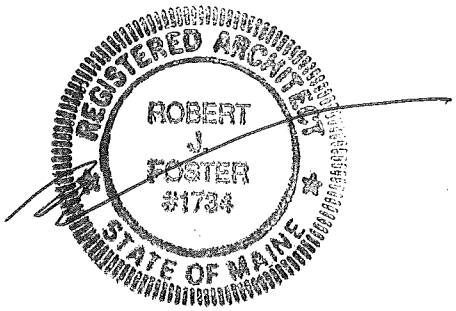
U-HAUL MOVING
&
STORAGE

425 Marginal Way
Portland, Maine

PROJECT MANUAL



ISSUED FOR CONSTRUCTION

September 8, 2014

ROBERT J. FOSTER – ARCHITECT

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Portland, Maine 04101
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FOR
U-HAUL MOVING
&
STORAGE
PORTLAND, MAINE

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OUTLINE SPECIFICATION
Project: U-Haul Moving & Storage
Location: Portland, Maine
Date: 09/08/14

Section 01010 – Summary of Work

a. Renovation of existing 1 story building (10,420 sq. ft.). 2,170 sq. ft. will used as a retail sales center, including offices, break room, toilet rooms and vehicle service bay. The remainder of the building will be developed in the future as a self-storage facility.
b. The General Contractor shall be responsible for obtaining any and all required permits to construct the project.

Section 01500 – Temporary Facilities

a. Sanitary Facilities – The Contractor shall provide temporary toileting on site throughout the construction period.
b. Heat – The Contractor shall provide and maintain any temporary heating equipment as may be required. The interior of building shall have a temporary of approx. 60 deg. F for spackling of GWB, installation of wood finishes, installation of carpet and interior decoration. Existing heat and air shall be maintained to existing building tenant throughout course of project.
c. Temporary stairs, ladders, ramps, hoists, scaffolding – Provide and maintain all necessary means of access as above listed or as required for proper execution of the work. Such work shall comply with the requirements of applicable Federal, State and Local laws and requirements.
d. Pumping – Provide labor and equipment as necessary to keep all portions of the excavations free from water. If conditions so dictate, provide a well point system to maintain excavations free from water.
e. Demolition/Debris removal – It is the responsibility of the Contractor to make al required arrangements for the legal disposal of all debris generated from this project. The Contractor shall keep the building and site clean at all times and maintain safe access to and from the site for current building tenants.

Section 01700 – Project Closeout

a. Clean up – The Contractor shall provide a thoroughly cleaned facility at the conclusion of the project. Use only cleaning materials and methods recommended by the manufacturer of the surface material to be cleaned.
b. Transmission of extra material – The Contractor shall transfer extra material, i.e. flooring tiles, ceiling tiles, paint, etc… as define in the specifications.
c. Maintenance data and instructional manuals – The Contractor shall transfer all required maintenance and instruction manuals.
d. Guarantees and Warrantees – The Contractor shall transfer all required guarantees and warrantees.
e. Final Inspection – A final inspection shall be performed at the conclusion of the project by the Owner. The issuance of the Certificate of Substantial completion and final payments shall be subject to the completion of the items generated during the final inspection.

Section 02060 – Selective Demolition and Alterations

a. Materials Ownership – Except for items or materials indicted to be reused or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's

property and shall be removed from the site with further disposition at the Contractor's option.

b. Utility Services – Maintain existing utilities to remain in service and protect them against damage during selective demolition operations.
c. Repair Materials – Use materials identical to existing materials or whose installed performance equals or surpasses that of the existing materials.
d. Selective Demolition – Demolish and remove existing construction only to the extent required by new construction and/or as indicated.
e. Patching and Repairs – Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.
f. Cleaning – Sweep clean the building broom clean and change filters on air handling equipment on completion of the selective demolition operation.

Section 03300 – Cast in Place Concrete

a. Reinforcing Steel – 60,000 psi new billit steel conforming to ASTM A-615 and ASTM A-305 deformations.
b. Concrete – 3000 psi for footings & foundations. 3500 psi for slabs.
c. Concrete Aggregates – Shall conform to ASTM C-33. Fine aggregates shall consist of hard, tough and preferably siliceous material, clean, free from mineral or other coatings, soft particles, clay, loam or other deleterious matter. Course Aggregate shall consist of crushed stone or gravel, having clean, hard durable, uncoated particles, free from deleterious matter.
d. Rapid setting floor slab trench patching material – Rapid set concrete mix, CTS Cement Manufacturing (800) 929-3030. Pre-blended hydraulic cement, sand, and 3/8 inch stone, with rapid curing for placement of flooring materials with 24 hours. Job site blended material consisting of 1 part CTS hydraulic cement, 2 parts coarse washed aggregate 3/8 to 3/4 inch size, and 2 parts fine aggregate mortar sand will be permitted.
e. Vapor retarder – 10 mil polyethylene.

Section 03360 – Concrete Finishes

a. Stained Concrete Finish – Specifications to be provided by Owner.

Section 04810 – Unit Masonry

a. Block – Normal weight Portland cement and aggregate blocks conforming to ASTM C-33. Hollow load bearing conforming to ASTM C 90-70. Hollowing non-load bearing conforming to ASTM C 129-71.

Section 06100 – Rough Carpentry

a. Lumber Standards – Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
b. Light Framing – 2 inch to 4 inch thickness – Provide SPF No. 2 grade or better

Section 06200 – Finish Carpentry

a. Quality Standard – AWI quality standard – "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.
b. Softwood Trim – Species: Eastern white pine (NELMA). Grade: Select. Texture: Surfaced (smooth). Solid lumber stock.
c. Hardwood Trim – Species for transparent finish: Maple, plain sawn selected for compatible grain and color. Species for painted finish: Poplar, plain sawn. Texture: Surfaced (smooth). Solid lumber stock.

d. Wood Molding Patterns – Provide stock moldings made to patterns indicated. Transparent finish – N Grade. Moldings for painted finish – P Grade.

Section 06400 – Architectural Woodwork/Casework

a. Plastic Laminate Tops – Plastic laminate sheet, Wilsonart, .048 inch thickness or equal complying with NEMA LD 3, bonded with fully waterproof glue specified to both sides of 1 inch thick particle board. Provide ¾ inch thick hardwood faced plywood substrate for entire top where sinks occur.
b. Solid Surface Tops – Solid surface tops shall be ½" solid material with rounded edges as indicated on the drawings. Solid surface material shall be Corian or equal. Color shall be as selected, from manufacturer's full range of colors, by the Owner.
c. Cabinet Hardware – Hinges: 5 knuckle hinges complying with BHMA 156.9, grade 1, with antifriction bearings and rounded tips. Provide 2 for doors less than 48 inches, 3 for doors up to 62 inches and 4 for doors greater than 62 inches. Drawer Slides: Grass or MEPLA, telescoping full extension ball bearing slide, 100 pound capacity. Door and Drawer Pulls: Ives and Stanley 1 5/16 inch projection by 4 inches screw hole spacing. Shelf Standards: By Knape and Vogt – No. 255 nickel finish, 5/8 inch wide by 3/16 inch high standards and No. 256 series nickel finish brackets. Door catches: Adjustable nylon roller spring catch or duel, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches high. Plastic Grommets: Round wire management grommets by Outwater Plastics, Woodridge, NJ (800-631-8375). Color by Owner.

Section 07200 – Insulation

a. Sound Attenuation Insulation – Unfaced mineral fiber "formaldehyde free" blanket/batt insulation per ASTM C 665. Insulation to be provided by Certainteed, Owens Corning, Johns Manville or equal.
b. Unfaced Building Insulation – ASTM C 665, Type I (blankets without membrane facing) consisting of fibers manufactured from glass "formaldehyde free"; with maximum flame spread and smoke developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. CertainTeed, Owens Corning, Johns Manville or equal.
c. Rigid Insulation – Rigid, cellular thermal insulation with glass fiber reinforced polyisocyanurate closed cell foam core and trilaminate aluminum foil face laminated to both sides. Celotex Tuff, Johns Manville Barrier Board or equal. Use aluminum tape at all joints to form continuous vapor barrier at exterior wall applications.

Section 07841 – Through Pentration Firestop Systems

a. This section includes through penetration fire stop systems for penetrations through fire resistance rated assemblies at floors, ceilings, walls/partitions, smoke barriers and construction enclosing compartmentalized areas.
b. Provide through penetration fire stop systems that are produced and installed to resist the spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of assembly penetrated. Provide through penetration fire stop systems with F-ratings and T-ratings as determined per ASTM E 814.
c. Provide Products by one of the following: Bio Fireshield, W.R. Grace & Co., Hilti Construction Chemicals, Isolatek International, Nelson Firestop Products, Specified Technologies, and 3M Fire Protection Products.
d. Fill Materials:

Cast in Place Firestop Devices – Factory assembled devices for use in cast in place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket. CP 680 Cast in Place Firestop Device; Hilti Construction Chemicals, Inc.

Latex Sealants – single component latex formulations that after cured do not re-emulsify during exposure to moisture. FlameSafe FS 900 Sealant by W.R. Grace or Equal.

Firestop Devices – Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specified diameter of penetrant. FlameSafe FSWS Series FlameSafe devices by W.R. Grace or equal.

Intumescent Composite Sheets – Rigid panels consisting of a aluminum foil faced elastomeric sheet bonded to a galvanized steel sheet. CS-195 Composite Sheet, 3M Fire Protection Products or equal.

Intumescent Putties – Nonhardening dielectric, water resistant putties containing no solvents, inorganic fibers, or silicone compounds. FlameSafe FSP 1000 Putty and FSP 1077 Putty Pads by W.R. Grace or equal.

Intumescent Wrap Strips with Foil – Single component intumescent elastomeric sheets with aluminum foil on one side. Fire Barrier FS-195+ Wrap Strip by 3M Fire Protection Products or equal.

Intumescent Wrap Strips – Single component intumescent elastomeric sheets. Biostop Wrap Strip by Bio Fireshield or equal.

Mortars – Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar. FlameSafe Mortar Safe by W.R. Grace & Co. or equal.

Pillows/Bags – Reusable, heat expanding pillows/bags consisting of glass fiber cloth cases filled with a combination of mineral fiber, water insoluble expansion agents and fire retardant additives. FlameSafe Bags and FlameSafe Pillows by W.R. Grace & Co. or equal.

Silicone Foams – Multicomponent, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Fire Barrier 2001 Silicone RTV Foam by 3M Fire Protection Products or equal.

Silicone Sealants – Moisture curing, single component, silicone based neutral curing elastomeric of grades indicated below. Grade for horizontal surfaces – pourable (self leveling) – Biotherm 200SL Firestop Sealant by Bio FireShield or equal. Grade for vertical surfaces – nonsag formulation – Biotherm 100 Firestop by Bio FireShield or equal.

Section 07842 – Fire Resistive Joint Systems

a. This section includes fire resistive joint systems for floor to wall joints, head of wall joints, wall to wall joints and wall to adjacent structures joints.
b. Provide fire resistive joint systems that are produced and installed to resist the spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of assembly in which fire resistive joint systems are installed.
c. Joint Systems in and between Fire Resistance Rated Construction: Provide systems with assembly ratings equaling or exceeding the fire resistance ratings of construction that they join, and with movement capabilities indicated as determined by UL 2079.
d. For fire resistive systems exposed to view, provide products with flame spread and smoke developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
e. Provide products by one of the following: A/D Fire Protection Systems Inc., W.R. Grace & Co., Hilti Inc., Johns Manville, Nelson Firestop Products, NUCO Inc., RectorSeal Corp., Specified Technologies Inc., 3M Fire Protection Products Division, Tremco Sealant/Weatherproofing Division, USG Corp.

Section 07900 – Joint Sealants

a. General Purpose Exterior Sealant (non-masonry) – Polyurethane ASTM C920, Type S, Grade NS, Class 25, single component. Sonolastic NP-1 by Sonneborne or equal.
b. General Purpose Exterior Sealant (masonry) – Polyurethane ASTM C920, Type M, Grade NS, Class 25, two component. Sonolastic NP-2 by Sonneborne or equal.
c. General Purpose Interior Sealant – Acrylic emulsion latex ASTM C834, single component, paintable. Tremco Acrylic Latex or equal.
d. General Purpose Interior Sealant (toilet fixtures, counters) – Acrylic emulsion latex ASTM C920, uses M and A, single component, mildew resistant. Sanitary 1700 by GE Silicones or equal.

Section 08100 – Doors and Frames

a. Steel Doors – Provide (Grade II) 1 3/4 inch thick doors manufactured from 18 gauge galvanized cold rolled steel face sheets by Ceco, Curries, Steelcraft or equal. Provide 14 gauge channels at top and bottom of doors. Provide 12 gauge reinforcement welded within the door for closer attachment. Doors shall bonderized and have one coat of baked on prime coat of paint.
b. Metal Frames – Welded frames shall be 16 gauge, cold rolled prime quality galvanized steel. Frames shall be bonderized and have baked-on prime coat of paint. Provide 3 anchors per jamb consisting of 3 wall anchors and 1 floor anchor. Provide 3 door silencers on strike jambs of single doors and 2 silencers on head of double door frames.
c. Wood Doors – Provide 1 3/4 inch thick solid core wood doors by Algoma, Eggers, Marshfield Door or equal. Doors shall be 5 ply construction with type I adhesive for core construction and veneer plies. Facing shall be "A" grade rotary cut, natural maple for transparent finish.
d. Glazing Beads – For metal door beads shall be cold rolled sheet steel, 18 gauge minimum, mitered and welded corners with countersunk mounting holes and Shop primed finish. For wood door beads shall be solid wood of same species as door facing and mitered corners.
e. Overhead Door – Specification for overhead door, operator & controls to be provided by Owner.

Section 08400 – Aluminum Entrances

a. Doors and Framing – Provide 451 T Thermal Framing system with 500 wide stile doors by Kawneer or equivalent by Tubelite. Provide door reinforcement for closers. Furnish weather-stripping, butt hinges and aluminum threshold. The remaining hardware shall be provided under finish hardware section 08710. Refer to section 08800 for glazing.

Section 08461 – Automatic Sliding Doors

a. Automatic Sliding Door System: Dura-Glide 2000 by Stanley. Full breakout design consists of an aluminum door with side lite. Emergency breakout shall be for sliding door only. Medium style single slide doors with 1 inch insulated tempered glass. Door system shall be provided with electric lock, access control with recessed panic exit devices, and full weather stripping.

Section 08710 – Finish Hardware

a. Hinges – Standard weight average frequency FBB line by Stanley or equal by McKinney or Bommer. Solid brass or bronze, five knuckle, flush ball bearing design. Provide 3 hinges for each door leaf.
b. Locksets – Heavy Duty Cylinder Locksets. 10 line series by Sargent with LNL levers, or equal.
c. Exit Devices – 8800 series rim devices by Sargent. Lever design shall match lock trim.

d. Door Closers – Door closers shall have sully hydraulic, full rack and pinion action. Cylinder body shall be 1 ½ in. diameter heat treated pinion shall be 11/16 in. diameter. All closers shall solid forged steel main arms and forged forearms for parallel arm closers. Closers shall be by Sargent or LCN.
e. Door Stops – Provide Ives 436B and 438B dome type floor stops or equal by Rockwood or Glynn Johnson.
f. Push Plates – Push plates shall be 4 in. x 16 in. x .050 in. thickness stainless steel. Rockwood 70 Series or equal.
g. Door Pulls – Door pulls shall be 1 in. x 10 in. Type A: Rockwood BF111, Burns BF26C or Quality BF163-10". Type B: Rockwood 157, Burns 39C or Quality 521.
h. Protective Plates – Kick plates shall be 8 in. high by 1 ½ in. less door width. Plates shall by .050 thickness, stainless steel, bevel 4 edges, screws shall be oval head counter sunk.
i. Threshold – Flat extruded aluminum threshold, ½ in. high with beveled edges and corrugated surfaces. Set thresholds in a full bed of sealant.
j. Weatherstripping – As required for exterior doors.
k. Silencers – Provide silencers on all metal and wood frames. Silencers shall be Ives 20/21, Glynn Johnson 64/65, or Rockwood 608/609.
l. Keying – Per instructions by Owner.
m. Key Cabinet – Furnish 1 Aristocrat wall cabinet as manufactured by Telkee, Inc., Key Control Systems, Lund or equal. Cabinet shall be sufficient to accommodate all locks related to this project (2 keys per lockset), with an allowance for expansion of not less than 50%.
n. Finishes – All items shall be furnished in finish approved by Owner.

Section 08800 – Glazing

a. Tempered Safety Glass – ASTM C1048 fully tempered, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select conforming to ANSI Z97.1, 1/4 inch thick.
b. Low – E insulated glass units: Uncoated insulating glass units complying with ASTM E 773 and E 774; double pane with glass elastomer edge seal; inner and outer panes of 1/4 inch glass; total unit thickness of 1 inch minimum.

    1. Interspace Content: Argon.
    2. Outdoor Lite: Class 1 tinted (gray) float glass.
        a. Kind FT fully tempered.
    3. Indoor Lite: Class 1 (clear) float glass.
        a. Kind FT fully tempered.
    4. Low-E Coating: Sputtered coated on third surface.
    5. Winter U-Value: 0.28.

Section 09250 – Gypsum Board Assemblies

a. Steel Framing for Walls and Partitions – Steel framing and furring shall be by Dietrich Industries, Marino/Ware or equal. Provide steel framing members complying with ASTM A 653, G 40 (ASTM A 653M, Z 90) hot dipped galvanized coating.
b. Steel Studs and Runners – ASTM C 645 with flange edges of studs bent back 90 degrees and doubled to form 3/16 inch wide min. lip. Thickness shall be 25 gauge for studs less than 3 5/8 inches deep, 22 gauge for studs 3 5/8 inches deep and 20 gauge for studs 6 inches deep.
c. Steel Furring Channels – ASTM C 645, hat shaped, 25 gauge with a depth of 7/8 inches.
d. Gypsum Board and Related Products – Shall be provided by Domtar, U.S. Gypsum Co., Georgia Pacific Corp., National Gypsum Co. or equal.
e. Gypsum Wallboard – ASTM C 36 type "X" for 5/8 inch thickness with tapered edges.
f. Water Resistant Gypsum Board (MR) – ASTM C 630/C 630M for 5/8 inch thickness with tapered edges. Install at Bathrooms, Toilet Rooms, Janitor's Closets, Trash Rooms and wherever else indicated.

g. Corner Bead – 1 1/4 inch x 1 1/4 inch galvanized steel external corner with 1/8 inch nose bead.
h. Casing Bead – 30 gauge galvanized steel channel-type casing with 1/16 inch nose bead ground and knurled flange for joint compound finishing.
i. Control Joint – One piece control joint formed with V-shaped slot and removable strip covering slot opening.
j. Joint Treatment Materials – Provide joint treatment material complying with ASTM C 475 and the recommendations of both the manufacturers of the sheet products and of joint treatment materials for each application indicated.
k. Acoustical Sealants – Acoustical Sealant for exposed & concealed joints: Pecora Corp. AC-20 FTR or equal by U.S. Gypsum Co. Acoustical Sealant for concealed joints: Ohio Sealants Inc. Pro-Series SC-175 rubber base sound sealant, Pecora Corp. AIS-919 or equal by Tremco Inc.

Section 09300 – Tile

a. Floor Tile – (Toilet Rooms) Porcelain Tile by American Olean or equal by Daltile. Slip resistant 12 inch x 12 inch tile. Colors shall be by Owner.
b. Wall/Wainscot Tile – (Toilet Rooms) Porcelain Tile by American Olean or equal by Daltile 12"x12" tile – to match floor tile. Supply with matching base units.
c. Thin-set Installations – Latex-Portland Cement Mortar and Grout. Factory prepared thin-set mortar consisting of Type 1 Portland cement and fine aggregate blended with acrylic latex liquid additive conforming to ANSI A 118.4.
d. Elastomeric Sealants – Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Section 07900 - Joint Sealants, including ASTM C 920 as referenced Type, Grade, Class and Uses.
e. Metal Edge Strips – Anodized aluminum, Schluter – RENO – V with adjustable transition arm.

Section 09510 – Acoustical Panel Ceilings

a. Acoustical Tiles – Acoustical tile ceilings shall be provided by Armstrong, USG Industries or equal. Ceiling tiles shall 24 inch x 48 inch x 5/8 inch, mineral wool fiber, white vinyl paint, fissured surface with revealed angled tegular edge. The tiles shall be the equivalent to Armstrong's Cortega with an STC range 35 to 39 and NRC range .50 to .60.
b. Metal Suspension System – The metal suspension system shall be equal to the Prelude 15/16 inch Exposed Tee System (7300 series) by Armstrong, the 1200 System by Chicago Metallic Corp. , or the DX 24 System by USG Interiors.

Section 09650 – Resilient Flooring

a. Vinyl Composition Floor Tile – 12 inch x 12 inch x 1/8 inch tile as manufacture by Armstrong, Mannington or Azrock. Provide colors and patterns as selected from manufacturer's full range of colors and as directed by the Owner.
b. Rubber Wall Base – Provided by Johnsonite, Armstrong, Roppe or equal. Cove with top-set toe for resilient flooring. The tile shall be 1/8 thick, 4 inches in height and have corners job formed. Provide colors as selected from manufacturer's full range of colors.
c. Trowelable Underlayments and Patching Compounds – Latex modified, Portland cement based formulation provided or approved by the tile manufacturer for application intended.
d. Adhesives – Water-resistant type recommended by the tile manufacturer to suit resilient floor tile products and substrate conditions indicated.
e. Transition Strips – Provided by Johnsonite. Carpet to Resilient: No. CTA-XX-D. Resilient to Concrete: No. RRS-XX-C. Carpet to Concrete: No. EG-XX-G.

