

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 2*	06/01/2016	$31.65	$7.45	$12.65	$0.00	$51.75
	12/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER - Zone 2*

Effective Date - 06/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$18.99	$7.45	$12.65	$0.00	$39.09
2	70	$22.16	$7.45	$12.65	$0.00	$42.26
3	80	$25.32	$7.45	$12.65	$0.00	$45.42
4	90	$28.49	$7.45	$12.65	$0.00	$48.59

Effective Date - 12/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$19.44	$7.45	$12.65	$0.00	$39.54
2	70	$22.68	$7.45	$12.65	$0.00	$42.78
3	80	$25.92	$7.45	$12.65	$0.00	$46.02
4	90	$29.16	$7.45	$12.65	$0.00	$49.26

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER *LABORERS - ZONE 2*	06/01/2016	$31.65	$7.45	$12.65	$0.00	$51.75
	12/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 2*	06/01/2016	$31.65	$7.45	$12.65	$0.00	$51.75
	12/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 2*	12/01/2015	$31.35	$7.45	$12.60	$0.00	$51.40
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 2*	06/01/2016	$31.65	$7.45	$12.65	$0.00	$51.75
	12/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 2*	06/01/2016	$31.65	$7.45	$12.65	$0.00	$51.75
	12/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50
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*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2016	$38.08	$10.18	$17.70	$0.00	$65.96
	08/01/2016	$38.78	$10.18	$17.78	$0.00	$66.74
	02/01/2017	$39.24	$10.18	$17.78	$0.00	$67.20

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MARBLE & TILE FINISHER - Local 3 Marble & Tile*

Effective Date - 02/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.04	$10.18	$17.70	$0.00	$46.92
2	60	$22.85	$10.18	$17.70	$0.00	$50.73
3	70	$26.66	$10.18	$17.70	$0.00	$54.54
4	80	$30.46	$10.18	$17.70	$0.00	$58.34
5	90	$34.27	$10.18	$17.70	$0.00	$62.15

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.39	$10.18	$17.78	$0.00	$47.35
2	60	$23.27	$10.18	$17.78	$0.00	$51.23
3	70	$27.15	$10.18	$17.78	$0.00	$55.11
4	80	$31.02	$10.18	$17.78	$0.00	$58.98
5	90	$34.90	$10.18	$17.78	$0.00	$62.86

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2016	$49.90	$10.18	$19.14	$0.00	$79.22
	08/01/2016	$50.80	$10.18	$19.22	$0.00	$80.20
	02/01/2017	$51.37	$10.18	$19.22	$0.00	$80.77

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile*

Effective Date - 02/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.95	$10.18	$19.14	$0.00	$54.27
2	60	$29.94	$10.18	$19.14	$0.00	$59.26
3	70	$34.93	$10.18	$19.14	$0.00	$64.25
4	80	$39.92	$10.18	$19.14	$0.00	$69.24
5	90	$44.91	$10.18	$19.14	$0.00	$74.23

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.40	$10.18	$19.22	$0.00	$54.80
2	60	$30.48	$10.18	$19.22	$0.00	$59.88
3	70	$35.56	$10.18	$19.22	$0.00	$64.96
4	80	$40.64	$10.18	$19.22	$0.00	$70.04
5	90	$45.72	$10.18	$19.22	$0.00	$75.12

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 2) *MILLWRIGHTS LOCAL 1121 - Zone 2*	04/01/2015	$34.69	$9.80	$16.21	$0.00	$60.70

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 2*

Effective Date - 04/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$19.08	$9.80	$4.48	$0.00	$33.36
2	65	$22.55	$9.80	$13.36	$0.00	$45.71
3	75	$26.02	$9.80	$14.18	$0.00	$50.00
4	85	$29.49	$9.80	$14.99	$0.00	$54.28