Section 09900 – Painting

a. VOC Compliance for Paints and Coatings: Provide the manufacturer's formulation for the products specified below that are VOC compliant with the State of Maine Dept. of Environmental Regulation "Chapter 151 – Architectural and Industrial Maintenance Coatings".
b. Gypsum Board – Eggshell (Flat at Ceilings), Acrylic Enamel Finish: 2 finish coats over a primer. Primer – Sherwin Williams ProMar 200 Zero VOC Latex Primer; 1.3 mils DFT. Finish coats – ProMar 200 Zero Latex Paint; 3.2 mils DFT.
c. Natural Finish Wood – Waterborne, Satin-Varnish Finish: 3 finish coats. Finish coats – Sherwin Williams Minwax Polycrylic.
d. Painted Finish Wood – Semigloss, Acrylic Enamel Finish: 2 finish coats over a primer. Primer – Sherwin Williams Sherwin Williams ProMar 200 Zero VOC Latex Primer; 1.3 mils DFT. Finish Coats – Sherwin Williams ProMar 200 Zero VOC Latex Semi-gloss Paint; 3.0 mils DFT.
e. Ferrous Metal – Semigloss, Acrylic Enamel Finish: 2 coats over a rust inhibitive primer. Primer – Sherwin Williams Galvite HS, B50WZ30; 3.5 DFT. Finish coats – Sherwin Williams Duration Exterior Gloss Latex Coating; 5.6 mils DFT.
f. Ferrous and Zinc Coated Metal – Semigloss, Acrylic Enamel Finish: 2 finish coats over a primer. Primer – Sherwin Williams Galvite HS Paint B50WZ30; 3.5 mils DFT. Finish coats – Sherwin Williams ProMar 200 Interior latex Semi-Gloss B31-2200 Series; 3.0 mils DFT.
g. Telecommunication and Electrical Backboards – Flat Intumescent Finish: 2 finish coats over a primer. Primer – Moore Pristine EcoSpec Interior Latex Primer Sealer 231; 0.8 mils DFT. Finish coats – Moore M59 220 Latex Fire Retardant Coating.
h. Concrete: Provide the following finish systems over exterior concrete substrates. 2 finish coats over primer. Primer: Penetrating, flexible, low odor, modified polyamine epoxy primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than recommended by manufacturer; Tnemec Series 151, Elasto-Grip FC. Finish Coats: Low luster (matte), exterior, modified waterborne acrylate paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product; Tnemec Series 156 Enviro-Crete; minimum 12.0 mils DFT total.

Section 10522 – Fire Extinguishers, Cabinets and Accessories

a. Cabinets – Provide cabinets by Larsen's Manuf., J.L. Industries, Potter Roemer Inc., Lyon Metal Products, or Croker Standard.

   Cabinet – Model 2409-6R in non-rated walls, Model FS 2409-6R in rated walls; semi recessed design with 2 ½ inch rolled edge trim, capable of being installed in a rough wall opening depth of no more than 4 ¼ inch and able to hold the supplied extinguisher. The door shall be Horizontal Duo Panel, ½ inch thick hollow metal design, pull handle, self-adjusting roller catch, continuous piano hinge permitting door to open 180 degrees and 1/8 inch thick glass panel. Glass shall be fully tempered float glass.

b. Extinguishers – Provide extinguishers by Amerex, Potter Roemer Inc., Kidde, or Larsen's Manuf. Multipurpose dry chemical type in steel containers, UL rated with monoammonium phosphate based dry chemical in enameled steel container. Provide 4-A:60-B:C, 10 lb units for all fire extinguisher cabinets. Provide 4-A:60-B:C, 10 lb bracket mounted units in Mechanical Rooms.

Section 10800 – Toilet Accessories

a. Toilet Tissue Dispensers – Model B-5288 by Bobrick.
b. Mirrors – Unframed tempered glass mirrors.

c. Grab Bars – Bobrick B-6806.99 Series, 18 gauge heavy duty, type 304 stainless steel, 1 ½ inch diameter, .064 inch minimum wall thickness with 3/16 inch thick flanges.
d. Soap Dispensers – Model B-5050 by Bobrick.
e. Paper Towel Dispensers – Model B-52860 by Bobrick.
f. Toilet Seat Cover Dispensers – Model B-5221 by Bobrick.

END

SECTION 15400
PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings, Addenda, General Provisions of Contract, including General and Supplementary conditions and General Requirements apply to work specified in this Section.

1.02 DEFINITIONS

A. ADA: Designed to meet the requirements of the Americans with Disabilities Act.

B. Adaptable: Designed so in the future it can be easily adapted to meet most of the essential requirements of the Americans with Disabilities Act with minor additions and adjustments, such as change of height of counter or addition of a lift seat.

C. Concealed: Shall mean in walls, in chases, above ceilings, within enclosed cabinets, otherwise enclosed.

D. Equal: Shall mean essentially the same as that product specified, but a model of a different manufacturer

E. Exposed: Shall mean in finished spaces, in closets, under counters, behind and/or under equipment and/or otherwise visible.

F. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

G. Materials: Shall mean any product used in the construction, including but not limited to: fixtures, equipment, piping and supplies.

H. Others: Shall mean provided by sections other than this section. If not purposely assumed by another section, shall be provided by the Contractor.

I. Piping: Shall mean pipe, fittings, hangers and valves.

J. Provide: Shall mean the furnishing and installing of materials.

K. Reviewed equal: Shall mean that the Architect or a designated Consultant, not the contractor, shall make final determination whether materials are an equal to that which is specified.

L. Substitution: Shall mean of materials of significantly different physical, structural or electrical requirements, performance, dimensions, function, maintenance, quality or durability, than that specified.

1.03 ALTERNATES

There are NO alternates that apply to this section of the project.

1.04 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation, and perform all operations required for the demolition, alteration and renovation indicated. And to install complete plumbing systems in the building, in accordance with these specifications and applicable drawings.

2. Provide the following:

a. Sanitary, waste and vent systems.
b. Domestic hot and cold water system.
c. Fuel gas system.
d. Pipe, valve and fittings
e. Water specialties
f. Drainage specialties
g.. Plumbing fixtures and accessories
h. Insulation
i. Installation and/or connections to fixtures/equipment provided by others.

3. Specifications and accompanying drawings do not indicate every detail of pipe, valves, fittings, hangers, fixtures and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.

1.05 PERMITS

A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.

B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner's maintenance manual.

1.06 CODES AND ORDINANCES

A. All work performed under this Section of the Specifications shall be done in accordance with applicable Federal Laws, Maine State Laws, Uniform Plumbing Code, Subsurface Wastewater Disposal Rules, and local plumbing codes and ordinances. The following standards are also to be followed when applicable:

ADA	Americans With Disabilities Act
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
BOCA	Building Officials & Code Administrators International, Inc.
NFPA	National Fire Protection Association (a.k.a. NFC, National Fire code)
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Act

UL Underwriter’s Laboratories

B. If an obsolete code section or standard is specified, the latest replacement issue of each Code or standard for the application, in effect at the time of bidding, shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.07 QUALITY ASSURANCE

A. Use sufficient qualified workmen and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of the system throughout. Work performed shall conform to manufacturers’ recommendations, good standard practice and industry standards.

B. Technical training of workmen installing the systems specified, by the systems manufacturer, shall be mandatory prior to commencement of work. Documentation of such certification shall be made available to the Architect upon request within 5 business days

C. Any work deemed unacceptable by the Engineer, Architect or Clerk of the Works shall be redone correctly, at no additional cost to the owner.

1.08 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD drawings will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD 2006 and may be provided in either the 2000 or 2004 file formats. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files.

All contract documents are copyrighted material. No portion of materials may be reproduced or duplicated except as indicated in the release form. Where release forms are not required (Adobe based files), materials may be printed for use by the intended recipient only and may not be reproduced or copied in any other manner unless written permission is obtained.

1.09 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise.

A. Any proposal for substitution of Plumbing equipment shall be made in writing PRIOR TO OPENING OF BIDS. Submit full details for consideration and obtain written approval of the Architect. The phrase "or approved equal" shall be intended to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "approved equal" meets or exceeds

the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.

B. Approval by Architect for such substitution shall not relieve the Plumbing Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work

C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.

D. Materials and equipment determined as an “approved equal” and /or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. manufacturer, model, etc.) specified.

E. Any additional cost resulting from the substitution of equipment shall be paid by this Contractor.

1.10 PLANS AND SPECIFICATIONS FOR SUPPLIERS

This Contractor shall provide his Suppliers, and any related subcontractors, with a copy of the specification pages, and letter sized photocopies of equipment details and schedules, that pertain to the item to be supplied.

1.11 SHOP DRAWINGS & SUBMITTALS

A. As soon as possible after award of Contract (but not longer than 21 calendar days), before any material or equipment is purchased, Plumbing Contractor shall submit to the Architect no less than ten (10) copies of shop drawings for approval. If shop drawings are not submitted within the allotted time frame all substitutions included the late shop drawings will be invalid and the equipment specified must be provided. Any costs resulting from delays in the project schedule due to failure to submit shop drawings related to this section in a timely manner shall be the responsibility of the Plumbing Contractor.

B. Each item shall be properly identified, preferably by fixture/equipment tag number (such as WC-3), and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.

C. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with requirements of the drawings and specifications. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.

D. Should any materials or products be purchased and/or installed without prior review and

comment the contractor shall be required to remove or replace those products and/or materials if directed by the Architect at his own expense. If the materials are not removed (or replaced) or if the project is delayed as a result the Architect reserves the right to order the withholding of payment until the situation is resolved in a manner satisfactory to the Architect.

E. Shop drawings for sections 15400, 15600 and 15710 shall be submitted under separate cover or they will be refused for re-submittal. In order to maintain consistency, submittals shall be identified by job title, specification section and paragraph number. Electronic files shall be identified in the same manner (Leonardlake-15400-2.01-E.pdf for instance). Items under each paragraph may be combined into one submittal but do not combine items from multiple paragraphs. For instance, do not combine items specified under par 2.01 with items specified under par. 2.02.

F. It is desirable for shop drawings to be submitted electronically, including all documentation outlined in paragraph "A" above. Hard copies of shop drawings must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.

G. Review must be obtained on all items specified in Section 2 Products or shown on the drawing, and any significant items implied or otherwise required but not specified.

H. Format

1. Related items shall be stapled or Bound together as a package. The number of copies of each package shall be as listed above. Examples of packages of related items include:

    a. Hangers and Supports
    b. Identification
    c. Insulation
    d. Valves
    e. Piping
    f. Plumbing Fixtures with accessories
    g. Drainage Specialties
    h. Water Specialties
    i. Pumps

2. If due to circumstances beyond his control, the contractor is unable to include all the related items in the submitted package, he shall insert in its place a plain sheet of paper with a notation stating that the item will be submitted separately.

1.12 PRODUCT HANDLING

Use all means necessary to protect materials before, during and after installation, and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.13 AS-BUILT DRAWINGS

Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of all blueprints furnished for this job. On this special set of blueprints, record *completely and accurately* all differences between the work as actually installed and the design as

shown on the drawings. These record prints must be kept up to date by recording all changes within one week of the time that the changes are authorized. At the completion of the work, this set of drawings shall be delivered to the Architect for the Owner electronically in the form of CAD drawings. If a complete record of changes is not made and electronic CAD drawings not provided by the Plumbing Contractor, a record shall be made by the Engineers, and *the cost of the record shall be paid by the Plumbing Contractor*. Copies of the plumbing CAD drawings may be made available electronically to the Contractor if desired. Drawings shall be dated accordingly and clearly identified as "AS-BUILT". Contact the Architect directly or the Engineer via e-mail at mechsyst@maine.rr.com. Specify required CAD format when requesting the files. CAD drawings were generated using AutoCAD 2006 and utilize both paper space and model space with external references to various other drawings. Files will be compressed and will require "WinZip" (http://www.winzip.com) for extraction. A release form will be provided which must be signed and returned to the Engineer prior to transfer of files.

1.14 MAINTENANCE MANUAL

On completion of this portion of the work, and as a condition of its acceptance, submit for review two copies of a manual describing the system. Plumbing equipment manuals shall be separate from mechanical manuals. All manuals shall be original copies, not photocopies, or they will be refused for resubmittal. Prepare manuals in durable 3-ring binders approximately 8.1/2" by 11" in size with at least the following:

A. Project name on the spine and front cover, and identification on the front cover stating the project name, general nature of the manual, and name, address and telephone number of the General and Plumbing Contractors.

B. Neatly typewritten index.

C. Complete instructions regarding operation and maintenance of all equipment involved.

D. Complete nomenclature of all frequently replaceable parts and supplies, their part numbers, and name, address and telephone number of the vendor.

E. Copy of all guarantees and warranties issued, and dates of expiration.

F. Shop drawings and equipment/fixtures manufacturer's catalog pages. Clearly indicate the precise item included in this installation and delete, cross out or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.

1.15 OBJECTIONABLE NOISE AND VIBRATION

All equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus or piping, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Contractor at no extra cost to the Owner.

1.16 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.

1.17 DEVIATIONS, DISCREPANCIES AND OMISSIONS

A. The drawings are intended to indicate only diagrammatically the intent, extent, general character and approximate locations of plumbing work. Work indicated, but having details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. This shall include but not be limited to:

1. All items that are required to meet all applicable codes and referenced standards.

2. Piping for cold and hot water supply, drain, vent, gas, etc to each plumbing fixture/equipment shown on the drawings, or scheduled as required.

3. Shut-off valves on lines feeding individual fixtures without integral stops.

4. Minor single phase electrical wiring, or control wiring, between Plumbing provided items that require it, unless indicated on the Electrical Drawings.

5. Plumbing related items indicated on the drawings of other trades.

6. Items indicated on one plumbing drawing but not shown on a corresponding drawing.

7. Items implied on the plumbing drawings but not shown.

8. All plumbing related items clearly shown in dark print on the Plumbing drawings but not included in the specification, unless it is noted as being provided by the owner or other contractor or unless other sections assume the responsibility.

B. The drawings and specifications are complimentary to each other and what is called for in one shall be as binding as if called for by both. In the event of conflicting information on the drawings, or in the specifications, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.

1.18 WORKPLACE SAFETY

A. The Trade Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods, and for any damage, which may result from their failure of their improper construction, maintenance, or operation.

1.19 CHANGE ORDERS

A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by the Architect or Engineer of record.

B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

PART 2 - PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, the materials to be furnished under this contract shall be new and the standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest standard design that complies with the specification requirements.

B. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise. An entire product line may be rejected if one, or more, of the products submitted is not an equal to that specified.

C. All products shall be manufactured within the United States, unless specified otherwise, and supplied locally (within the State) wherever possible. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.

D. Unspecified items shall be by the same manufacturer and level of quality and as similar items specified, whenever possible. Whenever items have no similarity to those specified in this section, provide the equivalent item as specified in other Division 15 Sections. When no similarity exists in other sections, the Contractor shall submit for review an appropriate commercial/institutional quality item, complete to perform the functions intended, using his best discretion. The Architect or a designated Consultant, not the contractor, shall make final determination whether materials are of suitable quality and perform the functions intended.

2.02 HANGERS AND SUPPORTS

A. General

1. All hangers and supports shall be especially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.

2. Piping specified herein shall not be supported from piping of other trades.

3. All steel hangers shall be factory painted.

4. Hangers shall be heavy-duty steel adjustable clevis type, plain for steel, cast iron and plastic pipe, and copper plated for piping in direct contact with copper tubing (i.e. copper hot water piping) shall be equal to Carpenter & Paterson Inc., Fig. 100 (Fig. 100CT copper plated).

5. Hangers shall go outside of insulation for domestic water piping. Each hanger shall be furnished with metal shield; Fig. 100 SH.

6. Exposed vertical risers ¾ inch and smaller shall be supported at 6 foot intervals between floor and ceiling with split ring type hangers; copper plated for piping in direct contact with copper tubing equal to Carpenter & Paterson Inc., Fig.81 (Fig. 81CT copper plated). ALL PIPING DROPS TO FIXTURES SHALL BE ANCHORED SOLID TO WALL WITH A STEEL SUPPORT BRACKET WITH ADJUSTABLE CLIP, ESPECIALLY PIPING TO FLUSH VALVES

7. Piping suspended from walls and partitions shall be supported by steel support bracket with adjustable clips equal to Carpenter & Paterson Inc., Fig. 69. All

attachments to bar joists shall be from top chord.

B. Hanger Rods & Attachments

1. Hanger rods shall be galvanized all thread rod. Rod size shall be as follows:

Pipe Size	Rod Size
3/8” to 2”	3/8”
2.1/2” to 3.1/2”	1/2"
4” to 5”	5/8”
6”	3/4"

2. All nuts for hanger rods and hangers to be galvanized steel.

3. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks and compound anchor shields and bolts in poured concrete.

4. Provide toggle bolts with rod couplings for fastening in the pre-cast concrete plank decks.

5. Provide and install angle iron supports for pipe hangers in locations as required. Angle iron supports shall be adequate size for span and piping or equipment.

6. Hot and cold water piping at each fixture shall be securely fastened in wall with split ring type hanger fastened to studs within wall.

2.03 SEISMIC RESTRAINT

All seismic restraints shall be in accordance with the International Building Code.

A. Piping Suspended by Hangers

Piping suspended by individual hangers 12 inches or less in length, need not be braced. The following piping shall be braced:

1. Fuel Oil, Fuel Gas, 1 inch and larger

a. Brazed or Soldered Joints - Transverse bracing every 20 feet and longitudinal every 40 feet.
b. Threaded or Mechanical Joints - Transverse bracing every 10 feet and longitudinal every 20 feet.

B. Piping Risers

1. All vertical pipe risers shall be laterally supported with a riser clamp at each floor.

2. No-hub joints shall be braced or stabilized between floors.

C. Equipment

1. All floor/pad mounted equipment including: water heaters, above ground water storage tanks, pneumatic pressure tanks, expansion tanks and boilers shall be anchored to the floor.

2. Suspended equipment shall be cross braced in all directions.

2.04 IDENTIFICATION

A. Tag each new pump /equipment, and switch with 2½ inches x ¾ inch rectangular engraved nameplates with white letters on black, #2060-20 by Seton Name Plate Corp. or reviewed equals. Nameplates shall be mechanically fastened to equipment (adhesives are not acceptable). Embossed labels are not acceptable.

B. Identify all new water and drain piping with "Set Mark" snap-around pipe markers by Seton Name Plate Corporation or reviewed equal. Markers shall include both identification and arrows indicating direction of flow. Markers shall be placed on pipe segments 5 feet and longer, and spaced no less than 10 feet apart. Heating hot water piping shall be labeled differently from Domestic hot water piping. On parallel runs of piping, plumbing markers shall be grouped together, and grouped with heating markers whenever practical.

Legend	Background/Letter Color
"Cold Water"	Green/ white letters
"Domestic 120°F Water"	Yellow/ black letters
"Gas"	Yellow/ black letters
"Plumbing Vent"	Green/ white letters
"Sanitary Drain"	Green/ white letters
"Storm Drain"	Green/ white letters

C. Tag all new valves with Seton #M4506 1½ inch square brass tags and #6 bead chains, stamped with the following identification: "CW", "HW", "HWR" or "140HW". Tag shall be consecutively numbered. DO NOT DUPLICATE EXISTING VALVE IDENTIFICATION NUMBERS. Fixture stops, control valves or valves adjacent to equipment, the use of which is obvious, are not to be tagged.

D. Provide valve charts identifying valve number, valve identification and service (i.e. Apt. 203, HW). Mount charts in Boiler Room and Mechanical Room in 8½ inch x 10 inch and 8½ inch x 11 inch self-closing aluminum frame with plastic windows. Provide additional copies for maintenance manuals.

2.05 INSULATION

A. All Domestic Water Piping and any uninsulated Storm/Roof drain water piping.

1. Exposed Piping: Insulate exposed piping above slab/grade with Owens Corning Evolution SSL II paper free ASJ with tough, wrinkle resistant, easy to-clean jacket, or approved equal. Install will great care for appearance, turning any writing or seams toward the wall. Or reviewed equal.

a. Option: use standard Owens Corning fiberglass insulation with ASJ or approved equal, and carefully and neatly cover it with a white PVC plastic covering material. Covering shall be applied in no less than 4 foot lengths with shingle joints. Longitudinal joints shall be on the top or back sides so as to be out of sight and sealed with adhesive materials provided with the jacketing. Material shall be butted to finish walls or Insulation. Jacketing material shall be Zeston pre-cut, pre-curled 0.030 thickness. Or reviewed equal.

2. Concealed piping and piping in Mechanical rooms: Insulate with well installed and sealed Armaflex Pipe Insulation with pressure sealing lap adhesive, or equal.

   a. Option: use standard Owens Corning fiberglass insulation with ASJ or approved equal.

3. Thickness as follows:
   a. Hot water: 1" thick.
   b. Cold water and roof drain piping: ½" thick minimum.

4. Insulate any below grade hot water piping run outs with ½" Armaflex closed cell piping insulation.

B. Fittings

1. All fittings and valves shall be covered with a one piece PVC insulated fitting cover secured.

2. The ends of insulation on exposed pipes at valves, flanges, unions, etc., shall be finished neatly with covering to match jacket and secure with mastic.

3. Valves, flanges and unions on hot water piping shall not be insulated.

C. Installation

All insulation work shall be executed by skilled insulation workmen regularly in the trade.

2.06 VALVES

A. General

1. Valves shall be provided as shown and as required to make the installation and its apparatus complete in operation; locate to permit easy operation, replacement and repair.

2. All valves must be so constructed that they may be repacked under pressure while open.

3. Check valves shall be installed in all lines where flow may reverse from intended direction.

4. Valves shall have name and/or trademark of manufacturer as well as working pressure stamped or cast on valve body.

5. Valves shall comply with Manufacturer's Standards Society (MSS) specifications and be so listed.

B. Types and Manufacturers

All valves shall be of one manufacturer and by one of the manufacturers listed. The following list is provided as a means of identifying the quality and type required.

1. Ball valves 1¼ inches in size and smaller

Shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blowout proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "full port". Rated for 400# WOG and 350°F:

	Soldered Ends	Screwed Ends
Milwaukee	BA-350S	BA-300S
Apollo	82-200	82-100
Watts	B-6081	B-6080
NIBCO	------	------
Hammond	8614	8604

2. Ball valves 1½ inches in size and larger

Shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blowout proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "conventional port". Rated for 400# WOG and 350°F:

	Soldered Ends	Screwed Ends
Apollo	70-200	70-300
Watts	B-6000-SS	B-6001-SS
NIBCO	S-585-66	T-585-66
Hammond	8514	8503

3. Check Valves 2 inches in size and smaller

Shall be horizontal swing type with bronze body, Teflon disc. Rated for 125# WSP, 200# WOG:

	Soldered Ends	Screwed Ends
Milwaukee	1509-T	509-T
Stockham	B-310-T	B-320-T
NIBCO	S-413-Y	T-413-Y
Hammond	IB945	IB904

4. Drain Valves

Shall be conventional ball valves and provided with hose nipples and threaded metal cap on chain. Watts B-6001-CC or reviewed equal.

2.07 DOMESTIC WATER PIPING

A. Interior Exposed, High temperature and Supportive

1. All exposed piping carrying domestic water, all piping with a temperature above 140 deg. F., all piping supporting inline equipment, and piping within 6 ft of the water heaters, shall be hard-drawn type "L" copper tube with cast or wrought fittings and made up with Silvabrite 100 lead-free solder. Care shall be taken not to over flux.

B. Interior Concealed

All concealed hot (below 141) and cold water piping above finish floor (not buried) shall be one or more of the following:

1. Type L Copper and fittings, all sizes

2. Flowguard Gold CPVC pipe and fittings, all sizes.

3. PEX, sizes 3/4" and smaller

   a. Uponor AquaPEX (PEX-a) (cross linked polyethylene tubing) piping and cold expansion fittings, specifically designed for domestic water. ASTM F 876, Fittings for PEX Tube: ASTM F 1960, insert type and matching PEX tube dimensions. Manifold (if used): Uponor multiple-outlet, corrosion-resistant assembly.

   b. Piping shall be installed in a neat and orderly manner. No wild spaghetti installations will be tolerated. Piping shall be run straight and parallel, and level or sloped slightly to low points with no droops exceeding 1/8". Use PEX bend supports to keep turns tight and steel channel supports to keep piping supported. Any work that in the opinion of the Architect or Engineer of Record that does not meet these standards will be removed and redone at the Contractor's expense.

   d. All PEX piping shall be insulated as indicated under Insulation. Use Armaflex insulation on piping run outs to individual fixtures to allow bending.

   e. Provide the correct spacing of hangers (w/ saddles) for PEX; every 3' or as recommended by the Manufacturer. Do not use the spacing designated for CPVC or copper piping unless using steel u-shaped support channels under insulation. .

   f All work shall be done in accordance with the manufacturer's recommendations.

4. All buried water and trap primer piping shall be AquaPEX or type "K" soft copper tubing. No joints below slab.

5. All buried hot water piping shall be insulated and sealed with ½" Armaflex. **Do not direct bury copper hot water piping.**

6. All exposed, uninsulated water piping near fixtures in finished areas shall be chromium plated I.P.S. copper or red brass pipe or tubing and fittings. Valves shall also be chrome plated brass or bronze. Any chrome trim with wrench marks shall be removed and new trim installed.

7. Type of tubing shall be stamped or printed on each length by Manufacturer.

2.08 SANITARY WASTE AND VENT PIPING

A. All Vent Piping, and Most Sanitary Waste and any Storm Water Piping

Piping and fittings shall be PVC Schedule 40 polyvinyl chloride plastic, as per ASTM-A-

2665 or latest standard. Solvent as per ASTM-D-2564. Exposed vent piping above roof shall be **black** PVC or CPVC for appearance and solar heat dissipation of frost.

2.09 PIPE SLEEVES AND ESCUTCHEONS

A. Sleeves

1. Contractor shall set sleeves for all piping penetrating walls and floors. Sleeves through masonry shall be steel pipe sleeves two sizes larger than pipe. Piping passing through walls other than masonry shall be provided with # 24 gauge galvanized steel tubes with wired or hemmed edges.

2. Sleeves set in concrete floors shall finish flush with underside, but extend minimum of 1 inch above finish floor. Weld clips to sleeves for support in concrete pre-cast planks of a size that will be covered by concrete topping. Sleeves set in partitions shall finish flush with each side.

3. Space between sleeves and pipes shall be sealed to make smoke and water tight with 3M Brand Fire Barrier Caulk CP25 or Putty 303.

4. Masonry sleeves shall be Schedule 40 steel pipe.

5. This Contractor has the option to use the Pro-set system on lieu of the above.

B. Exterior Sleeves (if any)

Where piping passes through exterior walls, provide and install a complete pipe sleeve/hydrostatic wall closure system.

1. Wall sleeve shall be schedule 40 steel pipe, two pipe sizes larger than carrier pipe. Sleeve shall be the same length as the thickness of the wall served.

2. The hydrostatic closure device shall consist of identical interlocking links of solid synthetic rubber compounded to resist ozone, water, chemicals and extreme temperature variations. Each link shall be connected by corrosion resistant bolts and nuts to form a belt that is to fit snugly around the pipe. Under each bolt and nut there shall be a metal pressure plate so that when each nut is tightened the rubber links will expand between the pipe and sleeve to form a continuous, air tight and water tight seal.

3. Units to be Link-Seal system Model LS wall seal by Thunderline Corp. or reviewed equal.

C. Escutcheons

Where piping passes through finish walls, floors, ceilings and partitions, provide and set two piece nickel plated steel floor and ceiling plates.

2.10 PLUMBING FIXTURES

A. DF-1 Drinking Fountain - ADA

1. Halsey Taylor HRFE Contour Series, barrier free fountain, stainless steel, front pushbutton. Or reviewed equal. Provide additional blocking in wall as required for a solid installation.

B. LV-1 Lavatory, Wall - ADA

1. AMERICAN STANDARD 0124.024 Comrade Wall Hung Lavatory, vitreous china, for wall hanger, front overflow, faucet ledge, holes on 4" centers, color "white". Provide wall hanger. Provide additional blocking in wall as required for a solid installation. Or reviewed equal.

2. Delta 523LF-HDF Commercial brass, single lever handle lavatory faucet, 4" centers, ceramic control components, pop-up drain assembly, chrome, meets ADA.

3. McGuire Prowrap offset drain and Prowrap P-trap with supply covers. Chrome plated angle supplies, wheel stops, wrought (not bell) escutcheons. Or provide reviewed equal with TrueBro.

4. Provide carrier as stated under Carriers. Mount rim at 34" to meet ADA.

C. MB-1 Mop Basin

1. The mop basin shall be Fiat MSB-2424, molded stone or reviewed equal. The molding shall be done in matched metal dies under heat and pressure resulting in a one-piece homogeneous product. Size of unit shall be 24"x24"x10" high.

   The drain body shall be cast brass, chrome plated, complete with cast brass lock nut and gaskets. A combination dome strainer and lint basket made from #302, 16 gauge stainless steel attached with tamper proof screws shall be included. The drain body shall provide for a lead caulked joint to be 3" I.P.S.

   Provide the following accessories:
   a. Stainless steel wall guard, MSG-2424
   b. Service faucet with vacuum breaker; integral stops and wall brace plate #830-AA.
   c. 30" Hose with ¾" coupling at one end; Plate #832-AA.
   d. Mop Hanger, stainless steel, 24" long with (3) holders, Plate #889-CC.
   e. Silicone sealant #833-AA.
   f. Vinyl bumper guard #-77-AA.

D. WC-1 Water Closet, Floor – ADA

1. AMERICAN STANDARD 2886.516 H2Option Siphonic Dual Flush Right height Elongated Two-piece Toilet, 16-1/2", Elongated Toilet, vitreous china, 1.6 GPF (when full flush mode), tank top push buttons, close coupled tank with Aquaguard liner, bolt caps, fully glazed trapway, Everclean surface, color "white", 5 year warranty. Install with the centerline of the toilet 18" from the finished sidewall to meet ADA.

2. Church 3155SSCT elongated open front less cover, solid plastic, commercial duty,

stainless steel posts, white. Or reviewed equal.

3. McGuire chrome water closet supply with wheel handle stop. Or reviewed equal.

4. Install water closet solidly to floor; any wobbly water closets will be redone and all costs, direct and incidental, paid for by this contractor.

E. WC-2 Water Closet, Floor – ADA

Same as WC-1 except if providing an equal with the flush handle on the side rather than on the top of the tank, then submit/provide a tank with the handle on the right hand side.

2.11 EQUIPMENT OR PLUMBING FIXTURES BY OTHERS

Any equipment and fixtures by other sections will be provided and set in place by those sections. This contractor will connect gas, domestic hot water, waste and vent as required.

2.12 PLUMBING SPECIALTIES, DRAINAGE

A. Carriers

1. Wall hung fixtures including water closets, lavatories, lav-decks and drinking fountains shall be supported with adjustable floor mounted carriers to fit building conditions, piping system, and fixtures specified. Each carrier shall be provided with a wall finishing frame. All carriers shall be secured to the floor with tie down lugs.

2. Carriers shall be as manufactured by Zurn or reviewed equal.

B. Traps

1. Traps of material and design as approved by the State and shall be furnished and installed at all fixtures and appliances. Trap each fixture separately, keeping all trap screws below water line; vent each trap. Make offsets in vent piping with 45-degree angle fittings when possible. Pitch horizontal vents toward waste lines, group vents and take through roof as shown. All traps, at fixtures and appliances shall be provided with accessible clean outs.

C. Cleanouts

Provide cleanouts for soil and waste where shown on the drawings and as required by code.

1. Floor Cleanouts (FCO)

All floor cleanouts in concrete or tile shall be flush with finish floor.

a. Type “1”, Round, for finished areas

Zurn ZN-1400-BP-K, polished nickel bronze top, bronze plug, anchor flange.

2. Wall Cleanouts

All wall cleanouts shall be Zurn Z-1445 cleanout tee with threaded plug. Polished nickel smooth bronze cover, Zurn ZANB-1462 or reviewed equal.

3. Flashing

Flash each above grade floor clean out with Chloraloy® 240 thermoplastic elastomeric sheet membrane for concealed waterproofing, or other approved flashing material, extending 24" beyond perimeter of clean out and lock into clamping collar.

D. Floor Drains (FD) (if any)

1. All floor drains above grade shall be complete and each provided with flashing flange, flange device, and 24"x24", Chloraloy® 240 thermoplastic elastomeric sheet membrane for concealed waterproofing, or other approved flashing material, lock into drain clamping collar.

2. Traps for floor drains shall be deep seal traps.

a. Type "1 Indirect Waste w/ recessed grate

Cast iron body, flashing collar, polished bronze, 7" adjustable raised flanged grate, inside caulk, trap primer connection. Zurn ZB-415-7I-P or equal by Josam, Wade or Smith. Install with top of flange flush with floor so grate is recessed, or approved equal

2.13 PLUMBING SPECIALTIES, WATER

A. Trap Primer (TP) (if any)

1. Type "1" General

Precision Plumbing Products Inc. Model PR-500 Self-adjusting automatic trap primer. Provide DU-2 distribution unit where indicated. Or reviewed equal. NOTE: As the trap primer may be on a line larger than 1/2", submitting / providing a "flow through" type trap primers smaller than the actual pipe size is not acceptable.

B. Shock Absorbers (SA)

Shock protection shall be provided where shown on drawings and at all quick closing devices. Devices shall be stainless steel shell, welded expansion bellows surrounded by on-toxic mineral oil or gas, pressurized compression chamber charged and factory sealed, all, in-line design, threaded nipple and PDI reviewed. Sized to meet the conditions.

1. Type "1", 'A' P.D.I. units

Zurn Z-1700, #100. Or reviewed equal.

C. Thermometer (T)

Units to be dial type, 4.1/2" with 30° to 180° range; Trerice Universal angle or reviewed equal.

D. Vacuum Relief Valve

Watts Model N36 or reviewed equal.

F. Relief Valve

Watts #530 calibrated pressure relief valve. Set at 100 PSI. Or reviewed equal.

G. Braided Stainless Steel Water Connectors

EPDM tubing jacketed by type 304 stainless steel braid, stainless ferrule, brass nuts. By Zurn or reviewed equal.

H. Dielectric Unions

Series 3000 as manufactured by Watts or reviewed equal.

I. Mixing Valves (MV)

1. Type "1" Master Mixer

Leonard valve model 270-LF, ½", capacity 3.5 GPM @ 5 psi differential pressure for exposed piping, rough bronze, set at 120°F. Or reviewed equal.

J. Expansion Tank

Watts Model DET-5-M1. Potable water expansion tank, 2.1 gallon, 0.85 gallon acceptance, 3/4" connection, precharged to 40 psi. One per water heater. Or reviewed equal.

K. Hose Bibs (HB)

1. Type "1" Exterior Hose Bib

Zurn Z-1321 exposed Ecolotrol "Anti-Siphon" automatic draining, non-freeze wall hydrant, integral backflow preventer, all bronze interior parts, operating key. Or reviewed equal.

2.14 WATER HEATERS

1. Type "1" Electric

ProMax EJCS-20, 20 gallon electric water heater, 4500 KW, top or side connect, magnesium anode, 1 year warranty. Or reviewed equal. Provide shelf, all water piping, valves and accessories required for a complete installation

2.15 PAINTING

Painting shall be provided for all steel/iron equipment supports, steel/iron fuel piping, exposed flanges, fittings and valves within boiler rooms, basements and outside and where specified elsewhere within this section. Painting shall consist of no less than two (2) coats of rust inhibiting paint, Rust'O'leum or approved equal. Paint shall be capable of withstanding temperatures of up to 250^{o}F. Colors shall be as follows:

Equipment supports	Flat black
Fuel Gas Piping outside	Grey

2.16 FUEL GAS SYSTEM

A. Interior Piping shall be Schedule 40 black steel pipe, ASTM 120 with 150# fittings.

a. Piping 2" and less in diameter shall be screwed pattern malleable iron fittings, shall meet ASTM A-47, ASA B16.3. Pipe joint compound shall be used on all threaded joints.

b. Piping shall use welded fittings if over 2" in diameter, or if pressure in excess of 14" W.C.

B. Provide dirt leg, gas cock and union at each boiler.

C. Installation shall meet the requirements of the gas supplier and NFPA 54.

2.17 VALVE BOXES, ACCESS DOORS AND PANELS

A. Furnish General Contractor with valve boxes, access doors/ panels for all locations where service access is required behind walls, above sheetrock and masonry ceilings, and below floors for equipment, piping, valves, and specialties furnished under Division 15.

B. Shall be located in closets, storage rooms and/or other non-public areas whenever possible, in a workmanlike manner, positioned so that junction can be easily reached and the size shall be sufficient for this purpose . When required in corridors, lobbies or other habitable areas, they shall be located as directed by the Architect.

C. Units shall have 16-gauge steel frame and 14-gauge steel hinged door panel. Door shall have concealed spring hinges allowing door to be opened to 175^{o}.

D. Units shall be factory primed for field painting by Section 09900.

E. Provide UL-rated 1-1/2 hour Class B access panels where required to comply with applicable Code requirements.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that plumbing may be installed in strict accordance with all pertinent codes and regulations and the reviewed Shop Drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.02 COORDINATION WITH OTHER TRADES

A. Before installation, participate in a coordination meeting with the Clerk of the Works, Construction Manager, Mechanical/HVAC, Fire Protection and Electrical trades. Establish and resolve areas of conflict and congestion, especially those indicated on the drawings. Priority to be given to HVAC equipment and large ductwork, then gravity piping, then small ductwork, then piping based on descending order of size. Special consideration given to allow access to valves, dampers etc.

B. Failure to coordinate will result in this contractor removing and relocating his piping at no additional expense to the owner.

3.03 INSTALLATION OF PIPING AND EQUIPMENT

A. General

1. Install all piping promptly, making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.

2. Provide uniform pitch of at least ¼ inch per foot for all horizontal waste and soil piping 3” or less. For piping 4” and above, slope at 1/8” minimum per foot

3. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the jobs site.

4. Install pipes to clear all beams and obstructions. Do not cut into or reduce the size of load carrying members without the approval of the Architect.

5. Allow room between all piping and other obstructions to allow for the installation of the specified pipe insulation.

6. Plumbing vents

a. Back vent all plumbing fixtures.
b. Pitch all vents at 1/64” per foot minimum toward waste lines for proper

drainage to prevent unintended traps.

c. Install vent piping with each bend 45 degrees minimum from the horizontal, wherever structural conditions will permit.

d. Group plumbing vents and take through roof as shown.

e. Increase vents 3" and smaller one size before going thru roof. Make size transition a minimum of 12" below the surface of flat roofs and 72" (or as structure permits) below sloped roofs.

f. Terminate 18" to 24" above roof.

g. If installing in locations other than as shown on the drawings, line up with other plumbing vents for a neat appearance.

h. Do not install plumbing vents within 10 feet of an operable window or door or within 25 feet of a ventilation air intake.

6. All risers and off-sets shall be substantially supported.

7. Pipe hangers shall be placed on center as follows:

MATERIAL	HORIZONTAL	VERTICAL
Copper 1-1/4" & less	6'	6'
1-1/2"	6'	10'
2" & up	10'	10'
PVC, DWV	4'	4'
Steel	10'	10'

8. Arrange all piping to maintain required grade and pitch to lines to prevent vibration. Expansion loops to anchors shall be provided where shown on drawings.

9. Make all changes in pipe size with reducing fittings.

10. All low points in water piping shall be drained with ½" gate valve with hose nipple and metal cap.

11. No piping shall be installed in such a manner to permit back-siphonage or flow of any liquid in water piping under any conditions.

12. No water piping shall be installed outside of building or in an exterior wall unless adequate provisions are made to protect such pipe from freezing.

13. All piping and drain openings left unattended will be capped, plugged or securely covered to prevent accidental entry of foreign matter. Roof drains in use will be provided with domes.

B. Joints and Connections

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside the fittings; use graphite on all clean out plugs. DO NOT use Teflon tape on gas piping.

2. Smoothly ream all cut P.V.C. pipe. Clean and use solvent for fitting connection and in strict accordance with the manufacturer's recommendations.

3. Make all joints in copper water tube with solder applied in strict accordance with the manufacturer's recommendations.

3.04 STERILIZATION AND FLUSHING OF PIPES

A. After preliminary purging of the system, chlorinate the new potable water system in accordance with the current recommendations of the American Water Works Association, and in accordance with all pertinent codes and regulations. Chlorinate only when the building is unoccupied.

B. Upon completion of the sterilization, thoroughly flush the entire potable water system.

C. After sterilization and flushing are complete, a sample shall be collected from the end of the longest main, or at any other location selected by the Architect, and a water analysis test provided. The test must prove the water acceptable or additional disinfecting of system performed. A copy of the test report shall be submitted to the Architect.

3.05 CLOSING IN UNINSPECTED WORK

Do not cover up or enclose work until it has been properly and completely inspected and approved. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect and at no additional cost to the Owner.

3.06 TESTING OF PIPING

Tests shall be applied to the plumbing installation as required by codes and where as directed by the Architect, and in all cases before work is covered by earth fill or pipe covering.

A. Sanitary piping shall be tested when all underground work is complete (before covering) and again, after all piping is installed, but before it is further closed in. Sanitary systems shall be securely stopped, except at the highest point, and the entire system filled with water to the point of overflow for 24 hours. All leaks shall be repaired. Cracked pipes and fitting shall be removed and replaced. No doping of soil pipe or fittings will be allowed. Plan testing around expected weather and temperature conditions or provide protection so that pipes do not freeze.

B. New domestic water piping shall be filled and subjected to a hydrostatic pressure test of 150 psi for 8 hours with no leaks. If leaks are detected they shall be repaired and the test repeated until work is tight. NOTE: Testing with compressed air only is NOT ACCEPTABLE.