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$22.41	$10.00	$15.15	$0.00	$47.56
	12/01/2016	$23.06	$10.00	$15.15	$0.00	$48.21
	06/01/2017	$23.57	$10.00	$15.15	$0.00	$48.72
	12/01/2017	$24.09	$10.00	$15.15	$0.00	$49.24
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$26.29	$10.00	$15.15	$0.00	$51.44
	12/01/2016	$27.04	$10.00	$15.15	$0.00	$52.19
	06/01/2017	$27.64	$10.00	$15.15	$0.00	$52.79
	12/01/2017	$28.25	$10.00	$15.15	$0.00	$53.40
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2016	$49.51	$7.85	$16.10	$0.00	$73.46
	07/01/2016	$50.46	$7.85	$16.10	$0.00	$74.41
	01/01/2017	$51.41	$7.85	$16.10	$0.00	$75.36

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.76	$7.85	$0.00	$0.00	$32.61
2	55	$27.23	$7.85	$3.66	$0.00	$38.74
3	60	$29.71	$7.85	$3.99	$0.00	$41.55
4	65	$32.18	$7.85	$4.32	$0.00	$44.35
5	70	$34.66	$7.85	$14.11	$0.00	$56.62
6	75	$37.13	$7.85	$14.44	$0.00	$59.42
7	80	$39.61	$7.85	$14.77	$0.00	$62.23
8	90	$44.56	$7.85	$15.44	$0.00	$67.85

Effective Date - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.23	$7.85	$0.00	$0.00	$33.08
2	55	$27.75	$7.85	$3.66	$0.00	$39.26
3	60	$30.28	$7.85	$3.99	$0.00	$42.12
4	65	$32.80	$7.85	$4.32	$0.00	$44.97
5	70	$35.32	$7.85	$14.11	$0.00	$57.28
6	75	$37.85	$7.85	$14.44	$0.00	$60.14
7	80	$40.37	$7.85	$14.77	$0.00	$62.99
8	90	$45.41	$7.85	$15.44	$0.00	$68.70

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) *	01/01/2016	$40.41	$7.85	$16.10	$0.00	$64.36
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. *PAINTERS LOCAL 35 - ZONE 2*	07/01/2016	$41.36	$7.85	$16.10	$0.00	$65.31
	01/01/2017	$42.31	$7.85	$16.10	$0.00	$66.26

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - New*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.21	$7.85	$0.00	$0.00	$28.06
2	55	$22.23	$7.85	$3.66	$0.00	$33.74
3	60	$24.25	$7.85	$3.99	$0.00	$36.09
4	65	$26.27	$7.85	$4.32	$0.00	$38.44
5	70	$28.29	$7.85	$14.11	$0.00	$50.25
6	75	$30.31	$7.85	$14.44	$0.00	$52.60
7	80	$32.33	$7.85	$14.77	$0.00	$54.95
8	90	$36.37	$7.85	$15.44	$0.00	$59.66

Effective Date - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.68	$7.85	$0.00	$0.00	$28.53
2	55	$22.75	$7.85	$3.66	$0.00	$34.26
3	60	$24.82	$7.85	$3.99	$0.00	$36.66
4	65	$26.88	$7.85	$4.32	$0.00	$39.05
5	70	$28.95	$7.85	$14.11	$0.00	$50.91
6	75	$31.02	$7.85	$14.44	$0.00	$53.31
7	80	$33.09	$7.85	$14.77	$0.00	$55.71
8	90	$37.22	$7.85	$15.44	$0.00	$60.51

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2016	$38.47	$7.85	$16.10	$0.00	$62.42
	07/01/2016	$39.42	$7.85	$16.10	$0.00	$63.37
	01/01/2017	$40.37	$7.85	$16.10	$0.00	$64.32

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.24	$7.85	$0.00	$0.00	$27.09
2	55	$21.16	$7.85	$3.66	$0.00	$32.67
3	60	$23.08	$7.85	$3.99	$0.00	$34.92
4	65	$25.01	$7.85	$4.32	$0.00	$37.18
5	70	$26.93	$7.85	$14.11	$0.00	$48.89
6	75	$28.85	$7.85	$14.44	$0.00	$51.14
7	80	$30.78	$7.85	$14.77	$0.00	$53.40
8	90	$34.62	$7.85	$15.44	$0.00	$57.91