C. Testing of Fuel Gas piping shall conform to NFPA 54.

3.07 CLEANING

Prior to acceptance of the buildings, thoroughly clean all exposed portions of the this installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item, being careful to avoid all damage to finished surfaces. Additional attention may be required to thoroughly clean any used, re-used or owner provided fixtures. Clean out all strainers and aerators and adjust or replace washers, cartridges, etc

3.08 INSTRUCTIONS

On completion of the job, this Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The time of instruction

shall be arranged with the Owner.

3.09 RECYCLING

Discarded materials, both new and removed, shall be recycled whenever practical through metal salvage dealers (piping, etc.), paper salvage (cardboard shipping containers, etc.), wood products, etc. The Plumbing Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

3.10 HAZARDOUS MATERIALS

Mercury or any other material deemed by the Federal Environmental Protection Agency or the State Department of Environmental Protection to be hazardous shall not be used in any components of the plumbing systems.

END OF SECTION

SECTION 15600
MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

1.02 ALTERNATES

There are no alternates that apply to this section of the project.

1.03 DEFINITIONS

ATC Automatic Temperature Control
EC Electrical Contractor (Division 16)
GC General Contractor
HC Heating (mechanical) Contractor
PC Plumbing Contractor

1.04 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation and perform all operations required to install a complete heating, ventilating, heat recovery and air conditioning system in the building, in accordance with these specifications and applicable drawings.

2. All temperatures are expressed in degrees Fahrenheit.

3. Perform demolition and removal as required.

4. Work to be performed shall include, but is not limited to, the following:

   a. Provide and install forced hot air heating and ventilating system in building areas indicated on drawings.
   b. Provide and install direct expansion air conditioning system in building areas indicated on drawings.
   c. Air handling units
   d. Unit heaters and cabinet unit heaters
   e. Insulation
   f. Fans
   g. Sheetmetal
   h. Automatic Temperature Control (ATC)
   i. Tests and balance

5. Specifications and accompanying drawings do not indicate every detail of ductwork and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.

6. Before submitting proposal, Mechanical Contractor shall be familiar with all conditions. Failure to do so does not relieve Mechanical Contractor of responsibility regarding satisfactory installation of the system.

7. Mechanical contractor shall be responsible for rigging to hoist his own (and his sub-contractors') materials and equipment into place.

8. Mechanical contractor and his sub-contractors shall be responsible for start-up of all equipment provided under this section.

B. Related Work Described Elsewhere

1. Excavation and backfill
2. Cutting and patching
3. Electrical conduit and wiring, except as noted below
4. Roofing, curbs, curb openings and framing of openings.
5. Setting of sleeves in masonry work (sleeves provided by Mechanical Contractor)
6. All finish work

C. Mechanical Electrical Work

1. Provide and erect all motors, temperature controls, limit switches as specified.

2. Power supply to switches, fused switches, outlets, motor starters, to line terminals of equipment, and all related wiring and fuses to properly connect and operate all electrical equipment specified shall be furnished and installed under Division 16, "ELECTRICAL". Division 16 shall not drill wiring holes in equipment casings but shall make use of factory wiring knockouts when present. Coordinate all wiring between Mechanical and Electrical to provide a complete and operating system.

3. All wiring provided under this section shall be in accordance with the latest rules and regulations of the National Fire Underwriters, National Electric code, National Fuel Gas Code, and Local Codes. Install all wiring under the supervision of Division 16. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section.

4. Automatic Temperature Control (ATC) Systems

   Low voltage electric wiring shall be furnished and installed by Mechanical Contractor under supervision of Division 16. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section.

   Low voltage control wiring must be plenum rated and adequately supported with no sags or "droops". Low voltage wiring need not be installed in conduit unless required by local code.

5. Air Handling Units

Division 16 shall provide a separate circuit breaker for each unit and wire to line terminals on unit control. Disconnect switches shall be internal to each unit and factory installed. Mechanical Contractor shall provide and install low voltage control wiring to thermostats under supervision of Div. 16.

6. Fans

Division 16 to wire to unit mounted disconnect switch with overload protection provided with unit and wire line voltage power to motorized damper provided with each unit.

Wiring and control for Exhaust Fan #1 is diagrammed on sheet M1.

7. Unit Heaters

Division 16 to wire to unit mounted disconnect switch with overload protection provided with unit and wire line voltage power to motorized damper provided with each unit. Mechanical Contractor shall provide and install low voltage control wiring to thermostats under supervision of Div. 16.

1.05 PERMITS

A. Mechanical Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.

B. Mechanical Contractor shall frame, under clear plastic, all permits secured by him adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed by law shall be laminated in plastic and included in the Owner's maintenance manual.

1.06 CODES, ORDINANCES AND PERMITS

A. All work performed under this Section of the Specifications shall be done in accordance with applicable National, State and local Codes, Laws and Ordinances. The following abbreviations are used for reference to standards which are to be followed:

AABC	Associated Air Balance Council
ADA	Americans With Disabilities Act
AMCA	Air Movement & Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
NEC	National Electrical Code
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Act

SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriter's Laboratories

B. The latest issue of each Code in effect at the time of bidding shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.07 QUALITY ASSURANCE

A. Mechanical Contractor shall have prior experience with at least two projects of this nature, size and scope and be capable of producing references indicating as such.

B. Use sufficient qualified workpersons and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of systems throughout. Technical training and certification of workpersons installing the systems specified, by the systems manufacturer, shall be mandatory prior to commencement of work. Documentation of such certification shall be made available to the Architect upon request within 5 business days.

C. Work performed shall conform with all Local and State Rules and Regulations, as well as those of the International Building Code and National Fire Protection Association (N.F.P.A.).

D. Piping design shall conform to ANSI, ASME B31.9 and AWS D10.9 codes.

1.08 PLANS AND SPECIFICATIONS

Mechanical Contractor shall provide his sub-contractors with a copy of the entire portion of Part 1 of this specification, portions of this specification and copies of drawings which pertain to the equipment to be supplied at no cost to the sub-contractor. Provide Testing and Balancing sub-contractor with copies of shop drawings indicating exhaust fan and air handling unit air volumes, etc. Failure to do so may result in the Architect providing the required materials at the Contractor's expense.

Sketches pertaining to changes and amendments during construction (ASI's, RFI's and RFP's for example) shall be contract form documents issued by the Architect and/or Engineer for use during construction and it shall be the Architect's and/or Engineer's discretion to provide sketches or full size drawings. Requests for documentation other than what is provided (full size revised drawings for instance) and deemed suitable for the particular situation shall be paid for by the contractor making the request. The cost(s) shall include, but not limited to, drafting time and reproduction costs.

1.09 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD (.dwg and .dxf) files will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD and will be provided in the 2004 file format. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files. E-mail requests may be made at rob@mechanicalsystemseng.com

1.10 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise.

A. Any proposal for substitution of Mechanical equipment, materials or vendors not mentioned in this specification shall be made in writing via letter or e-mail to the Architect or Engineer up to four working days prior to opening of bids to permit sufficient time to notify all bidders via addenda. Any requests made after the final addenda prior to bid opening will not be considered. Contractor must certify within his submittals that any equipment or materials requested to be considered as an "approved equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided while providing adequate clearances for servicing of equipment as required by the manufacturers and will not interfere with other trades. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids.

B. The phrase "or approved equal" shall be defined to mean the Architect shall make final determination whether or not substitute materials are an equal to that which is specified. Materials and equipment determined as an “approved equal” and/or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. Manufacturer, model, etc.) specified.

C. Approval by Architect for such substitution shall not relieve Mechanical Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work Architect's decision on acceptability of substitute materials shall be final. Architect's decision on acceptability of substitute materials shall be final.

D. All materials not specified otherwise shall be manufactured within the United States and supplied locally (within the State of Maine) when available. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.

E. Any additional cost(s) resulting from the substitution of equipment, regardless of acceptance by the Architect or Engineer, shall be the responsibility of Section 15600. Additional costs may include, but not be limited to, electrical and/or structural alterations from the contract documents.

1.11 SHOP DRAWINGS & SUBMITTALS

A. As soon as possible after award of contract (*but not longer than 21 calendar days*), before any material or equipment is purchased, Mechanical Contractor shall submit shop drawings for review. Unless prior arrangements are made with the Architect all shop drawings must be submitted to the General Contractor who in turn will forward them to the Architect. The quantity of copies shall be as outlined in Division 01. If shop drawings are rejected or returned for re-submittal, Mechanical Contractor shall provide said re-submittals within 14 calendar days of receipt of original submittals with engineer’s comments. If original or re-submitted shop drawings are not submitted within the allotted time frames indicated all

substitutions included in the late shop drawings will, at the Architect's discretion, be invalid and the equipment primarily specified must be provided. Any costs resulting from delays in the project schedule due to failure to submit shop drawings related to this section in a timely manner shall be the responsibility of the Mechanical Contractor. Mechanical Contractor's and vendor's name, address, telephone number and e-mail addresses shall be provided with every shop drawing submission. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.

B. Shop drawings shall be properly identified and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data clearly indicated, fan curves, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.

C. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with requirements of the drawings and specifications. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.

D. Should any materials or products be purchased and/or installed without prior review and comment the contractor shall be required to remove or replace those products and/or materials, if directed by the Architect, at his expense. If the materials are not removed (or replaced) or if the project is delayed as a result of the contractor's actions, the Architect reserves the right to order the withholding of payment until the situation is resolved in a manner satisfactory to the Architect.

E. Shop drawings for sections 15400 and 15600 shall be submitted under separate cover or they will be refused for re-submittal. Submittals shall be identified by job title, specification section and paragraph number. Items under each paragraph may be combined into one submittal but do not combine items from multiple paragraphs. For instance, do not combine items specified under par 2.01 with items specified under par. 2.02.

F. Shop drawings are required to be submitted electronically (paper copies will not be accepted). Resolution on files in .pdf format shall be a minimum of 300 dpi and a maximum of 600 dpi. Electronic files must be accessible and in an open format, meaning files must not be locked and comments may be added without altering the original content, or have interactive fields intended specifically for commenting. Locked files will not be reviewed. Exception: Color samples, where required, must be provided to the Architect in the form of original paper copies. Electronic color samples are not acceptable due to differences in monitor color rendition. Faxed copies of color samples will be refused.

G. Review must be obtained on the following items:

1. Ductwork and Accessories

    a. Registers, diffusers, and grilles
    b. Duct access doors
    c. Volume control dampers (manual and automatic)
    d. Duct sealant
    e. Turning vanes
    f. Side (bellmouth) takeoff fittings

g. Flexible duct
h. Roof jacks
i. Manual dampers
j. Filters
k. Vents from gas heating appliances

2. Mechanical Equipment (sound data must be provided with all interior motorized equipment).

a. Full warrantee information must be included with all submittals.
b. Air handling units and accessories - provide curves for fan wheels submitted and computer selection printouts.
c. Fans and accessories - provide full fan curves and computer selection printouts.
d. Unit heaters
e. Equipment identification tags

3. Insulation

a. Duct

4. Qualifications and Certifications

a. Certification(s) of Testing and Balancing Contractor

1.12 PRODUCT HANDLING

A. Protection

Use all means necessary to protect heating, ventilating and air conditioning materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.13 AS-BUILT DRAWINGS

Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of all drawings furnished for this job. On this special set of drawings, record *completely and accurately* all differences between the work as actually installed and the design as shown on the drawings. These record drawings must be kept up to date by recording all changes within one week of the time that the changes are authorized. At the completion of the work, this set of drawings shall be delivered to the Architect for the Owner electronically in the form of CAD drawings or .pdf format with markups in red. If a complete record of changes is not made and electronic drawings not provided by the Mechanical Contractor, a record shall be made by the Engineers, and the cost of the record shall be the responsibility of the Mechanical Contractor. Copies of the mechanical CAD drawings (minus professional engineering stamps) may be made available at no cost to the Mechanical Contractor of record if desired. Drawings shall be dated accordingly and clearly identified as “AS-BUILT”. See par. 1.09, “ELECTRONIC DRAWINGS AND FILE SHARING” for additional information.

1.14 MAINTENANCE MANUAL

A. On completion of this portion of the work, and as a condition of its acceptance, submit for approval two copies of a manual describing the system. Mechanical equipment manuals shall be separate from plumbing manuals. All manuals shall be original copies, not photocopies or they will be refused for re-submittal. Prepare manuals in durable 3-ring binders approximately 8½ inches by 11 inches in size with at least the following:

1. Identification on the front cover and spine stating general nature of the manual.
2. Neatly typewritten index.
3. Complete instructions regarding operation and maintenance of all equipment involved.
4. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name, address and telephone number of nearest vendor of parts.
5. Copy of all guarantees and warranties issued.
6. Where contents of manuals including manufacturer's catalog pages, clearly indicate the precise item included in this installation and delete, or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.

B. In addition to above, provide two (2) separate offset style binders properly identified, each containing a copy of all reviewed shop drawings and catalog cuts. These may be incorporated in Maintenance Manuals, if binders are of adequate size. Also, include (2) CD’s with all electronic shop drawings and catalog cuts.

1.15 OBJECTIONABLE NOISE AND VIBRATION

Mechanical equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping or ducts, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Mechanical Contractor at no extra cost to the Owner.

1.16 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.

1.17 DEVIATIONS AND DISCREPANCIES

A. The drawings are intended to indicate only diagrammatically the extent, general character and approximate locations of mechanical work. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, plumbing and electrical drawings so that work under this section is properly installed and coordinated with other Sections.

B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on section 15600 drawings, or between section 15600 drawings and this specification notify the Architect immediately so a clarification may be issued by addenda.

C. Questions to the Architect or Engineers are encouraged, however any answers and/or advice is non-binding unless incorporated into the contract documents in the form of addenda, change order, etc. Inquiries requiring an answer prior to opening of bids should be made at least 4 days prior to when bids are due to allow time for a clarifying addendum to be issued.

D. Any conflicts arising from duplication of equipment specified in different portions of the specifications shall be brought to the attention of the Architect prior to submitting bids. Failure to do so does not relieve the Contractor from responsibility of providing said materials and equipment and a credit will be taken for the duplicated item(s).

E. Should unforeseen job conditions require re-arrangement of piping and/or ductwork resulting in deviation from the intent of the contract documents or potentially compromising the integrity of the mechanical systems, the Architect shall be notified immediately prior to commencement of work. Failure to do so will result in the contractor being responsible to correct any work installed that is contrary to the contract documents at his own expense.

1.18 CHANGE ORDERS

A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.

B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.19 COORDINATION

A. Contractor shall be responsible to coordinate his work with that of other trades to adjust to field conditions prior to commencing work. It is also this contractor's responsibility to coordinate locations of his own piping and ductwork to ensure the two do not conflict. If a reasonable solution cannot be achieved without compromising the integrity of the intended design or would result in additional cost the Architect must be notified immediately prior to commencement of work. Failure to do so does not relieve the Contractor from providing and installing the systems to the satisfaction of the Architect at no additional cost.

B. Contractor shall be responsible to review job conditions and identify conflicts and/or obstructions to ductwork and piping prior to fabrication. If conflicts and/or obstructions are noted the Architect must be notified immediately prior to commencement of work. The cost of any fabrication work performed without confirmation and notification of conflicts and/or obstructions shall be the responsibility of the contractor.

1.20 REQUESTS FOR INFORMATION

Requests for Information (RFI) or other correspondences which are submitted electronically must be in an open format, meaning files must not be locked and comments may be added without altering the original content, or have interactive fields intended specifically for commenting. No special software other than Microsoft Word, Microsoft Excel or Adobe Acrobat Standard shall be required to open files or make comments.

1.21 WORKPLACE SAFETY

Mechanical contractor shall be responsible for the safety of his workpeople.

PART 2 - PRODUCTS

2.01 FIRE SEALING

A. Material

Sealant material shall be 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant, or approved equal and shall be U.L. listed.

B. Ductwork

Voids between ductwork and walls/floors shall be sealed fire and smoke tight by this contractor.

2.02 UNIT HEATER No. 1

A. Furnish and install a natural gas fired, horizontal unit heater as shown. Unit shall be separated combustion and designed for 82-83% thermal efficiency, approved for commercial/industrial installations in the United States and Canada by the Canadian Standards Association (CSA).

B. Unit shall have a white cabinet which is suspended from four points. A low voltage terminal strip on the outside of the cabinet shall be included for connection to a thermostat.

C. Unit shall have a factory installed gas line nipple to the exterior of the cabinet for easy gas service connection. The heat exchanger shall be a single burner combustion system which includes a two-stage gas valve, multi-try direct spark ignition with timed lockout, pressure switch to verify vent flow, resiliently isolated venter motor, venter wheel with improved housing, a high temperature limit control, interlock door switch, and a built-in disconnect switch. Unit shall include a centrifugal blower and direct drive motor with multispeed taps. Unit shall include a 30° downturn nozzle with horizontal and vertical louvers. Operation shall be controlled through an integrated circuit board which monitors heater operation and has LED diagnostic indicator lights to identify abnormalities in control functions.

D. Features shall also include:

1. 115/1/60 Supply voltage
2. 115 Volt open dripproof blower motor with internal overload protection
3. Direct drive blower with multispeed taps
4. Transformer for 24-volt controls
5. Integrated circuit board with diagnostic indicator lights
6. Blower relay (included on the circuit board)
7. Multi-try direct spark ignition with timed lockout
8. Two-stage natural gas valve
9. Vibration/noise isolated venter motors
10. Titanium stabilized aluminized steel heat exchanger
11. Sealed compartment houses all electrical components
12. 4-pt Suspension
13. Built-in disconnect switch
14. External terminal strip for 24-volt wiring
15. Sealed junction box for supply wiring
16. External gas connection
17. Fully gasketed door panel with safety door switch
18. Remote thermostat with locking cover.

E. Unit shall be Reznor Model UDBS or approved equal.

2.03 UNIT HEATER No. 2

A. Furnish and install a natural gas fired, horizontal unit heater as shown. Unit shall be gravity vented, propeller fan type and designed for 80% thermal efficiency, approved for commercial/industrial installations in the United States and Canada by the Canadian Standards Association (CSA).

B. Unit shall include a terminal strip for field connection to a remote 24 volt thermostat. Unit shall be equipped with a fan control and all required limit safety controls, including energy cutoff (ECO) device and a blocked vent switch.

C. Features shall include:

1. Orifices for natural gas
2. E-3 (409) stainless steel heat exchanger and burner
3. Aluminized steel burner rack with stainless steel insert
4. Spark ignited, intermittent safety pilot with electronic flame supervision
5. Single-stage combination gas valve
6. 115/1/60 supply voltage
7. 115 volt fan motor with internal overload protection
8. Fan and limit safety controls
9. Energy cutoff (ECO) device
10. Blocked vent shutoff system
11. 24-volt control voltage transformer
12. Individually adjustable horizontal louvers
13. Full safety fan guard
14. Terminal strip connector for 24-volt field wiring
15. Bottom burner access
16. 2-point 3/8"-16 threaded hanger connections
17. Horizontal/vertical vent outlet
18. Thermostat and relay kits
19. Thermostat guard with locking cover

D. Unit shall be Reznor Series 100, Model F or approved equal.

2.04 GAS VENT SYSTEM

A. Furnish and install as indicated on drawings, a single wall pre-fabricated steel gas vent system complete with all required supports, braces, stiffeners, hangers, roof flashing devices and weather cap on the outside.

B. Shop drawings shall include a drawing showing a profile of the entire assembled system with all components and dimensions clearly indicated.

C. Roof and wall thimbles for the vent system shall be provided by the Mechanical Contractor and set by the General Contractor.

D. Vent pipe and accessories shall be Metalfab Type AB@ with Type MC vent cap for low heat gas appliances or approved equal and shall be installed in strict accordance with the manufacturer's instructions and all applicable N.F.P.A., B.O.C.A. and local codes and ordinances.

2.05 AIR HANDLING UNITS

A. General

Provide and install rooftop, curb mounted air handling units where shown on drawings. Units shall have capacities indicated. Units shall be Model YSC as manufactured by Trane Co. Units meeting the requirements of this specification and scheduled capacities by American Air Filter, Carrier, McQuay or York will be considered.

B. Units shall be convertible airflow. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for units with microprocessor controls. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be cULus listed and labeled, classified in accordance for Central Cooling Air Conditioners. Electrical and gas utilities shall be thru-the-curb.

C. Unit casings shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have lifting handles and be removed and reinstalled by removing two fasteners while providing a water and air tight seal. All exposed vertical panels and top covers in the indoor air section shall be insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material. The base of each unit shall be insulated with 1/8 inch, foil-faced, closed-cell insulation. All insulation edges shall be either captured or sealed. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1.1/8 inch high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting, with forklift capabilities on three sides of the unit. The top cover shall be one piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top.

D. Compressors shall be direct-drive, hermetic, scroll type with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors. Dual compressors shall be provided on AHU-1 to allow for 3-stages of compressor operation. Crankcase heaters shall be provided on AHU-1.

E. The indoor fan for AHU-1 shall be direct drive plenum fan design and shall include a backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor. Fan design shall have a variable speed adjustment potentiometer located in the control box.

AHU-2 and AHU-3 shall have multispeed, direct drive fan motors. All motors shall be thermally protected.

All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).

F. Outdoor fans shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and shall have built-in thermal overload protection.

G. Evaporator and condenser coils shall be internally finned, 5/16 inch copper tubes mechanically bonded to a configured aluminum plate fin. Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 600 psig. The assembled unit shall be leak tested to 465 psig. The condenser coil shall have a patent pending 1+1+1 hybrid coil designed with slight gaps for ease of cleaning. A removable, reversible, double-sloped condensate drain pan with through the base condensate drain is standard. Each refrigerant circuit shall include a thermal expansion valve as standard. Service pressure ports, and refrigerant line filter driers shall be factory-installed as standard. An area shall be provided for replacement suction line driers.

H. Units shall be completely factory-wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Units shall provide an external location for mounting a fused disconnect device. Controls shall be microprocessor type and shall provide for all 24V control functions. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point, and provides better building comfort. A centralized microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection. Units shall include High Pressure Cutout as standard. A phase monitor shall provide 100% protection for motors and compressors against problems caused by phase loss, phase imbalance, and phase reversal. Phase monitor is equipped with an LED that provides an ON or FAULT indicator. There are no field adjustments. The module will automatically reset from a fault condition.

Provide remote thermostats for field mounting. Devices shall be programmable to provide automatic heat/cool switching, programmable daily occupied and occupied settings, fan controls and ventilation controls.

I. The heating section shall have a progressive tubular heat exchanger design using stainless steel burners and corrosion resistant steel throughout. An induced draft combustion blower shall be used to pull the combustion products through the firing tubes. The heater shall use a direct spark ignition (DSI) system. On initial call for heat, the combustion blower shall purge the heat exchanger for 20 seconds before ignition After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat/zone sensor. Units shall be suitable for use with natural gas or propane (field-installed kit) and also comply with the California requirement for low NOx emissions (Gas/Electric Only).

J. Provide an economizer assembly with barometric relief. Assembly shall include fully modulating 0-100 percent motor and dampers, minimum position setting, preset linkage, wiring harness with plug, spring return actuator and fixed dry bulb control. The barometric relief shall provide a pressure operated damper that shall be gravity closing and shall prohibit entrance of outside air during the equipment off cycle. Provide a factory installed solid state enthalpy control.

K. Provide each unit with an insulated roof curb designed for flat roof, self-flashing installation. Minimum height above roof insulation shall be 12 inches. Curbs shall include curb gaskets. Also provide AHU-2 and AHU-3 with a concentric diffuser/return grille assembly for hard ducting to the unit.

2.06 FANS

A. General

1. Fans with capacity and types shown on the drawings shall be provided and installed. All roof curbs shall be provided by the fan manufacturer and installed by the General Contractor. This Contractor shall furnish the General Contractor with the correct sizes of roof curbs bases for units supplied. In order to establish a standard, fan model numbers indicated below are based on Cook (unless noted otherwise). Equivalent units by Acme, Greenheck and Penn ONLY will be considered.

2. Fan selection shall be based on sloping portion of curve with spare capacity of 20% of total CFM and static pressure without increasing motor size. **Provide full fan curves with submittals that shown the entire operating range of the fan - not just the operating point. Fans that are submitted without this data will not be accepted.**

3. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be listed by the Canadian Standards Association Testing Laboratory (CSA). Sones indicated on drawings are AMCA ratings and are the maximum allowable. HVI sound ratings are not acceptable. All three phase motors shall be inverter ready and premium efficiency.

4. All roof fans shall be provided by this Contractor with a continuous ½ inch (minimum) thick neoprene rubber curb gasket covering the full thickness of the curb wall.

5. Roof curbs shall be not less than 12 inches high above the roof insulation, double wall construction, insulated with not less than 1½ inch thick, 3 lbs density insulation and self-flashing type designed for EPDM roofing systems on a flat surface. Curbs shall include a damper shelf and be structurally designed to adequately support no less than twice the weight of the equipment to be placed on them.

6. Motor operated dampers shall be furnished with each fan and sized for mounting within the curbs.

B. Types

1. EF-1 and EF-2 shall be ACE-D Series centrifugal roof exhauster. Fans shall be a spun aluminum, roof mounted, direct driven, downblast centrifugal exhaust ventilator.

   Fans shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

   Fans shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap

and into the motor compartment to facilitate wiring connections. Components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Units shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

Wheels shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, *Balance Quality and Vibration Levels for Fans.*

Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. A disconnect device/switch shall be factory installed and wired from the fan motor to a junction box. Standard wiring shall comply with National Electric Code and NBFU Standards and the fan shall be listed by Underwriters Laboratories (UL705). Thermal overload protectors shall be standard.

Provide the following accessories:

a. Solid state speed controller internally wired (from the factory).
b. Motorized backdraft damper with 115 volt motor (field wired by Div. 16).
c. Hinged base for damper access.

2.07 SHEETMETAL

A. General

The work under this section includes all the required sheetmetal and duct work, extensions for grilles, manual dampers, automatic counterbalanced (backdraft) dampers, deflectors, duct lining, setting of control dampers, grilles, registers, diffusers, flexible connections, fire dampers, and louvers, as shown on the drawings or required to make the installation complete in accordance with the intent of the drawings and specifications.

B. Ducts

1. The size of ducts marked on the drawings will be adhered to as closely as possible. The right is reserved to vary duct sizes to accommodate structural conditions during the progress of the work without additional cost to the Owners. The duct layout is schematic to indicate size and general arrangement only. All ducts shall be arranged to adjust to "field conditions". The Sheet Metal Contractor shall coordinate his work with Division 16 and other trades.

2. Medium and low pressure ducts shall be constructed of galvanized steel in accordance with the following table of duct sizes OR the latest SMACNA HVAC Duct Construction Standards for Metal and Flexible Duct unless otherwise shown on drawings.

Dimensions of Longest Side (inches)	Minimum Sheet Metal Gauge
Up thru 12	26
13 --> 30	24
31 --> 42	22
43 --> 60	20
61 --> inf.	18

3. Methods of fabrication and installation shall be in strict accordance with guidelines set forth in the latest SMACNA Guide and Data Book for Low and Medium Pressure Duct Construction unless otherwise shown on drawings. Cross break all ducts with largest dimension being 18 inches and larger. Beaded ducts are not acceptable except for ductwork less than 18 inches in either direction.

4. All dampers and deflectors shall be a minimum of #22 gauge and stiffened as required. Splitter dampers shall not be acceptable.

5. All joints in ducts shall be made air tight, and all branches and turns shall be made with long radius elbows and fittings. Long radius elbows are defined as having a centerline radius of 1½ times the width of the duct. If long radius elbows are not used, elbows 18 inches wide and larger shall be provided with fixed double wall airfoil turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius elbow with a throat radius of not less than duct width. Square elbows less than 18 inches wide shall be provided with single wall turning vanes. Square elbows with outside corners cut at 45^{o} or rounded are not acceptable.

6. All ducts shall be installed with necessary offsets, changes in cross sections, risers, and drops which may be required. They shall be constructed with approved joints and be supported in an approved manner.

7. Round ductwork shall be constructed in accordance with the latest SMACNA HVAC Duct Construction Standards for round and oval duct construction. Ductwork larger than 8 inches in diameter shall employ spiral seams. All turns shall be made with smooth (not segmented), long radius elbows and fittings. All seams shall be type RL-5, grooved seam pipe lock or better. *Lap seams are not permissible*. Gauge thicknesses shall be as outlined in SMACNA for galvanized steel round duct gauge selections for maximum 2 inches w.g. static pressure. Ductwork shall be supported with full wrap-around band and single hanger strap as indicated in Figure 4-4 of the 1985 edition of the SMACNA HVAC Duct Construction Standards handbook.

8. Furnish and install flexible connections on exhaust fans (where indicated), horizontal unit ventilators, horizontal cabinet unit heaters and all Mechanical units. Connections shall be made from Ventglas neoprene coated glass fabric as furnished by Ventfabrics, Inc., or approved equal.

9. Every precaution shall be taken to keep interior of duct system free from dirt and rubbish and to protect all ducts and equipment during construction. At completion, this Mechanical Contractor shall thoroughly clean all equipment to the satisfaction of the Architect.

10. Spaces between ducts and wall or floor construction shall be caulked to make smoke and water tight by this section. Sealant material shall be 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant or approved equal.

11. Testing, Balancing and Leak Testing... See Part 3, EXECUTION

12. Requirements set forth in applicable codes (see part one) shall supersede SMACNA standards.

C. Diffusers, Grilles and Registers

1. Grilles and/or registers shall be installed at all air supply and exhaust openings as shown. All units to be aluminum, except as noted, and provided with baked enamel finish to match color of grille or register and countersunk screw holes. Mounting screws shall be oval head type with head painted to match finish. Unless stated otherwise, the following list is based on model numbers of Titus to establish a standard of quality (if substituting, certified sound criteria shall be included with submittals indicating CFM and NC levels of each register and grille). Anemostat, Krueger, Metalaire and Price only will also be considered for review.

   a. Exhaust and Return Registers: 350FL with opposed blade damper and ¾ inch blade spacing, 35° front blade angle, front blades set horizontal.

   All lay-in registers and grilles shall be supported directly to building structure with no less than two (2) safety chains located at opposing corners.

2. Diffusers shall be installed at air supply openings as shown. All units to be aluminum, except as noted, and provided with white baked enamel finish. The following list is based on model numbers of Titus to establish a standard of quality. Anemostat, Krueger, Metalaire and Price only will also be considered for review.

   a. Square face, 24 gauge steel construction, 4 way discharge with circular duct connection, adjustable discharge pattern, removable core assembly, white prime finish. Model TMS-AA for 24 inch x 24 inch lay-in application for suspended tile ceilings or mounting in gypsum ceilings. Provide factory mounted straightening grid for all units.

   All lay-in diffusers shall be supported to building structure with no less than two (2) safety chains located at opposing corners.

D. Duct Sleeves

Provide aluminum duct sleeves through outside wall at all locations as shown on drawings.

E. Sealing of Ducts

All interior ductwork shall be sealed with low VOC water based duct mastic, either "MP" (Multi-Purpose), Carlisle Hardcast "Iron-grip 601", Polymer Adhesive "Airseal #11", or United Duct Seal (United McGill Corp.) water base, latex or acrylic type sealant. All transverse joints to be continuously sealed. Note that, except as noted, oil or solvent based sealants are specifically prohibited for use on this project. Duct tape is prohibited exclusively.

F. Manual Dampers

1. See Part 3, EXECUTION for installation notes.

2. Manual dampers with smallest dimension 5 inches or less shall be shop fabricated, single 22 gauge blade, 3/8 inch rod, provided with position indicator and locking quadrant.

3. Manual dampers with smallest dimension larger than 5 inches but smaller than 11 inches shall be single blade steel, 16 gauge construction, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.

4. Manual dampers with smallest dimension larger than 11 inches shall be opposed blade steel, 16 gauge construction, linkage concealed in frame, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.

5. Dampers to be installed in aluminum ductwork shall be fabricated of aluminum or isolated from ductwork with rubber grommets between the damper and the duct to prevent oxidation between dissimilar metals.

6. Provide hand quadrants for <u>all</u> manual dampers, Ventline Model 560 or approved equal.

G. Roof Jacks

1. Provide and install roof jacks for UH-1 combustion air intake where show. Device shall be designed for use on a flat roofs and include roof flashing pan not less than 16 inches square, tall cone flashing and a vent cap. Device shall be 28 gauge galvanized steel for 4 inch ducts.

2. Master Flow by GAF Industries, models RFTS4 roof flashing with tapered stack and GAF Versa-Cap model 3050 for 4 inch pipe or approved equal.

H. Flexible Duct

Provide and install insulated flexible duct where shown on drawings. Ducts 20 inches in diameter and smaller shall be a double lamination of polyester encapsulating a steel wire helix forming an air-tight inner core. The core shall be wrapped in a blanket of fiberglass insulation (R 4.2) and sheathed in a rugged and durable reinforced metallized polyester jacket. Duct shall be class 1, U.L. 181 compliant and rated for not less than 2 inches w.g. positive working pressure. Duct internal diameter shall be same size as diffuser served. Atco UPC 030 or approved equal.

I. Side Takeoff Fittings (for flexible duct)

Provide and install, at all flexible duct branches to diffusers, a bellmouth side takeoff fitting with manual damper. Fittings shall be pre-manufactured with bell end shall have a 1½ inch radius and employ a self-adhesive gasket seal and be pre-drilled for attachment screws. Units with manual dampers shall be heavy duty with bearings and hand quadrants. Fittings shall be anchored to ductwork with <u>*not less than*</u> three (3) screws. Final diameter shall be same size as diffuser served. Units shall be no thinner than 22 gauge, G-90 galvanized

steel. Buckley Bellmouth HD-BM, HD-BMD or approved equal by Flexmaster or United Enertech.

J. Turning Vanes

1. Provide and install at all square duct elbows 18 inches and larger, and where shown on drawings, fixed double wall airfoil type turning vanes. Turning vanes shall be constructed as outlined in the latest SMACNA HVAC Duct Construction Standards guidebook, Figure 2-3.

2. Provide and install at all square duct elbows less than 18 inches in width, and where shown on drawings, fixed single wall turning vanes. Turning vanes shall be constructed as outlined in the latest SMACNA HVAC Duct Construction Standards guidebook, Figure 2-3.

2.08 FILTERS

Air handling units shall be provided with a minimum of three (3) sets of filters with pleated media. One set to be used during construction (and replaced by the Mechanical Contractor during construction if required as determined by the Clerk of the Works and/or the Mechanical Engineer). Second set to be installed a minimum of one (1) day and a maximum of three (3) days prior to testing and balancing and/or final inspection. The third set shall be turned over to the Owner in their original unopened shipping boxes for their future use.

Filters shall be Farr 30/30, Air Guard DP-40 or approved equal, 2 inches thick.

2.09 EQUIPMENT IDENTIFICATION

Tag each fan, air handling unit and unit heater with rectangular engraved nameplates with white letters on black, Brady Corp., Seton Name Plate Corp. or approved equals. Nameplates shall be mechanically fastened to equipment (adhesives are not acceptable). Embossed labels are not acceptable. Nameplates shall be 4 inches by 1½ inches, Setonply Style No. M1774. On all other units nameplates shall be 2½ inches by ¾ inch, Setonply Style No. M1771.

2.10 INSULATION AND CONDENSATE PROTECTION

A. General

1. Insulation shall be provided for all supply ducts associated with AHU-1 and other insulation where shown on drawings.

2. All insulation products shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less per ASTM E 84, UL 723 and NFPA 255.

B. Duct and Equipment Insulation

1. Duct insulation shall be a ¾ pound density, all-service fiberglass duct wrap with factory applied foil faced FRK vapor barrier facing meeting the requirements of ASTM C 1136, Type II. Insulation material shall meet the requirements of NFPA 90A, NFPA 90B, ASTM C 1290 and ASTM C 553. Operating temperature range shall be from 40°F. to 250°F. Maximum "k" factor of 0.30 at 75°F. mean temperature difference. Owens Corning Type 75, Johns Manville Microlite XG or approved equal.

2. Insulate all supply air ductwork for AHU-1 with 1½ inches installed thickness.

3. Material to carry U. L. label. All laps to be sealed and held in place with adhesive and flare staples. All lap joints to be folded under before stapling so no raw insulation will be showing. On the bottom of ducts 24 inches or wider, mechanical fasteners shall be provided approximately 12 inches O.C.

C. Condensate Protection

Solder or weld bottom and sides of ducts connected to outdoors to prevent water leaks from rain and snow. Seal duct wrap and liner to minimize condensation.

D. Installation

All insulation work shall be executed by skilled insulation workmen regularly employed in the trade.

2.11 AUTOMATIC TEMPERATURE CONTROL (ATC)

A. General

1. Controls shall consist of factory furnished thermostats for air handling units and low voltage, heavy duty thermostats for unit heaters. Provide heavy duty, clear plastic locking covers for all thermostats.

2. Thermostats shall be installed and wired to their respective devices (air handling units and unit heaters) by the Mechanical Contractor under supervision of Division 16 (Electrical). Mechanical Contractor may engage the services of Division 16 to install the devices and wiring if so desired. All line voltage wiring shall be provided and installed by Division 16.

3. Mechanical Contractor shall instruct the Owner in the use of the control systems.

B. Instruction and Adjustment

Upon completion of the project, after the ATC systems have been commissioned and are functioning as intended, the Mechanical Contractor shall:

1. Adjust for use by Owner, all thermostats, controllers, damper operators, and relays provided under this section.

2. Furnish two (2) instruction manuals covering function and operation of control systems for use of the Owner's operating personnel.

3. A competent technician shall be provided to thoroughly instruct the Owner's Representative(s) in the care and operation of the ATC system. The total period of instruction shall not exceed one (1) hour. This instruction shall be in addition to instructions for equipment and systems not included in the ATC portion of this project. See par. 3.07, “INSTRUCTIONS”. Date and time of instruction shall be arranged with the Owner.

4. Contractor shall engage the services of the manufacturer of the air handling units to balance return air, relief air and outdoor air dampers on air handling units in order to achieve proper mixed air temperatures.

C. Guarantee

Control system shall be guaranteed to be free from original defects in both material and workmanship for a period of not less than one (1) year of normal use and service. This guarantee shall become effective starting the date Architect agrees Owner has begun to receive beneficial use of the system.

D. Hazardous Materials

Mercury, or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the ATC system.

E. Thermostats

1. Unit heaters: Thermostats shall be provided with heaters.

2. Air handling unit thermostats: Thermostats shall be provided with the equipment served.

3. Thermostats shall be mounted according to ADA requirements (http://www.access-board.gov/adaag/html/adaag.htm#4.27).

F. Description of Operation

1. Air Handling Units

Unit fans shall operate continuously during occupied periods and cycle on call for heating or cooling during unoccupied. During the occupied cycle the outdoor air damper opens to its minimum position. The control cycle shall be ASHRAE II. Whenever the units run during the unoccupied cycle or are off, the outdoor air dampers shall be fully closed. Relief air shall be a barometric backdraft damper. During the heating mode a freeze protection thermostat shall stop the unit fan and close the outdoor air and relief air dampers whenever the discharge temperature is less than 40^{o}F (adjustable).

In the heating mode the unit natural gas furnace fires to provide heat in response to the setpoint on the room thermostat. In the cooling mode the furnace is disabled and the unit attempts to cool the space in free cooling mode according to the ASHRAE Cycle II protocols. When free cooling isn't able to satisfy thermostat setpoint the outdoor air damper shall revert to its minimum position and mechanical cooling shall be activated. During unoccupied modes the outdoor air dampers shall be closed but heat or mechanical cooling shall be available as programmed into the thermostat.

2. Unit Heaters

Each unit heater shall have a low voltage, single temperature wall mounted thermostat. Unit heaters shall cycle to provide heat as required.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all work is complete to the point where this installation may properly commence.

2. Verify that Mechanical systems may be installed in strict accordance with all pertinent codes and regulations and the approved shop drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify Architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION OF DUCTWORK AND EQUIPMENT

A. General

1. Size and general arrangements as well as methods of connecting all diffusers, registers, grilles and equipment shall be as indicated, or to meet requirements for complete installation.

2. Construction standards and sheet metal gauges shall be as outlined in the latest edition of the SMACNA HVAC Duct Construction Standards handbook for metal and flexible ducts unless specifically indicated otherwise.

3. Do not use segmented elbows or screws to connect fittings on clothes dryer ducts. Use smooth, long radius elbows and pop rivets instead.

4. Manual Dampers

a. Manual dampers may be shop-fabricated on units 5 inches in height and less. All dampers larger than 5 inches MUST be pre-fabricated as previously outlined in this specification.
b. All manual dampers located within 10 feet of a fan outlet shall have the blades oriented perpendicular to the fan shaft.
c. Provide duct access door as large as possible up to 12 inches x 12 inches at each manual damper larger than 5 inches.

B. Protection and Cleaning

1. All open ends of ductwork which is to be unattended for 4 hours or more shall be temporarily protected with plastic sheeting and duct tape (or similar method) to reduce the collection of construction dust and debris.

2. Prior to testing and balancing and at the end of the construction, clean the interiors of all supply and return air ductwork before changing filters in air handling equipment. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

3.03 TESTING, ADJUSTING AND BALANCING (TAB)

A. General

1. TAB contractor shall be a subcontractor to the Mechanical Contractor.

2. The TAB Contractor must provide, for review, contact information and copies of qualifications and certifications through the shop drawing review process. The following is a list of acceptable TAB contractors.

a. Central Air Balance
b. Maine Air Balance
c. Tab-Tech International
d. Tekon-Technical Consultants
e. Yankee Balancing

No others will be accepted unless pre-approved prior to opening of bids.

3. TAB contractor shall perform functional performance test of all Division 15 equipment.

4. The mechanical contractor shall startup all Division 15 equipment as required by the equipment specifications. Mechanical contractor shall verify that systems are complete and operable before TAB commencing work. Ensure the following conditions:

a. Systems are started and operating in a safe and normal condition.
b. Temperature control systems are installed complete and operable.
c. Proper thermal overload protection is in place for electrical equipment.
d. Final filters are clean and in place. If required, install temporary media in addition to final filters.
e. Duct systems are clean of debris.
f. Fans are rotating correctly.
g. Volume dampers are in place and open.
h. Access doors are closed and duct end caps are in place.
i. Air outlets are installed and connected.
j. Duct system leakage is minimized.