Effective Date - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.71	$7.85	$0.00	$0.00	$27.56
2	55	$21.68	$7.85	$3.66	$0.00	$33.19
3	60	$23.65	$7.85	$3.99	$0.00	$35.49
4	65	$25.62	$7.85	$4.32	$0.00	$37.79
5	70	$27.59	$7.85	$14.11	$0.00	$49.55
6	75	$29.57	$7.85	$14.44	$0.00	$51.86
7	80	$31.54	$7.85	$14.77	$0.00	$54.16
8	90	$35.48	$7.85	$15.44	$0.00	$58.77

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) *LABORERS - ZONE 2* For Apprentice rates see "Apprentice- LABORER"	06/01/2016	$31.65	$7.45	$12.65	$0.00	$51.75
	12/01/2016	$32.40	$7.45	$12.65	$0.00	$52.50
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*	01/01/2016	$39.01	$7.85	$16.10	$0.00	$62.96
	07/01/2016	$39.96	$7.85	$16.10	$0.00	$63.91
	01/01/2017	$40.91	$7.85	$16.10	$0.00	$64.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER - Local 35 Zone 2 - BRUSH NEW*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.51	$7.85	$0.00	$0.00	$27.36
2	55	$21.46	$7.85	$3.66	$0.00	$32.97
3	60	$23.41	$7.85	$3.99	$0.00	$35.25
4	65	$25.36	$7.85	$4.32	$0.00	$37.53
5	70	$27.31	$7.85	$14.11	$0.00	$49.27
6	75	$29.26	$7.85	$14.44	$0.00	$51.55
7	80	$31.21	$7.85	$14.77	$0.00	$53.83
8	90	$35.11	$7.85	$15.44	$0.00	$58.40

Effective Date - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.98	$7.85	$0.00	$0.00	$27.83
2	55	$21.98	$7.85	$3.66	$0.00	$33.49
3	60	$23.98	$7.85	$3.99	$0.00	$35.82
4	65	$25.97	$7.85	$4.32	$0.00	$38.14
5	70	$27.97	$7.85	$14.11	$0.00	$49.93
6	75	$29.97	$7.85	$14.44	$0.00	$52.26
7	80	$31.97	$7.85	$14.77	$0.00	$54.59
8	90	$35.96	$7.85	$15.44	$0.00	$59.25

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2016	$37.07	$7.85	$16.10	$0.00	$61.02
	07/01/2016	$38.02	$7.85	$16.10	$0.00	$61.97
	01/01/2017	$38.97	$7.85	$16.10	$0.00	$62.92

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - BRUSH REPAINT*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.54	$7.85	$0.00	$0.00	$26.39
2	55	$20.39	$7.85	$3.66	$0.00	$31.90
3	60	$22.24	$7.85	$3.99	$0.00	$34.08
4	65	$24.10	$7.85	$4.32	$0.00	$36.27
5	70	$25.95	$7.85	$14.11	$0.00	$47.91
6	75	$27.80	$7.85	$14.44	$0.00	$50.09
7	80	$29.66	$7.85	$14.77	$0.00	$52.28
8	90	$33.36	$7.85	$15.44	$0.00	$56.65

Effective Date - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.01	$7.85	$0.00	$0.00	$26.86
2	55	$20.91	$7.85	$3.66	$0.00	$32.42
3	60	$22.81	$7.85	$3.99	$0.00	$34.65
4	65	$24.71	$7.85	$4.32	$0.00	$36.88
5	70	$26.61	$7.85	$14.11	$0.00	$48.57
6	75	$28.52	$7.85	$14.44	$0.00	$50.81
7	80	$30.42	$7.85	$14.77	$0.00	$53.04
8	90	$34.22	$7.85	$15.44	$0.00	$57.51

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2012	$30.28	$9.07	$8.00	$0.00	$47.35
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PILE DRIVER - Local 56 Zone 1*

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.02	$9.80	$19.23	$0.00	$50.05
2	60	$25.22	$9.80	$19.23	$0.00	$54.25
3	70	$29.43	$9.80	$19.23	$0.00	$58.46
4	75	$31.53	$9.80	$19.23	$0.00	$60.56
5	80	$33.63	$9.80	$19.23	$0.00	$62.66
6	80	$33.63	$9.80	$19.23	$0.00	$62.66
7	90	$37.84	$9.80	$19.23	$0.00	$66.87
8	90	$37.84	$9.80	$19.23	$0.00	$66.87

Notes:

Apprentice to Journeyworker Ratio:1:3

PIPELAYER *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
PLUMBER & PIPEFITTER *PLUMBERS & PIPEFITTERS LOCAL 51*	03/01/2016	$37.38	$11.00	$16.10	$0.00	$64.48

Apprentice - *PLUMBER/PIPEFITTER - Local 51*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$14.95	$11.00	$1.50	$0.00	$27.45
2	50	$18.69	$11.00	$1.50	$0.00	$31.19
3	60	$22.43	$11.00	$7.85	$0.00	$41.28
4	70	$26.17	$11.00	$11.66	$0.00	$48.83
5	80	$29.90	$11.00	$14.20	$0.00	$55.10

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*	03/01/2016	$37.38	$11.00	$16.10	$0.00	$64.48
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 2*	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER *LABORERS - ZONE 2*	06/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
	12/01/2016	$33.40	$7.45	$12.65	$0.00	$53.50
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$30.40	$10.00	$15.15	$0.00	$55.55
	12/01/2016	$31.27	$10.00	$15.15	$0.00	$56.42
	06/01/2017	$31.96	$10.00	$15.15	$0.00	$57.11
	12/01/2017	$32.65	$10.00	$15.15	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER *TEAMSTERS LOCAL 653*	08/01/2008	$19.76	$7.16	$4.21	$0.00	$31.13
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RESIDENTIAL WOOD FRAME (All Other Work) *CARPENTERS -ZONE 2 (Residential Wood)*	04/01/2011	$24.24	$8.67	$15.51	$0.00	$48.42
RESIDENTIAL WOOD FRAME CARPENTER ** ** The Residential Wood Frame Carpenter classification applies only to the construction of new, wood frame residences that do not exceed four stories including the basement. *CARPENTERS -ZONE 2 (Residential Wood)*	05/01/2011	$24.24	$6.34	$6.23	$0.00	$36.81

As of 9/1/09 Carpentry work on wood-frame residential WEATHERIZATION projects shall be paid the RESIDENTIAL WOOD FRAME CARPENTER rate.

Apprentice - *CARPENTER (Residential Wood Frame) - Zone 2*

Effective Date - 05/01/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$14.54	$6.34	$0.00	$0.00	$20.88
2	60	$14.54	$6.34	$6.23	$0.00	$27.11
3	65	$15.76	$6.34	$6.23	$0.00	$28.33
4	70	$16.97	$6.34	$6.23	$0.00	$29.54
5	75	$18.18	$6.34	$6.23	$0.00	$30.75
6	80	$19.39	$6.34	$6.23	$0.00	$31.96
7	85	$20.60	$6.34	$6.23	$0.00	$33.17
8	90	$21.82	$6.34	$6.23	$0.00	$34.39

Notes:

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
RIDE-ON MOTORIZED BUGGY OPERATOR	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
LABORERS - ZONE 2	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
OPERATING ENGINEERS LOCAL 4	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg)	02/01/2016	$40.11	$11.00	$12.90	$0.00	$64.01
ROOFERS LOCAL 33						

Apprentice - *ROOFER - Local 33*

Effective Date - 02/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.06	$11.00	$3.39	$0.00	$34.45
2	60	$24.07	$11.00	$12.90	$0.00	$47.97
3	65	$26.07	$11.00	$12.90	$0.00	$49.97
4	75	$30.08	$11.00	$12.90	$0.00	$53.98
5	85	$34.09	$11.00	$12.90	$0.00	$57.99

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.

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE	02/01/2016	$40.36	$11.00	$12.90	$0.00	$64.26
ROOFERS LOCAL 33						
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER	02/01/2016	$43.31	$10.70	$21.95	$2.28	$78.24
SHEETMETAL WORKERS LOCAL 17 - A	08/01/2016	$44.46	$10.70	$21.95	$2.28	$79.39
	02/01/2017	$45.56	$10.70	$21.95	$2.28	$80.49
	08/01/2017	$46.66	$10.70	$21.95	$2.28	$81.59
	02/01/2018	$47.81	$10.70	$21.95	$2.28	$82.74

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SHEET METAL WORKER - Local 17-A*