5. TAB Contractor shall submit field reports to General Contractor. Report defects and deficiencies noted during performance of services which prevent system testing and balance.

6. TAB contractor shall submit all verification and functional performance checklists/results, signed by indicated personnel, organized by system and sub-system.

7. TAB contractor shall submit other reports described below.

B. Work Included

1. Test, adjust and balance all air systems, including components to conform to air rates shown on drawings.

2. Test complete automatic temperature control sequences for specified operations described under AUTOMATIC TEMPERATURE CONTROLS.

3. Complete and submit balance report. Report shall be submitted with information noted on one side of sheet only (i.e., backside of sheet shall be blank.).

4. Testing of all systems will be done by the same agency.

5. Mechanical Contractor shall provide copies of drawings indicating air handling unit and diffuser air volumes, etc. to the TAB contractor at no cost to the contractor.

6. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

C. Quality of Compliance

1. Qualification: TAB Contractor must be independent test and balancing agency.

2. AABC Compliance: Comply with AABC Manual MN-1 "AABC National Standards" as applicable to mechanical and hydronic distribution systems and/or Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

3. Industry Standards: Comply with ASHRAE recommendations for measurements, instruments and testing and balancing.

4. Coordination: Work together with ATC Contractor to adjust set points of various devices to balance system(s) and test control sequences of operation. ATC Contractor shall be responsible for balancing return air, exhaust (relief) air and outdoor air dampers on Air Handling Units in order to achieve proper mixed air temperatures.

5. ASHRAE Guideline 1-1996, "The HVAC Commissioning Process".

D. Execution of TAB Work

1. TAB Contractor shall visit job site and determine that control and test devices are correctly installed and ready for balancing.

2. Examine the air distribution system to see that it is free from obstructions. Determine that all dampers and registers are in a set or full open position; that moving equipment is lubricated, and that required filters are clean and functioning. Request that installing Contractor perform any adjustments necessary for proper functioning of the system.

3. TAB Contractor shall use test instruments that have been calibrated within a time period recommended by the manufacturer, and have been checked for accuracy prior to start of testing, adjusting and balancing activity.

4. Verify that all equipment performs as specified. Adjust variable type drives, volume and control dampers as required by TAB work.

5. Test pressure profile of systems by traverse as required.

6. Adjust each register, diffuser terminal unit and damper to handle and properly distribute design airflow within 5% of specified quantities. Mark all setpoints.

7. Adjust air discharge patterns of all supply air diffusers, registers and grilles for optimal air diffusion.

8. Document results of all testing on approved TAB report formats and submit 3 copies for approval and record within 15 days of completion of TAB work. Include a warranty period of 90 days, during which time the Architect/Engineer may request a re-check or re-adjustment of any part of the work.

9. Reports shall be compiled on a spreadsheet such as Excel, Quattro-Pro, Lotus, etc. and shall clearly indicate the following *minimum* information:

   a. System/unit name
   b. HP, BHP, voltage, amperage and fan rpm
   c. Static pressures; suction, discharge and total
   d. Total system flow rate
   e. Individual terminal flow rates (Terminal readings must show location, make, model and size of register, grille or diffuser).
   f. Provide a static pressure profile of all AHU's components in the two extreme operating modes; minimum outdoor air and economizer cycle.
   g. Filter status report

Reports to have a minimum of color or must be compatible with monochrome printers. Reports must be submitted to the Architect electronically in addition to hard copies.

E. Drawings

Drawings in CAD format may be made available to the TAB Contractor after the contract for this work is awarded. Contact the Engineer and request the drawings, indicating CAD format required and a return e-mail address. See par. 1.09, “ELECTRONIC DRAWINGS AND FILE SHARING” for additional information.

3.04 CLOSING IN UNINSPECTED WORK & ROUTINE INSPECTIONS

A. General

Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Contractor is required to provide not less than 48 hours advance notice to the Architect of intent to cover non-inspected work to permit time for scheduling inspections.

C. Contractor is required notify the Architect when the project is close to completion and ready for review by the design team. Notification shall be not less than 48 hours to permit time for scheduling. At the completion of the project, Contractor is required to provide, in writing, confirmation that any comments or issues brought up during construction and review have been addressed and corrective measures have been taken as required.

D. Noncompliance

Should any work be covered up or enclosed prior to all required inspections and approvals, the Architect reserves the right to order the uninspected work to be uncovered for inspection at the Contractor's expense. After the work has been inspected completely and approved, make all repairs and replacements with materials necessary for approval by the Architect and at no additional cost to the Owner.

3.05 TEMPORARY HEATING

A. Mechanical Contractor shall install the new heating system and related equipment as soon as those portions of the building are ready and the work can be performed.

B. Mechanical Contractor will be required to permanently connect as many units as possible for temporary heat.

C. At the conclusion of the temporary heating period, the complete system shall be thoroughly cleaned.

D. General Contractor will be required to assume full responsibility for the care and operation of the new equipment during its temporary use and to return the equipment to the Mechanical Contractor in perfect order, normal wear and tear excepted.

E. Water, fuel and electric power required to operate the heating system for temporary heat shall be provided by the General Contractor.

3.06 CLEANING

Prior to acceptance of the buildings, thoroughly clean all exposed portions of the Heating, Ventilating and Air Conditioning installation, including the removal all labels and all traces of foreign substance. Prior to testing and balancing vacuum and clean inside of air handling units. Clean the interiors of ductwork as outlined in 3.02, "INSTALLATION OF DUCTWORK AND EQUIPMENT"; paragraph "B", "Protection and Cleaning".

3.07 INSTRUCTIONS

On completion of the job, the Mechanical Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The total period of instruction shall not exceed one (1) hour. ATC system instruction shall be in addition to this instruction period. The time of instruction shall be arranged with the Owner.

3.08 HAZARDOUS MATERIALS

Mercury, asbestos or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the mechanical systems.

3.09 RECYCLING

Discarded materials, both new and removed, shall be recycled whenever practical through metal salvage dealers (ductwork, piping, etc.), paper salvage (cardboard shipping containers, etc.), wood & plastic products, etc. The Mechanical Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, refrigerants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

END OF SECTION 15600

SECTION 26 05 00

GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. DEFINITION OF WORK

Conditions of the Contract, Specifications, Change Orders, Addenda and Drawings apply to work of this section.

B. PROVISIONS

As used in this section, "provide" means "furnish and install", "furnish" means "to purchase and deliver to the project site complete with every necessary appurtenance and support and to store in a secure area in accordance with manufacturers instructions", and "install" means "to unload at the delivery point at the site or retrieve from storage, move to point of installation and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

1.2 APPLICABLE CODES AND STANDARDS

A. WORK

All work shall be in accordance with the laws, rules, codes, and regulations set forth by Local, State, and Federal authorities having jurisdiction. All products and materials shall be manufactured, installed and tested as specified, but not limited to the latest accepted edition of the following codes, standards and regulations:

NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
NEC	National Electrical Code (NFPA 70)
UL	Underwriters Laboratory
NESC	National Electrical Safety Code
FM	Factory Mutual Association
IBC	International Building Code
Local AHJ	Local and State building, electrical, fire and health department and public safety codes agencies.

B. CODE CONFLICTS

When requirements cited in this paragraph conflict with each other or with Contract Documents, the most stringent requirements shall govern conduct of work. The Engineer may relax this requirement when such relaxation does not violate the ruling of authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing. Should the Electrical Subcontractor perform any work that does not comply with the requirements of the applicable building codes, state laws, and industry standards, he shall bear all costs arising in correcting these deficiencies.

1.3 CONTRACT DOCUMENTS

A. WORK TO BE PROVIDED

Work to be provided under this division is shown on the electrical drawings listed in Division 1, General Requirements and in these Contract Specifications.

B. COORDINATION OF WORK

The listing of electrical drawings does not limit the responsibility of determining the full extent of work that is required by these contract documents. The Electrical Subcontractor shall refer to the drawings and other specification sections included in the complete Contract Package, that indicate types of construction with which work of this section must be coordinated. The General Contractor shall coordinate the work of all trades including that of the electrical contractor, with all other subcontractors to determine whether there will be any interference with the electrical work. If the Electrical Subcontractor fails to check with the General Contractor and the electrical work is later found to interfere with the work of other subcontractors, then he shall make necessary changes, without additional cost to the Owner, to eliminate such interference.

C. INTENT OF DESIGN

Drawings are diagrammatic and indicate the general arrangement of systems and work to be included in the Contract. Information and components shown on riser diagrams or called for in the specifications but not shown on plans, and vice versa, shall apply and shall be provided as though required expressly by both. The contract documents are not intended to indicate and specify each component required, but do require that the components and materials be provided for a complete and operational installation.

D. DISCREPANCIES IN DOCUMENTS

Each bidder shall be responsible for examining the drawings and specifications carefully before submitting his bid, with particular attention to errors, omissions, conflicts with provisions of laws and codes imposed by authorities having jurisdiction, conflicts between portions of drawings, or between drawings and specifications, and ambiguous definition of the extent of coverage in the contract. Any such discrepancy discovered shall be brought to the immediate attention of the Engineer for correction. Should any of the aforementioned errors, omissions, conflicts or ambiguities exist in either or both the drawings and specifications, the Electrical Subcontractor shall have the same explained and adjusted in writing before signing the contract or proceeding with work. Failure to notify the Engineer in writing of such irregularities prior to signing the Contract will cause the Engineer's interpretation of the Contract Documents to be final. No additional compensation will be approved because of discrepancies thus resolved.

E. CONFLICTS WITH CODES AND REGULATIONS

The drawings and these specifications are intended to comply with all the above mentioned Codes, Rules and Regulations. If discrepancies occur, the Electrical Subcontractor shall immediately notify the Engineer in writing of said discrepancies and apply for an interpretation and, unless and interpretation is offered in writing by the Engineer prior to the execution of the contract, the applicable rules and regulations shall be complied with as a part of the contract.

PART 2 - SCOPE OF WORK

2.1 GENERAL REQUIREMENTS

A. General Scope

The work to be accomplished under these specifications includes providing all labor, materials, equipment, consumable items, supervision, administrative tasks, tests and documentation required to install complete and fully operational electrical systems as described herein and shown on the Drawings.

B. Administrative Responsibilities

The Electrical Subcontractor shall file plans, obtain permits and licenses, pay fees and obtain necessary inspections and approvals from authorities that have jurisdiction, as required to perform work in accordance with all legal requirements.

C. Coordination with Local Utility Companies

1. The Electrical Subcontractor shall coordinate with the local Power, Telephone, and Cable System Utilities. The Electrical Subcontractor shall be responsible for paying any Utility charges and excess costs. The Electrical Subcontractor shall perform all work in accordance with utility company requirements and is subject to Utility Company inspection and approval prior to service installation.

2. The Electrical Utility for this project is Central Maine Power (CMP). Contact is Paul DuPerre, (207) 828-2882.

3. The Telephone Utility for this project is Fairpoint Communications.

2.2 WORK TO BE PROVIDED UNDER THIS DIVISION

A. General Scope

The Work shall be complete from point of service to each outlet or device with all accessory construction and materials required to make each item of equipment or system complete and ready for operation. The work shall include but not be limited to the following. The Electrical Subcontractor shall provide:

1. Service Entrance: Provide service conduits, secondary service lateral wiring and equipment as per the documents and as required by the Utility companies. Intent is have the utility furnish a new pole and electrical contractor to furnish new underground service to the building.

2. Utility Metering: Provide meter enclosures for utility company revenue metering. The preferred location for utility metering equipment will be at the exterior wall of the building as shown on the plans. Provide all enclosures, conduits, supports and wiring required as per CMP specifications.

3. Grounding System: Provide a complete grounding electrode system for the building and all equipment grounding and interconnection wiring.

4. Temporary Power: All charges for having temporary service provided to the facility, and all equipment, wiring and lighting as required and defined later in this specification section.

5. Service Entrances for Other Utilities: Provide empty conduits from new pole to the building for telephone and CATV.

6. Power Distribution Systems: Provide power and lighting distribution systems including service disconnecting means, panelboards, overcurrent devices, raceway, cable and wire.

7. Feeder and Branch Circuit Wiring: Provide feeder and branch circuits and devices for power to equipment and convenience receptacles. This includes branch wiring to system control panels furnished under other sections.

8. Motor Circuit Wiring: Provide all motor wiring, safety disconnects, and motor starters unless integral with equipment.

9. Interior Lighting Systems: Provide complete interior lighting system including normal and emergency fixtures, exit signs, lamps, controls, trim and accessories.

10. Exterior Lighting Systems: Provide complete exterior lighting system including building lighting fixtures, controls, lamps and accessories.

11. Fire Alarm Systems: Provide complete fire alarm and detection system including pull stations, heat detectors, area smoke detectors, duct smoke detectors, indicating appliances, voice evacuation system, remote annunciation devices, water flow and tamper switch wiring, auxiliary contacts for equipment interlocking and other devices shown on the drawings.

12. Telephone and Data Systems: Provide complete voice/data system conduits and boxes for installation of wiring and devices by Owners voice/data contractor.

13. Cable Television Systems: Provide conduits as required for CATV system outlets.

14. Control Wiring: Provide control wiring not provided by Division 25000.

15. Supports and Fittings: Provide all support material and hardware for raceway, cable tray and electrical equipment.

16. Terminations: Provide terminations of all cable and wire unless otherwise noted.

17. Penetrations: Provide all building wall, floor and roof penetrations for raceway and cable tray where not provided by the General Contractor.

18. Other Items Furnished By Others: Install the following equipment furnished by others:

    1. Motors

    2. Control Panels

2.3 WORK NOT INCLUDED UNDER THIS DIVISION

A. Related Work Included in Other Sections

The following work is not included in this Section and shall be performed under other sections:

1. Excavation and backfill.

2. Concrete work, including concrete housekeeping pads and other pads and blocks for vibrating and rotating equipment.

3. Cutting and patching of masonry, concrete, tile, and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal decks. The Electrical Subcontractor shall identify locations of penetrations, excavations, structural supports, etc. required for the completion of the Work of this Section to the General Contractor in a timely manner.

4. Installation of access panels in ceilings and wall construction.

5. Painting, except as specified herein.

6. Temporary water, heat, gas and sanitary facilities for use during construction and testing.

7. Outdoor air intake or exhaust louvers.

8. Control wiring specifically indicated as part of Division 25.

2.4 GENERAL EQUIPMENT AND MATERIALS REQUIREMENTS

A. General Requirements

All equipment and materials shall be new and of the quality specified. All materials shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged during construction shall not be repaired at the jobsite, but shall be replaced with new materials.

B. Representation of Equipment

All equipment installed on this project shall have local representation, local factory authorized service and a local stock of repair parts.

C. Warranties

No equipment or material shall be installed in such a manner as to void a manufacturer’s warranty. The Electrical Subcontractor shall notify the Engineer of any discrepancies between the Contract Documents and manufacturer's recommendations prior to execution of the work.

2.5 SHOP DRAWINGS

A. General Requirements

After the Contract is awarded, but prior to proceeding with the Work, the Electrical Subcontractor shall obtain complete shop drawings, product data and samples from manufacturers, suppliers, vendors, and Subcontractors for all materials and equipment specified herein, and submit data and details of such materials and equipment for review by the Engineer. Submission of such items shall follow the guidelines set in the General Section of the Specification Document. Prior to submission of the shop drawings, product data and samples to the Engineer, the Electrical Subcontractor shall review and certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Further, the Electrical Subcontractor shall check all materials and equipment after their arrival on the jobsite and verify their compliance with the Contract Documents. A minimum period of ten working days, exclusive of transmittal time will be required in the Engineer's office each time shop drawings, product data and/or samples are submitted or resubmitted for review. This time period shall be considered by the Electrical Subcontractor when scheduling his Work.

B. Information to be included in Submittal

The shop drawing submittal shall include all data necessary for interpretation as well as manufacturer's name and catalog number. Sizes, capacities, colors, etc., specified on the drawings shall be specifically noted or marked on the shop drawings.

C. Information Not to be included in Submittal

Submittals shall contain only information specific to systems, equipment and materials required by Contract Documents for this Project. Do not submit catalogs that describe products, models, options or accessories, other than those required, unless irrelevant information is marked out or unless relevant information is highlighted clearly. Marks on submittals, whether by Contractor, Subcontractor, manufacturer, etc., shall not be made in red ink. Red is reserved for review process.

D. Responsibility of Submitted Equipment

The Engineer's review of such drawings shall not relieve the Subcontractor of responsibility for deviations from the Contract, Drawings or Specifications, unless he has in writing called the attention of the Engineer to such deviations at the time of the submission. The Engineer's review shall not relieve the Electrical Subcontractor from responsibility for errors or omissions in such drawings.

E. Proposal of Other Equipment

If the Electrical Subcontractor proposes an item of equipment other than that specified or detailed on the drawings which requires any redesign of the wiring or any other part of the mechanical, electrical or architectural layout, the required changes shall be made at the expense of the trade furnishing the changed equipment at no cost to the Owner.

F. Substitution of Equipment of Equal Quality

Manufacturer's names are listed herein and on the drawings to establish a standard for quality and design. Where one manufacturer's name is mentioned, products of other manufacturers will be acceptable if, in the opinion of the Engineer the substitute material is of quality equal to or better than that of the material specified. Where two or more manufacturer's names are specified, material shall be by one of the named manufacturers only.

2.6 EQUIPMENT MANUALS

A. General Requirements

The Electrical Subcontractor shall provide three copies of operations and maintenance manuals for all items. These manuals shall be packaged with additional information including equipment cur sheets and as-built wiring diagrams. Manuals shall contain names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment.

B. Schedule

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. Instruction of Owner’s Operating Personnel

Upon completion of installation or when Owner accepts portions of building and equipment for operational use, instruct the Owner's operating personnel in any and all parts of various systems. Such instructions shall cover period of control such as will take mechanical equipment through complete cycle. Make adjustments under actual operating conditions.

2.7 RECORD DRAWINGS

A. General Requirements

As work progresses, and for duration of the Contract, the Electrical Subcontractor shall maintain a complete and separate set of prints of Contract Drawings at job site at all times and record work completed and all changes from original Contract. Drawings shall clearly and accurately include work installed as a modification or added to the original design. At completion of work and prior to final request for payment, the Electrical Subcontractor shall submit a complete set of reproducible record drawings showing all systems as actually installed.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Requirements

Unless otherwise noted all wiring shall be installed in raceway as follows:

1. Service Entrance Conductors: All service conductors shall be installed in rigid steel, rigid aluminum or intermediate metal conduit except when installed underground. Wiring installed underground shall be installed in rigid non-metallic, PVC conduit and as per the Contract Drawings.

2. Power Distribution Outdoors: All conduits installed outdoors, all risers between floors and conduit exposed to physical damage shall be rigid steel, rigid aluminum or intermediate metal conduit. Wiring installed underground shall be installed in rigid non-metallic, PVC conduit and as per the Contract Drawings.

3. Power Distribution Indoors: Unless otherwise noted, all other power distribution wiring including feeders and branch circuits shall be installed in electrical metallic tubing (EMT) when installed exposed. Where exposed to potential physical damage (especially in the D & R Bays) conduits shall be rigid steel, rigid aluminum or intermediate metal conduit. Wiring above hung ceilings and behind drywall can be installed in properly supported MC cables.

4. Telephone & Data: Shall be installed in EMT where exposed and filled as not to exceed fill ratio requirements. In finished spaces furnish ENT, ¾" (minimum) in walls from the box to the accessible ceiling space.

5. Cable Television (CATV): Shall be installed in EMT where exposed or where inaccessible. In common areas and offices, furnish ENT, ¾" (minimum) in walls from the box to the accessible ceiling space.

6. Fire Alarm System: Fire alarm system wiring shall be installed in EMT where exposed or NM cable where installed above ceiling tiles and behind drywall.

7. Control Wiring: Shall be installed in EMT where exposed and on J-hooks above acoustic ceilings.

3.2 EQUIPMENT ARRANGEMENT AND ACCESS

A. Location of Equipment

Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Minor deviations from the drawings may be made to allow for better accessibility at no additional cost to the Owner, but changes shall not be made without review by the Engineer. Minimum clearances in front of or around equipment shall conform to the latest applicable code requirements.

B. Arrangement of Equipment

The size of equipment shown on the drawings is based on the dimensions of a particular manufacturer. Where other manufacturers are acceptable, it is the responsibility of the Electrical Subcontractor to determine if the equipment he proposed to furnish will fit the space available. Layout drawings shall be prepared by the Subcontractor when required by the Engineer or Owner to indicate a suitable arrangement.

3.4 EQUIPMENT LABELING

A. Panelboards and Transformers

All panelboards, cabinets and other specified equipment shall be labeled with engraved laminated plastic plates, minimum 3/4" high with 3/8" engraved letters. Punch tapes with mastic backings are not acceptable.

B. Starters and Disconnect Switches

All starters, disconnect switches and other specified equipment shall be marked with engraved laminated plastic plates, minimum 1/2" high with 1/4" engraved letters. Where individual switches or circuit breakers in power or distribution panelboards do not have cardholders, they shall be marked with 1/2" high labels.

C. Empty Conduits

All empty conduits shall have labels tied to the pull string at each end of each empty conduit, marked as to identification of each end. Junction boxes with circuits provided for future use shall be labeled with appropriate circuit designation.

D. Panelboard Directories

Cardholders for panelboards shall be filled out with typewritten identification of each circuit, except that the word "spare" shall be written in soft pencil to identify all circuit breakers installed that are not used.

END OF SECTION 26 05 00

SECTION 26 05 19

600 VOLT WIRE

PART ONE - GENERAL

1.1 GENERAL REQUIREMENTS

A. Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work apply to the work of this section.

1.2 APPLICABLE CODES AND STANDARDS

A. Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

ASTM B-3	Soft or Annealed Copper Wire
ASTM B-8	Concentric Lay Stranded Copper Conductors
NEMA WC-5	Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
NEMA WC-7	Cross-Linked Thermosetting Polyethylene Insulated Wire for the Transmission and Distribution of Electrical Energy
UL 44	Rubber Insulated Wires and Cables
UL 62	Flexible Cord and Fixture Wire
UL 83	Thermoplastic Insulated Wires and Cables

1.3 SUBMITTALS REQUIRED

A. Manufacturer’s product data sheets.

1.4 MANUFACTURERS

A. Subject to compliance with the Specification Requirements:

- Anixter
- General Cable
- Rome Cable
- Approved Equal

PART TWO: PRODUCTS

2.1 GENERAL

A. Conductors

All conductors shall be annealed copper in accordance with ASTM B-3.

B. Jacket

The jacket of all wire shall be printed with the following information:

- Manufacturer
- Size
- Insulation type
- Maximum voltage
- UL label

C. Insulation

All insulation shall be 600 volt rated.

2.2 POWER WIRING

A. Service Lateral/Service Entrance Conductors

Service lateral and service entrance conductors shall be type XHHW in raceway. The electrical contractor may substitute conductors comprised of compact stranded aluminum alloy that is listed by UL Standard 486B, labeled "AL9CU" for 90°C rated circuits. Cable shall be as manufactured by Alcan Cable, Stabiloy Compact Stranded type. Cable sizes shall be adjusted to meet the same Ampacity levels as designed for copper cables. All aluminum connections shall be made using a listed Oxide Inhibiting Joint compound as recommended by the cable manufacturer.

B. Feeders and Motor Branch Circuits

Feeders and motor branch circuits shall be type XHHW or THHN/THWN in raceway or MC cable assembly where conceiled behind drywall.

C. Description

All power wiring shall be stranded, Class B strand in accordance with ASTM B-8, minimum size #12 AWG.

2.3 LIGHTING AND RECEPTACLE BRANCH CIRCUITS

A. Description

All lighting and convenience receptacle branch circuit wiring shall be type THHN/THWN, solid or stranded conductor, minimum size #12 AWG.

2.4 CONTROL WIRING

A. Description

Wiring for control circuits shall be THHN/THWN stranded, with Class B strand in accordance with ASTM B-8, minimum size #12 AWG unless otherwise noted on drawings.

2.5 FIXTURE WIRE

A. Description

Where high temperature fixture wire is required it shall be silicone rubber type SF-2.

PART THREE: EXECUTION

3.1 GENERAL

A. Installation

All wire shall be installed in accordance with manufacturer's instructions.

3.2 TESTING

A. Control and Instrument Wiring

Control and instrument field wiring shall be visually inspected and tested for continuity to insure that all field wiring is installed in accordance with Contract Drawings and/or equipment manufacturers drawings. Verify all field conductors are properly identified with wire numbers.

B. Low Voltage Power Wiring

All 208V power wiring shall be subjected to one minute 1000V megger test. Minimum insulation resistance shall be 50 megohms. Megger tests shall be performed between each phase (A-B, B-C, and C-A) and three phases tie together to ground.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING EQUIPMENT

PART ONE: GENERAL

1.1 GENERAL REQUIREMENTS

A. Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work apply to the work of this section.

B. Installation Compliance

The Contractor shall provide a complete grounding system including grounding electrodes, electrode conductors, bonding jumpers, equipment grounding conductors, connections and other materials as may be required for a complete installation. The completed system provided shall meet the requirements of the National Electrical Code and the interpretation of the Local Authority Having Jurisdiction.

1.2 APPLICABLE CODES AND STANDARDS

A. Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

NFPA 70	National Electrical Code
UL 467	Grounding and Bonding Equipment

1.3 SUBMITTALS REQUIRED

A. Equipment Data Sheets

Data sheets for chemical grounding systems, exothermal connection methods, and associated wiring.

1.4 MANUFACTURERS

A. Products shall be of firms regularly engaged in manufacture of grounding equipment.

PART TWO: PRODUCTS

2.1 GENERAL

A. Requirements

Provide all equipment, components and parts required to for a complete and operable system.

2.2 GROUND RODS

A. Requirements

Ground rods shall be ¾-inch copper clad steel construction furnished in 10 foot lengths.

2.3 CONDUCTORS

A. Bare Grounding Conductors

Bare grounding conductors shall be soft drawn stranded copper, sized in accordance with NEC Article 250 unless otherwise noted on the Drawings.

B. Insulated Grounding Conductors

Insulated grounding conductors shall be stranded copper with Type TW, THW or THHN/THWN insulation. Grounding conductor shall be provided with green insulation for identification purposes.

2.4 CONNECTIONS

A. Welded Connections

Welded connections shall be exothermic reaction type, as manufactured by Cadweld, or approved equal. The contractor shall provide all molds, crucibles, weld metal, and any necessary materials or equipment required to make connections using this process.

B. Compression Connections

Compression lugs shall be short barrel, one-hole compression type for conductors #2/0 AWG and smaller and long barrel, two-hole compression type for conductors #3/0 AWG and larger.

2.5 GROUNDING BAR

A. Requirements

Provide a wall-mounted copper grounding bar, mounted 6 inches above finished floor. Grounding bar shall be connected directly to the grounding grid.

PART THREE: EXECUTION

3.1 GROUNDING ELECTRODE SYSTEM

A. Requirements

Grounding electrodes of the types shown on the Contract Drawings and as required by NEC shall be provided. Additional electrodes shall be provided if required by the local Authority Having Jurisdiction. All electrodes shall be bonded together to form the grounding electrode system.

B. Installation of Ground Rods

Ground rods shall be driven vertically with the upper end of the rod not less than 2-1/2 feet below finished grade. When conditions require, ground rods may be driven at an angle not to exceed 45 degrees from vertical, with the driven end facing outside of the grounding ring.

C. Installation of Grounding Ring Conductors

Grounding ring conductors shall be bare copper, sized as shown on the Contract Drawings and installed at a minimum depth of 2-1/2 feet below finished grade. Conductors encased in concrete footings, in or under floor slabs, and in duct banks shall be bare copper, sized as shown on the Contract Drawings. All connections made below grade or encased in concrete shall be exothermic weld type.

D. Connection to Structural Steel

Grounding grid conductors shall be connected to building structural steel as required by the NEC this shall include a connection to reinforcing steel in a minimum of one concrete footing. All connections to building steel shall be exothermic weld type.

E. Grounding Electrode Conductors

The electrical service and all separately derived systems shall be grounded in accordance with NEC Article 250. The grounding electrode conductor shall be copper, sized in accordance with Article 250 of the NEC or as shown on the Drawings.

3.2 EQUIPMENT GROUNDING SYSTEMS

A. Requirements

A separate, insulated copper conductor, with green colored insulation, shall be provided in all raceways and with every feeder, branch and control circuit, in addition to the grounded metallic conduit system. The equipment grounding conductor shall be grounded at both ends.

B. Connection of Equipment Grounding Conductors

Connections to equipment grounding busses shall use compression type termination lugs bolted to a clean, dry surface on the bus, free from any contaminates which may hinder the electrical continuity of the connection. The contractor shall provide any additional hardware and all drilling and tapping that may be required for this connection.

3.3 ADDITIONAL BONDING REQUIREMENTS

A. Grounding of Raceway Systems

All metallic raceways shall be electrically continuous and bonded to the grounding system.

B. Grounding of Cable Tray

Cable tray shall be bonded to the grounding system through the provision of a #2/0 AWG bare copper conductor installed on the exterior rail and supported at 6 foot intervals by a ground clamp. All conduit terminating at the cable tray shall be provided with grounding bushings and bonded to the cable tray grounding conductor.

C. Bonding of Electrical Equipment Busses

All switchgear, switchboard and motor control center grounding busses shall be connected to the grounding electrode system at both ends. Bonding conductor shall be equal to that sized for the feeder to the equipment as shown on the Contract Drawings.

D. Bonding of Other Systems

Interior metal water, gas and sprinkler piping shall be bonded as required by Article 250 of the NEC. The points of attachment of these bonding conductors shall be located in readily accessible locations.

END OF SECTION 26 05 26

SECTION 26 05 33

RACEWAY AND FITTINGS

PART ONE: GENERAL

1.1 GENERAL REQUIREMENTS

A. Provisions

Provisions of Section 26 05 00, General Requirements for Electrical Work apply to the work of this Section.

1.2 APPLICABLE CODES AND STANDARDS

A. Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

ANSI C80.1	Standard for Rigid Steel Conduit
ANSI C80.3	Standard for Electrical Metallic Tubing
ANSI C80.6	Standard for Intermediate Metal Conduit
NEMA RN-1	Polyvinyl-chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
NEMA TC-2	Electrical Plastic Tubing and Conduit
NEMA TC-3	PVC Fittings for use with Rigid PVC Conduit and Tubing
UL 1	Flexible Metal Conduit
UL 6	Rigid Metal Conduit
UL 360	Liquid Tight Flexible Steel Conduit
UL 514B	Fittings for Conduit and Outlet Boxes
UL651	Schedule 40 and 80 Rigid PVC Conduit
UL797	Electrical Metallic Tubing
UL870	Wireways, Auxilliary Gutters and Associated Fittings
UL1242	Intermediate Metal Conduit

1.3 SUBMITTALS REQUIRED

A. Manufacturers' product data sheets

1.4 MANUFACTURERS

A. In compliance with the Specification Requirements:
- Allied Tube and Conduit (Conduit)
- Wheatland (Conduit)
- Thomas and Betts (Fittings)
- Appleton (Fittings)
- Crouse Hindes/Cooper (Fittings)
- OZ Gedney (Fittings)
- Killark (Fittings)
- Carlon (PVC)

- National Pipe and Plastics (PVC)
- AFC Cable Systems (MC/LFMC)
- Southwire (MC/LFMC)
- Other manufacturers listed in the specification descriptions
- Approved equals

PART TWO: PRODUCTS

2.1 CONDUIT

A. Galvanized Rigid Steel Conduit (GRS)

Rigid steel conduit shall be manufactured from mild steel tube with a uniform protective coating of hot dipped zinc galvanizing inside and outside, including all threads. The conduit shall be furnished in nominal 10-foot lengths, with both ends threaded and furnished with a galvanized coupling on one end and a plastic thread protector on the other end.

B. Rigid Aluminium Conduit

Rigid aluminum conduit, couplings and elbows shall be manufactured of a suitable copper-free aluminum alloy. Conduit lengths shall be seamless throughout and shall have hard, smooth and gum-free interior coatings to facilitate the pulling-in of conductors. It shall be furnished in nominal 10-foot lengths, with both ends threaded and a coupling applied to one end of each length. Threads on the coupling end shall be coated with a special lubricant so that the coupling may be removed without difficulty. Threads on the end opposite the coupling shall be protected from damaged by a plastic cap.

C. Intermediate Metal Conduit (IMC)

Intermediate metal conduit shall be of steel piping with a uniform protective coating of hot dipped zinc galvanizing on the outside of the conduit, including all threads. The conduit shall be furnished in nominal 10-foot lengths, both ends threaded furnished with a galvanized coupling on one end and a plastic thread protector on the other end.

D. Rigid Nonmetallic Conduit (PVC)

Rigid nonmetallic conduit shall be polyvinyl chloride, rated for use with 90°C conductors and furnished in 10-20-, or 30-foot lengths.

E. Electrical Metallic Tubing (EMT)

Electrical metallic tubing shall be constructed of zinc coated steel with an interior coating of lacquer or enamel to permit easier wire pulling.

F. Liquid Tight Flexible Metal Conduit (LFMC)

Liquid tight flexible conduit shall be constructed with a flexible core of galvanized steel and an oil and sunlight resistant PVC jacket to form a liquid tight raceway. The overall jacket shall be wrinklefree and suitable for use in temperatures from -25°C to +80°C.

G. Flexible Metal Conduit (MC)

Flexible metal conduit shall have an outer armor constructed of be hot dipped galvanized interlocked strip steel.

2.2 CONDUIT FITTINGS

A. Bushings

1. Insulated Bushings

Insulated bushings for conduit sizes 1-1/4 inches and larger shall have metal bodies and threads, with molded-on high impact phenolic thermosetting insulation to prevent conductor insulation damage. Bushings shall be Type “IBC” insulated bushings as manufactured by OZ Gedney or an approved equal. Insulated bushings for conduit sizes 1 inch and smaller may be of plastic, OZ Gedney Type "A", or an approved equal.

2. Insulated Grounding Bushings

Insulated grounding bushings shall be similar to the insulated bushings described above, except they shall have set screws to lock the bushings on the conduits and shall have mechanical type lugs attached. The lugs shall be sized to accept the ground wire sizes as set forth in the latest edition of the National Electrical Code, but in no case smaller than No. 8 AWG wire. Grounding bushings shall be Type “BLG” as manufactured by OZ Gedney or an approved equal.

3. Male Bushings

Male bushings shall be Thomas and Betts Corporation insulated throat chase nipples, or a product of equal construction. Bushings used only to pass conductors through metal partitions, etc. shall be OZ Gedney, Type "ABB".

4. Male Bushings

Bushings for use with EMT shall be OZ Gedney type “SBT” or approved equals.

B. Conduit Bodies

Conduit bodies for use with aluminum conduit shall be of copper free aluminum alloy. Those for use with steel conduit may be of galvanized, or cadmium plated cast iron, or of copper free aluminum alloy. All conduit fittings shall be provided with neoprene gaskets and sheet metal covers, except that cast covers shall be used for sized 1-1/2 inches and larger. Rigid conduit connections shall be threaded and EMT connections shall be set screw type. Cover screws shall be captive. All conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equal.

C. Hubs

Water-tight conduit connections are required on all NEMA 3R, 4, and 4X enclosures and all electrical equipment located outdoors or in damp or wet areas. Where hubs or water-tight threaded connections are not provided as part of the enclosure, water-tight hubs shall be Myers "Scrutite", or approved equal. All other terminations shall be double locknut and bushing.

D. Fittings

Fittings for use with liquid-tight flexible conduit shall be zinc plated malleable iron Crouse Hinds type “CGB” or approved equal.

E. Locknuts

Locknuts shall be hot dipped galvanized steel or malleable iron. Standard locknuts shall be used for connections to NEMA 1 enclosures. Sealing locknuts with integral gasket shall be used for connections to NEMA 12 enclosures.

2.3 JUNCTION BOXES

A. Pull and Junction Boxes

Pull and junction boxes shall be of code gauge metal with continuously welded joints or of cast metal if called for on the Drawings. All junction boxes shall have gasketed screw covers. Boxes for use with aluminum conduits shall be of aluminum. Sheet steel boxes shall be galvanized after fabrications. Screws for galvanized steel box covers shall be made of brass. Screws for aluminum box cover shall be stainless steel.

B. Boxes Installed in Concrete

Boxes installed in concrete shall be cast iron alloy or copper free aluminum.

C. Rating of Boxes

Unless otherwise shown on drawings, all boxes installed indoors shall be rated NEMA 1 and all boxes installed outdoors shall be rated NEMA 3R. Boxes located in fire walls, exterior walls, and at the ceiling of the top floor shall be sealed with UL approved fire sealant material to maintain the rating of the separation as well as providing air sealing to maintain the buildings thermal envelope. Boxes located on opposing sides of rated walls i.e. unit separations, must be at least 24” apart or treated with putty pads per IBC.

2.4 OUTLET BOXES

A. Outlet Boxes for Concealed Work

Outlet boxes for concealed work shall be pressed steel boxes, galvanized and not less than #12 gauge. Each ceiling outlet designated for a lighting fixture shall have a fixture support secured in place with bolts and nuts. Ceiling boxes shall be octagonal with lugs and screws for back plates.

B. Outlet Boxes Installed Outdoors

Outlet boxes installed outdoors, in concrete or exposed, shall be cast iron alloy or copper free aluminum with gasketed covers.

C. Outlet Box Accessories

Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and to fulfill installation requirements for individual wiring situations.

2.5 WIREWAY

A. Wireway

Wireway shall be lay-in type, code gauge steel with dark gray epoxy paint finish inside and out.

B. Covers

Covers shall be hinged with captive screw fasteners for NEMA 1 & NEMA 3R wireway and gasketed quick release latch covers for NEMA 12 wireway.

2.6 SUPPORTS

A. Sizing

The Electrical Subcontractor shall size and provide all supports necessary for the installation of all raceway.

B. Channel Framing

Channel framing shall be manufactured by Unistrut, Kindort, B-Line or approved equal.

C. Indoor Locations

In dry, non-corrosive areas, channel framing and angle shall be galvanized steel or aluminum and all nuts, bolts and hardware shall be carbon steel, cadmium plated or hot dipped galvanized. Ream clamps shall be galvanized steel or malleable iron.

D. Outdoor, Wet or Damp Locations

In outdoor, wet or damp areas channel framing and angle shall be aluminum or 304 stainless steel and nuts, bolts and hardware shall be 304 stainless steel. Beam clamps shall be hot dipped galvanized steel or malleable iron.

E. Corrosive Locations

In corrosive areas, channel framing shall be 316 stainless steel, PVC coated steel or PVC coated aluminum. Nuts, bolts and hardware shall be 316 stainless steel. Beam clamps shall be PVC coated.

F. Supports

Supports shall be sized with a minimum safety factor of four or 200 lbs. whichever is greater.

PART THREE: EXECUTION

3.1 GENERAL

A. Requirements

See Specification Section 26.05.00 Subsection 3.1 for Wiring Methods.

3.2 INSTALLATION

A. Conduit, EMT, Boxes and Enclosures

Conduit, EMT, boxes & enclosures shall be installed so that they are mechanically secure, electrically continuous and neat in appearance.

B. Exposed Runs

Exposed runs shall be installed to conform to the shape of the surface over which they are run. Where they are run over a plane surface, they shall be straight and true. All exposed conduits shall be run parallel and perpendicular to building column lines and walls. Diagonal runs will not be permitted. Conduit runs in groups shall be supported by means of common members made of channel framing. Group mounting is not required where the group consists of only two conduits. Machine bolts with expansion shields shall be used when fastening to solid masonry or concrete. Toggle bolts shall be used to fasten to hollow masonry.

C. Spacing

Unless otherwise approved, spacing between conduit supports shall not exceed ten feet. Conduits shall not be supported from structural members marked “Removable” on the structural drawings. Conduit hangers and supports shall be fastened to buildings and structural members only and not to any equipment or piping. Separate conduits a minimum of 6” from flues, steam and hot water lines. Install conduit above mechanical piping wherever possible.

D. Conduit Supports

All conduit supports other than structural members shall be galvanized. The use of perforated strap or plumber straps will not be permitted.

Conduit up to 1-1/2 inches may be supported by one-hole malleable iron straps with clamp backs.

Conduit 2 inches and larger shall be supported by two-hole straps.

E. Conduit Run Lengths

Conduit runs shall not exceed 100 feet between boxes, fittings or devices.

PVC conduits run above grade shall be sufficiently supported to prevent sagging.

MC cables shall be neatly bundled and tie wrapped and sufficiently supported.

F. Use of Expansion Joints

All conduit crossing building or structure expansion joints shall be provided with approved expansion fittings.

3.3 BENDS

A. Field Bends

Field bends shall be made with approved bending tools. All field-formed bends shall be of maximum radius permitted by the design and construction conditions.

B. Exposed Conduit Changing Direction

Where a group of exposed conduits change direction, the bends shall have a common center in order to maintain the uniformity and neat appearance of the group, having regard for the minimum bending radius of the largest conduit in the group.

C. General

Bends shall be uniform radius and free from cracks, crimps or other damage to the conduit or its coating and shall not unduly flatten the conduit section.

3.4 JOINTS AND TERMINATIONS

A. Joints in Rigid Conduit

All joints in rigid conduit shall be threaded, using standard couplings. The use of running threads, threadless or split couplings is prohibited. When reaming out of conduit ends to remove burrs and rough edges, care shall be exercised to avoid excessive reaming which results in the weakening of the conduit wall at the end.

B. Tightening of Joints

All joints shall be made up wrench tight and with a minimum of wrench work in order to avoid wrench cuts.

C. Cut Threads

All cut threads shall be thoroughly painted with a coating of a rust inhibiting primer.

D. EMT Couplings and Fittings

EMT couplings and fittings shall be compression type on conduits up to 1–1/4 inch and double set screw type for conduits 1-1/2 inch and larger.

E. Conduit Terminations

All conduit terminations in panels, enclosures, outlet boxes and equipment shall be provided with bushings.

3.5 FLEXIBLE CONDUIT

A. Terminations

Flexible conduit shall be use to terminate all, lighting, motors, unit lanterns, transformers, pilot devices and vibrating equipment.