Effective Date - 02/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.32	$10.70	$4.90	$0.00	$32.92
2	40	$17.32	$10.70	$4.90	$0.00	$32.92
3	45	$19.49	$10.70	$9.79	$1.20	$41.18
4	45	$19.49	$10.70	$9.79	$1.20	$41.18
5	50	$21.66	$10.70	$10.65	$1.29	$44.30
6	50	$21.66	$10.70	$10.90	$1.30	$44.56
7	60	$25.99	$10.70	$12.37	$1.47	$50.53
8	65	$28.15	$10.70	$13.24	$1.56	$53.65
9	75	$32.48	$10.70	$14.97	$1.74	$59.89
10	85	$36.81	$10.70	$16.18	$1.91	$65.60

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.78	$10.70	$4.90	$0.00	$33.38
2	40	$17.78	$10.70	$4.90	$0.00	$33.38
3	45	$20.01	$10.70	$9.79	$1.22	$41.72
4	45	$20.01	$10.70	$9.79	$1.22	$41.72
5	50	$22.23	$10.70	$10.65	$1.31	$44.89
6	50	$22.23	$10.70	$10.90	$1.31	$45.14
7	60	$26.68	$10.70	$12.37	$1.49	$51.24
8	65	$28.90	$10.70	$13.24	$1.59	$54.43
9	75	$33.35	$10.70	$14.97	$1.77	$60.79
10	85	$37.79	$10.70	$16.18	$1.94	$66.61

Notes:

Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SIGN ERECTOR *PAINTERS LOCAL 35 - ZONE 2*	06/01/2013	$25.81	$7.07	$7.05	$0.00	$39.93

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SIGN ERECTOR - Local 35 Zone 2*

Effective Date - 06/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$12.91	$7.07	$0.00	$0.00	$19.98
2	55	$14.20	$7.07	$2.45	$0.00	$23.72
3	60	$15.49	$7.07	$2.45	$0.00	$25.01
4	65	$16.78	$7.07	$2.45	$0.00	$26.30
5	70	$18.07	$7.07	$7.05	$0.00	$32.19
6	75	$19.36	$7.07	$7.05	$0.00	$33.48
7	80	$20.65	$7.07	$7.05	$0.00	$34.77
8	85	$21.94	$7.07	$7.05	$0.00	$36.06
9	90	$23.23	$7.07	$7.05	$0.00	$37.35

Notes:

Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	06/01/2016	$32.44	$10.41	$10.08	$0.00	$52.93
	08/01/2016	$32.44	$10.91	$10.08	$0.00	$53.43
	12/01/2016	$32.44	$10.91	$10.89	$0.00	$54.24
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	06/01/2016	$32.73	$10.41	$10.08	$0.00	$53.22
	08/01/2016	$32.73	$10.91	$10.08	$0.00	$53.72
	12/01/2016	$32.73	$10.91	$10.89	$0.00	$54.53
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1*	03/01/2016	$54.43	$8.67	$16.80	$0.00	$79.90
	10/01/2016	$55.53	$8.67	$16.80	$0.00	$81.00
	03/01/2017	$56.53	$8.67	$16.80	$0.00	$82.00

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SPRINKLER FITTER - Local 550 (Section A) Zone 1*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$19.05	$8.67	$8.55	$0.00	$36.27
2	40	$21.77	$8.67	$8.55	$0.00	$38.99
3	45	$24.49	$8.67	$8.55	$0.00	$41.71
4	50	$27.22	$8.67	$8.55	$0.00	$44.44
5	55	$29.94	$8.67	$8.55	$0.00	$47.16
6	60	$32.66	$8.67	$8.55	$0.00	$49.88
7	65	$35.38	$8.67	$8.55	$0.00	$52.60
8	70	$38.10	$8.67	$8.55	$0.00	$55.32
9	75	$40.82	$8.67	$8.55	$0.00	$58.04
10	80	$43.54	$8.67	$8.55	$0.00	$60.76

Effective Date - 10/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$19.44	$8.67	$8.55	$0.00	$36.66
2	40	$22.21	$8.67	$8.55	$0.00	$39.43
3	45	$24.99	$8.67	$8.55	$0.00	$42.21
4	50	$27.77	$8.67	$8.55	$0.00	$44.99
5	55	$30.54	$8.67	$8.55	$0.00	$47.76
6	60	$33.32	$8.67	$8.55	$0.00	$50.54
7	65	$36.09	$8.67	$8.55	$0.00	$53.31
8	70	$38.87	$8.67	$8.55	$0.00	$56.09
9	75	$41.65	$8.67	$8.55	$0.00	$58.87
10	80	$44.42	$8.67	$8.55	$0.00	$61.64

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 *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 223*	09/01/2015	$32.56	$8.40	$9.59	$0.00	$50.55
	09/01/2016	$33.33	$8.90	$9.78	$0.00	$52.01

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 223*

Effective Date - 09/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	0	$0.00	$0.00	$0.00	$0.00	$0.00

Notes: See Electrician Apprentice Wages
Steps are 750hrs
Telecom Apprentice Wages shall be the same as the Electrician Apprentice Wages

Apprentice to Journeyworker Ratio:2:3

TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2016	$48.80	$10.18	$19.14	$0.00	$78.12
	08/01/2016	$49.70	$10.18	$19.22	$0.00	$79.10
	02/01/2017	$50.27	$10.18	$19.22	$0.00	$79.67

Apprentice - *TERRAZZO FINISHER - Local 3 Marble & Tile*

Effective Date - 02/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.40	$10.18	$19.14	$0.00	$53.72
2	60	$29.28	$10.18	$19.14	$0.00	$58.60
3	70	$34.16	$10.18	$19.14	$0.00	$63.48
4	80	$39.04	$10.18	$19.14	$0.00	$68.36
5	90	$43.92	$10.18	$19.14	$0.00	$73.24

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.85	$10.18	$19.22	$0.00	$54.25
2	60	$29.82	$10.18	$19.22	$0.00	$59.22
3	70	$34.79	$10.18	$19.22	$0.00	$64.19
4	80	$39.76	$10.18	$19.22	$0.00	$69.16
5	90	$44.73	$10.18	$19.22	$0.00	$74.13

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE* For apprentice rates see "Apprentice- LABORER"	06/01/2016	$37.45	$7.45	$13.75	$0.00	$58.65
	12/01/2016	$38.45	$7.45	$13.75	$0.00	$59.65
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE* For apprentice rates see "Apprentice- LABORER"	06/01/2016	$36.17	$7.45	$13.75	$0.00	$57.37
	12/01/2016	$37.17	$7.45	$13.75	$0.00	$58.37
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE* For apprentice rates see "Apprentice- LABORER"	06/01/2016	$36.05	$7.45	$13.75	$0.00	$57.25
	12/01/2016	$37.05	$7.45	$13.75	$0.00	$58.25

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TRACTORS/PORTABLE STEAM GENERATORS	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
OPERATING ENGINEERS LOCAL 4	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT	06/01/2016	$33.02	$10.41	$10.08	$0.00	$53.51
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	08/01/2016	$33.02	$10.91	$10.08	$0.00	$54.01
	12/01/2016	$33.02	$10.91	$10.89	$0.00	$54.82
TUNNEL WORK - COMPRESSED AIR	06/01/2016	$48.33	$7.45	$14.15	$0.00	$69.93
LABORERS (COMPRESSED AIR)	12/01/2016	$49.33	$7.45	$14.15	$0.00	$70.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE)	06/01/2016	$50.33	$7.45	$14.15	$0.00	$71.93
LABORERS (COMPRESSED AIR)	12/01/2016	$51.33	$7.45	$14.15	$0.00	$72.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR	06/01/2016	$40.40	$7.45	$14.15	$0.00	$62.00
LABORERS (FREE AIR TUNNEL)	12/01/2016	$41.40	$7.45	$14.15	$0.00	$63.00
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR (HAZ. WASTE)	06/01/2016	$42.40	$7.45	$14.15	$0.00	$64.00
LABORERS (FREE AIR TUNNEL)	12/01/2016	$43.40	$7.45	$14.15	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL	06/01/2016	$32.44	$10.41	$10.08	$0.00	$52.93
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	08/01/2016	$32.44	$10.91	$10.08	$0.00	$53.43
	12/01/2016	$32.44	$10.91	$10.89	$0.00	$54.24
WAGON DRILL OPERATOR	06/01/2016	$31.90	$7.45	$12.65	$0.00	$52.00
LABORERS - ZONE 2	12/01/2016	$32.65	$7.45	$12.65	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
OPERATING ENGINEERS LOCAL 4	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER	03/01/2016	$37.38	$11.00	$16.10	$0.00	$64.48
PLUMBERS & PIPEFITTERS LOCAL 51						
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone)	08/30/2015	$26.11	$7.25	$1.78	$0.00	$35.14
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/28/2016	$26.61	$7.50	$1.80	$0.00	$35.91
	09/03/2017	$27.14	$7.75	$1.81	$0.00	$36.70
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables)	08/30/2015	$36.98	$7.25	$8.12	$0.00	$52.35
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/28/2016	$37.70	$7.50	$8.87	$0.00	$54.07
	09/03/2017	$38.45	$7.75	$9.53	$0.00	$55.73
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL	08/30/2015	$30.46	$7.25	$8.34	$0.00	$46.05
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/28/2016	$31.05	$7.50	$8.89	$0.00	$47.44
	09/03/2017	$31.66	$7.75	$9.44	$0.00	$48.85
For apprentice rates see "Apprentice- LINEMAN"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$23.93	$7.25	$1.72	$0.00	$32.90
	08/28/2016	$24.39	$7.50	$1.73	$0.00	$33.62
	09/03/2017	$24.88	$7.75	$1.75	$0.00	$34.38
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$36.98	$7.25	$12.29	$0.00	$56.52
	08/28/2016	$37.70	$7.50	$12.95	$0.00	$58.15
	09/03/2017	$38.45	$7.75	$13.61	$0.00	$59.81
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$32.63	$7.25	$9.05	$0.00	$48.93
	08/28/2016	$33.26	$7.50	$9.63	$0.00	$50.39
	09/03/2017	$33.92	$7.75	$10.21	$0.00	$51.88
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$23.93	$7.25	$1.72	$0.00	$32.90
	08/28/2016	$24.39	$7.50	$1.73	$0.00	$33.62
	09/03/2017	$24.88	$7.75	$1.75	$0.00	$34.38
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$19.58	$7.25	$1.59	$0.00	$28.42
	08/28/2016	$19.96	$7.50	$1.60	$0.00	$29.06
	09/03/2017	$20.35	$7.75	$1.61	$0.00	$29.71
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$43.51	$7.25	$15.06	$0.00	$65.82
	08/28/2016	$44.35	$7.50	$15.83	$0.00	$67.68
	09/03/2017	$45.23	$7.75	$16.61	$0.00	$69.59

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LINEMAN (Outside Electrical) - East Local 104*

Effective Date - 08/30/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.11	$7.25	$3.28	$0.00	$36.64
2	65	$28.28	$7.25	$3.35	$0.00	$38.88
3	70	$30.46	$7.25	$3.41	$0.00	$41.12
4	75	$32.63	$7.25	$4.98	$0.00	$44.86
5	80	$34.81	$7.25	$5.04	$0.00	$47.10
6	85	$36.98	$7.25	$5.11	$0.00	$49.34
7	90	$39.16	$7.25	$7.17	$0.00	$53.58

Effective Date - 08/28/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.61	$7.50	$3.30	$0.00	$37.41
2	65	$28.83	$7.50	$3.36	$0.00	$39.69
3	70	$31.05	$7.50	$3.43	$0.00	$41.98
4	75	$33.26	$7.50	$5.00	$0.00	$45.76
5	80	$35.48	$7.50	$5.06	$0.00	$48.04
6	85	$37.70	$7.50	$5.13	$0.00	$50.33
7	90	$39.92	$7.50	$7.20	$0.00	$54.62

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$28.98	$4.25	$3.12	$0.00	$36.35
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$27.31	$4.25	$3.07	$0.00	$34.63
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$27.31	$4.25	$3.07	$0.00	$34.63
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/31/2016	$18.51	$3.55	$0.00	$0.00	$22.06

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.

TREE TRIMMER GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	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 on the ground. This classification does not apply to wholesale tree removal.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Additional Apprentice Information:

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, 4:4, 4:5, 4:6, 5:7, 6:7, 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.