B. Liquitite Flexible Conduit

Liquitite flexible conduit and fitting shall be used outdoors and in all damp or wet areas, or where exposed to grease or oil.

C. Connections to Lighting Fixtures

Connections to lighting fixtures (lighting whips) shall be maximum length of 6 feet. All other flexible connections shall be maximum 24 inches.

3.6 PENETRATIONS

A. Penetrations through Slabs, Walls, Roofs

All penetrations through concrete slabs, masonry walls or roofs shall be provided with sleeves.

B. Sleeves

All sleeves shall be sealed to maintain the integrity of the structure. Fire resistant walls and floors shall be sealed with approved material, and shall maintain the original fire rating. All seals below grade shall be watertight, O.Z./Gedney type WSK or approved equal.

END OF SECTION 26 05 33

SECTION 26 24 16

PANELBOARDS

PART ONE: GENERAL

1.1 GENERAL REQUIREMENTS

A. Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work apply to the work of this section.

1.2 APPLICABLE CODES AND STANDARDS

A. Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

NEMA 250	Enclosures for Electrical Equipment
NEMA AB-1	Molded Case Circuit Breakers
NEMA KS-1	Enclosed Switches
NEMA PB-1	Panelboards
UL 50	Enclosures for Electrical Equipment
UL 67	Panelboards
UL 98	Enclosed and Deadfront Switches
UL 489	Molded Case Circuit Breakers and Circuit Breaker Enclosures
UL 943	Ground Fault Circuit Interrupters

1.3 SUBMITTALS REQUIRED

A. Manufacturer’s product data sheets.

B. Circuit breaker schedules.

1.4 MANUFACTURERS

A. Subject to compliance with the specification requirements:

- Square D
- Cutler Hammer
- General Electric

PART TWO: PRODUCTS

2.1 GENERAL

A. Panelboards

Panelboards, including lighting and appliance panelboards and power distribution panelboards, shall be of the sizes, rating and arrangement shown on the drawings.

B. Overcurrent Devices

Panelboards shall be provided complete with all overcurrent devices, accessories and trim.

C. Safety Barriers

All panelboards shall be provided with safety barriers for dead front construction.

D. Short Circuit Ratings

The required short circuit ratings of assembled panelboards are shown on the Drawings. The short circuit rating of every overcurrent device in the panel shall meet or exceed the panel rating. Unless otherwise noted on the Drawings, series rated combinations will not be permitted.

2.2 CABINETS

A. Boxes

Boxes shall be code gauge galvanized sheet steel.

B. Trim

Trim shall be code gauge steel, ANSI-61 gray finish with stainless steel flush type lock/latch handle. All locks shall be keyed alike.

C. Surface Mounted Panels

Trim for surface mounted panels shall be door-in-door construction such that the gutter space may be exposed by a hinged door.

D. Frames

Directory frames shall be metal frame with plastic covers.

2.3 BUS

A. Bus Work

All bus work shall be 750 amp/sq.in. aluminum.

B. Neutral Buses

Unless otherwise noted on the drawings, neutral busses shall be 100% rated with adequate connections for all outgoing neutral conductors.

C. Panelboards

Panelboards shall be provided with aluminum ground busses.

D. Connection

Bus shall be designed for sequence phase connection to allow the installation of one, two or three pole branch circuit breakers in any position.

2.4 OVERCURRENT DEVICES

A. Device Type

Overcurrent devices shall be trip-free molded case, bolt-on, thermal magnetic circuit breakers.

B. Main Circuit Breakers

Main circuit breakers shall be individually mounted and bolted to bus assembly. Back-fed branch mounted circuit breakers are prohibited.

C. Circuit Breakers Frontfaces

Front faces of all circuit breakers shall be flush. Trip indication shall be clearly shown by the handle position between the ON and OFF positions.

D. Ground Fault Circuit Breakers

Ground fault circuit breakers shall be provided as required on the Contract Drawings and shall require no more panel space than standard breakers.

E. Switching Lighting Circuit Breakers

Where circuit breakers are used for switching of lighting, circuits type "SWD" circuit breakers shall be provided.

F. Connections

All connections shall be rated for 75ºC copper conductors.

PART THREE: EXECUTION

3.1 GENERAL

A. Installation

Panelboards shall be installed in accordance with Manufacturer’s Instructions. Panelboard mounting heights shall be mounted so the highest breaker switch device does not exceed 48” of the finished floor.

END OF SECTION 26 24 16

SECTION 26 31 00

FIRE ALARM SYSTEM

PART ONE: GENERAL

1.1 GENERAL REQUIREMENTS

A. Definition of Work :

This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

1.2 APPLICABLE CODES AND STANDARDS

A. Compliance:

All work shall be in accordance with the laws, rules, codes, and regulations set forth by Local, State, and Federal authorities having jurisdiction. All products and materials shall be manufactured, installed and tested as specified, but not limited to the latest accepted edition of the following codes, standards and regulations:

NFPA 13	Sprinkler Systems
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
UL 38	Manually Actuated Signaling Boxes
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 346	Water-flow Indicators for Fire Protective Signaling Systems
UL 464	Audible Signaling Appliances
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 864	Control Units for Fire Protective Signaling Systems
UL 1971	Visual Notification Appliances

B. Electrically Supervised System

The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

C. UL Listing

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.

D. Authority Having Jurisdiction

1. The system and its components shall meet all requirements of the Local Authority Having Jurisdiction.

1.3 SUBMITTALS REQUIRED

A. Shop Drawings

Shop Drawings shall include but not be limited to the following:

- Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
- Show annunciator layout, configurations, and terminations.

B. Manuals

Manuals shall be submitted simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.

C. Wiring Diagrams

Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.

D. Sequence of Operation

Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

E. Battery Calculation

Provide a complete battery calculation showing that the battery system provided meets the operational requirements as defined by NFPA.

1.4 MANUFACTURERS

A. Subject to compliance with the requirements of this specification, provide alternate products by one of the following:

- SimplexGrinnell
- Notifier
- Gamewell
- Approved Equal

PART TWO: PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. General

A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic System Performance

Basic System performance shall meet the following:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).

2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

4. On Style 6 or 7 (Class A) configurations 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.

5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

C. Basic System Functional Operation

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 system display shall flash.

2. A local piezo-electric signal in the control panel shall sound.

3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.

5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

2.2 SYSTEM CONDUITS, WIRING AND GROUNDING

A. Conduits

Conduits shall be in accordance with other sections of this specification and The National Electrical Code (NEC), local and state requirements.

B. Wiring

Wiring shall be UL listed and in accordance with local, state and national codes 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 for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG for Notification Appliance Circuits. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

C. Terminal Boxes, Junction Boxes and Cabinets

All boxes and cabinets shall be UL listed for their use and purpose.

D. Arrangement of Circuit Wiring

Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. Grounding of Fire Alarm Control Panel

The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 FIRE ALARM CONTROL PANEL (FACP)

Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. 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, and other system controlled devices. This system shall also include a voice evacuation system integral to or as an adjunct (slave) to the control panel.

A. Operator Controls

1. Acknowledge Switch: Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel audible 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 LCD display to the next alarm or trouble condition. Depression of the Acknowledge switch shall also silence all remote annunciator audible signals.

2. Alarm Silence Switch: 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 silenced by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch: The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch: 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.

5. Lamp Test: The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

B. FACP System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to a minimum of 100 intelligent/addressable devices.

2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance

Circuits.

3. The control panel or each network node shall support up to 8 additional output modules (signal, speaker, telephone, or relay), each with 8 circuits for an additional 64 circuits. These circuits shall be either Class A (NFPA Style Z) or Class B (NFPA Style Y) per the project drawings.

4. The system shall include a full featured 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 with easy touch rubber keys for the field programming and control of the fire alarm system.

5. The system shall be 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.

6. The system shall allow the programming of any input to activate any output or group of outputs.

7. The system shall be provided with Drift Compensation to extend detector accuracy and filter out transient noise signals.

8. The system shall be provided with Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

9. The system shall be able to display or print system reports.

10. The system shall be provided with periodic detector test, conducted automatically by the software.

11. The system shall be provided with self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.

12. The system shall be provided with cross-zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.

13. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.

15. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

16. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.

17. Point Read: The system shall be able to display or print the following point status diagnostic functions:

    - Device status
    - Device type
    - Custom device label
    - View analog detector values
    - Device zone assignments
    - All program parameters

18. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. 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.

19. 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, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

20. 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.

21. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.

22. Waterflow Detection: An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display; turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.

23. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

24. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

25. Non-Alarm Input Operation: 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.

26. Combo Zone: A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

C. Central Microprocessor

The microprocessor will communicate with, monitor and control all external interfaces. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall not be lost even if system primary and secondary power failure occurs. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

D. System Display

The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.

E. Signaling Line Circuits (SLC)

Each SLC interface shall provide power to and communicate with the intelligent detectors (ionization, photoelectric or thermal) and modules (monitor or control). Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring. The CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

F. Serial Interfaces

The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

G. Notification Appliance Circuit (NAC)

1. The Notification Appliance Circuit module shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.

2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per module.

3. The module shall not affect other module circuits in any way during a short circuit condition.

4. The module shall provide eight green ON/OFF LEDs and eight yellow trouble LEDs.

5. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.

6. Each notification circuit shall include a custom label inserted to identify each circuit's location. Labels shall be created using a standard typewriter or word processor.

7. The notification circuit module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 12 AWG wire.

8. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.

9. Electrical Contractor shall be responsible for furnishing a system smoke detector at the location of any field located NAC modules not shown on the drawings in compliance with NFPA.

H. Control Relay Module

1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 5 amperes, 28 VDC. An expansion circuit board shall allow expansion to eight Form-C relays per module.

2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.

3. The relay module shall provide 8 green ON/OFF LEDs and 8 yellow LEDs to indicate disabled status of the relay.

4. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.

5. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or word processor.

6. The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 12 AWG wire.

I. Enclosure

The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall be provided with a key lock and shall include a glass or other transparent opening for viewing of all indicators.

J. Power Supply

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.

2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

3. 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 for use with batteries up to 60 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.

4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
   - Ground Fault LED
   - AC Power Fail LED
   - NAC on LED (4)

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 60 AH.

7. All circuits shall be power-limited, per UL864 requirements.

8. The batteries are to be completely maintenance free and shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

K. Surge Protection

All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

L. RF Subscriber Unit

Furnish an RF Subscriber Unit as required by the Town of Hartford Fire Department. This unit shall be as manufactured by AES Corporation, Intellinet Model 7788 (or current model required by local Fire Department). Coordinate the purchase, installation, and programming with the Town of Hartford Fire Department.

2.4 VISUAL STROBE NOTIFICATION DEVICES

Notification strobes shall be 24V xenon type, meet the requirements of the ADA, UL Standard 1971, and be fully synchronized. Minimum intensity is 15/75cd unless otherwise shown on the Drawings.

2.5 COMBINATION HORN/STROBE NOTIFICATION DEVICES

Electronic horns shall be 24V, field programmable without the use of special tools, at a sound level of at least 90dBA measured at 10 feet from the device. Strobes shall meet the requirements for Visual Strobe Notification Devices.

2.6 MANUAL PULL STATIONS

Manual fire alarm stations shall be analog addressable type, non-breakglass type, equipped with key

lock so that they may be tested without operating the handle. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset. An operated station shall be visually detected as operated at a minimum distance of 100 feet front or side. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters ½-inch in size or larger.

2.7 PHOTOELECTRIC AREA SMOKE DETECTORS

Photoelectric smoke detectors shall be a 24 VDC, two wire, analog addressable type, ceiling-mounted, light scattering type using an LED light source. Each detector shall contain a remote LED output and a built-in test switch. Detector shall be provided on a twist-lock base. 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. 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 flash at least every 10 seconds, indicating that power is applied to the detector. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet (914.4 m) per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber. All field wire connections shall be made to the base through the use of a clamping plate and screw.

2.8 DUCT SMOKE DETECTORS

Duct smoke detectors shall be a 24 VDC, analog addressable type with integral communications and device identification, and provided with a remote test indicator. Each detector shall be furnished and wired by the electrical contractor and installed by the mechanical contractor in the supply/return air ducts as shown on the Drawings. Duct smoke detectors shall be provided with properly sized air sampling tubes.

A. Operation of Duct Smoke Detectors

Duct smoke detectors shall be provided with 120V rated, form C contacts that open/close upon sensing of smoke or detector failure. Contacts will be used to shut down the associated air handler when detectors are installed in the supply ducts of the air handler.

2.9 HEAT DETECTORS

Automatic heat detectors shall be analog addressable type, and be of combination rate of rise and fixed temperature construction, rated at 135 degrees Fahrenheit for areas where ambient temperatures do not exceed 100 degrees, and 200 degrees for other areas. Heat detectors shall be low profile, ceiling mount type with positive indication of activation, and have smooth ceiling rating of 2500 square feet.

A. Rate of Rise Element

The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.

B. Fixed Temperature Element

The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.

2.10 WATERFLOW INDICATORS

Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type, with alarm transmission delay time adjustable from 0 to 60 seconds. Initial settings shall be 30-45

seconds.

A. Installation Requirements

Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

2.11SPRINKLER AND STANDPIPE VALVE SUPERVISORY SWITCHES

A. Where Used

Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

B. Post Indicator Valve (PIV) Switch

PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves. The switch housing shall be finished in red baked enamel. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

C. Valve Supervisory Switches

Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor. This unit shall provide for each zone: alarm indications using red LED for alarm and yellow LED for trouble and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local electric alarm signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels. 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.

PART THREE: EXECUTION

3.01 INSTALLATION

A. Installation Requirements

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 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.

4. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

5. 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.

6. Smoke detectors shall be provided with dust covers to remain in place during construction to protect smoke detectors from contamination and physical damage. Dust covers shall be removed prior to final acceptance.

7. 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.

8. Manual fire alarm boxes 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.

3.02 TESTING

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system.

A. Testing Requirements

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

3. Verify activation of all waterflow switches.

4. Open initiating device circuits and verify that the trouble signal actuates.

5. Open and short signaling line circuits and verify that the trouble signal actuates.

6. Open and short notification appliance circuits and verify that trouble signal actuates.

7. Ground all circuits and verify response of trouble signals.

8. Check presence and audibility of tone at all alarm notification devices and verify intelligibility and content of voice messages.

9. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

11. When the system is equipped with optional features, the manufacturer's manual 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.

3.03 FINAL INSPECTION AND CERTIFICATION

At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect. Upon completion of testing submit a certification from the major equipment manufacturer indicating that the supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

3.04 INSTRUCTION

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. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.05 GUARANTEE

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.

END OF SECTION 26 31 00

SECTION 26 29 13

MOTOR CONTROLLERS

PART ONE: GENERAL

1.1 GENERAL REQUIREMENTS

A. Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work apply to the work of this section.

B. The work of this section includes locally installed, enclosed combination magnetic motor starters and manual motor starters.

1.2 APPLICABLE CODES AND STANDARDS

A. Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

NEMA ICS-2	Industrial Control Devices, Controllers and Assemblies.
NEMA ICS-6	Enclosures for Industrial Controls and Systems
UL 508	Industrial Control Equipment.

1.3 SUBMITTALS REQUIRED

A. Manufacturer’s product data sheets.

B. Dimensioned Outline Drawings.

C. Control wiring diagrams.

1.4 MANUFACTURERS

A. Subject to compliance with the specification requirements:

- Square D
- Cutler Hammer
- General Electric
- Siemens

PART TWO: PRODUCTS

2.1 MAGNETIC MOTOR STARTERS

A. Full Voltage Type Non-Reversing Type (FVNR)

Unless otherwise noted, magnetic motor starters shall be NEMA rated full voltage non-reversing type. Minimum starter size shall be NEMA 1.

B. Full Voltage Reversing Type (FVR)

Provide FVR starters as required by the Contract Drawings. FVR starters shall be provided with electrical interlock and integral time delay transition between forward and reverse rotation. Starters shall be electrically and mechanically interlocked to prevent both starters being energized simultaneously. Minimum starter size shall be NEMA 1.

C. Two-Speed Starters (2S)

Provide 2S starters as required by the Contract Drawings. 2S starters shall be provided with integral time delay transition between fast and slow speeds. Starters shall be electrically and mechanically interlocked to prevent both starters being energized simultaneously. Minimum starter size shall be NEMA 1.

2.2 ITEMS COMMON TO ALL MOTOR STARTERS

A. Enclosure

All components including the disconnecting means shall be installed in a single enclosure rated NEMA 1 for indoor locations and NEMA 3R for wet, damp and outdoor locations.

B. Disconnecting Means

The disconnecting means shall be circuit breaker type, non-fused or fused as shown on the Contract Drawings and provided with an external operating handle which is interlocked to prevent opening the door when the handle is in the ON position and prevent closing the disconnect when the door is opened. The interlock shall be provided with an external mechanism capable of overriding the interlock. The handle shall be capable of being padlocked in the OFF position.

C. Circuit Breakers

Circuit breakers shall be adjustable magnetic trip, motor circuit protector type.

D. Short Circuit Rating

The short circuit rating of the assembly shall be as shown on the Contract Drawings, but not less than the rating of the upstream breaker.

E. Transformer

Each motor starter shall be provided with a control power transformer to provide 120 VAC control power. The transformer shall be provided with two primary fuses and one secondary fuse. The transformer shall be provided with a minimum of 100VA of spare capacity.

F. Overload Relays

Overload relays shall be three-pole, trip free, manually reset Class 20, bimetallic, ambient compensated type with an external reset mechanism.

G. Contactor Coils

Contactor coils shall be provided with surge suppressors.

H. Auxiliary Contacts

Sufficient auxiliary contacts shall be provided for all interlocks. A minimum of one normally open and one normally closed spare contacts shall be provided.

I. Door-Mounted Pilot Devices

A HAND-OFF-AUTO maintained contact selector switch, red RUN and green READY pilot lights shall be provided on each enclosure. All door mounted pilot devices shall be heavy-duty, oil tight type. Pilot lights shall be transformer type.

J. Control Wiring

All control wiring shall be brought to terminal blocks for connection of field cabling. Minimum wire size shall be #12 AWG.

K. Connections

Connections for motor leads shall be suitable for copper conductors applied at their 75ºC rating.

2.3 MANUAL MOTOR STARTERS

A. Single Phase Fractional HP Manual Motor Starters

Single phase fractional HP manual motor starters shall be toggle operated, enclosed, one or two pole switches as required by the installation.

B. Enclosure

The enclosure shall be NEMA 1 for indoor locations and NEMA 3R for outdoor, wet and damp locations. A handle guard shall be provided to allow the toggle operator to be padlocked in the OFF position.

C. Overloads

Starters shall be provided with trip free melting alloy thermal overloads.

PART THREE: EXECUTION

3.1 GENERAL

A. Installation: Equipment shall be installed in accordance with manufacturer’s instructions.

B. Overload Heater Elements

The Contractor shall verify motor nameplate amperes and motor service factors and shall provide all overload heater elements and fuses. Overload heater elements shall be sized in accordance with motor nameplate characteristics.

C. Auxiliary Contacts

The Contractor shall verify and provide the proper number of auxiliary contacts required by equipment provided by others, for control and interlocking of equipment specified in other Divisions of this Specification. Coordinate these requirements with Division 15 Controls Contractor.

END OF SECTION 26 29 13

SECTION 26 31 00

FIRE ALARM SYSTEM

PART ONE: GENERAL

1.1 GENERAL REQUIREMENTS

A. Definition of Work :

This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

1.2 APPLICABLE CODES AND STANDARDS

A. Compliance:

All work shall be in accordance with the laws, rules, codes, and regulations set forth by Local, State, and Federal authorities having jurisdiction. All products and materials shall be manufactured, installed and tested as specified, but not limited to the latest accepted edition of the following codes, standards and regulations:

NFPA 13	Sprinkler Systems
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
UL 38	Manually Actuated Signaling Boxes
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 346	Water-flow Indicators for Fire Protective Signaling Systems
UL 464	Audible Signaling Appliances
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 864	Control Units for Fire Protective Signaling Systems
UL 1971	Visual Notification Appliances

B. Electrically Supervised System

The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

C. UL Listing

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.

D. Authority Having Jurisdiction

1. The system and its components shall meet all requirements of the Local Authority Having Jurisdiction.

1.3 SUBMITTALS REQUIRED

A. Shop Drawings

Shop Drawings shall include but not be limited to the following:

- Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
- Show annunciator layout, configurations, and terminations.

B. Manuals

Manuals shall be submitted simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.

C. Wiring Diagrams

Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.

D. Sequence of Operation

Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

E. Battery Calculation

Provide a complete battery calculation showing that the battery system provided meets the operational requirements as defined by NFPA.

1.4 MANUFACTURERS

A. Subject to compliance with the requirements of this specification, provide alternate products by one of the following:

- SimplexGrinnell
- Notifier
- Gamewell
- Approved Equal

PART TWO: PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. General

A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic System Performance

Basic System performance shall meet the following:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).

2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

4. On Style 6 or 7 (Class A) configurations 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.

5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

C. Basic System Functional Operation

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 system display shall flash.

2. A local piezo-electric signal in the control panel shall sound.

3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.

5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

2.2 SYSTEM CONDUITS, WIRING AND GROUNDING

A. Conduits

Conduits shall be in accordance with other sections of this specification and The National Electrical Code (NEC), local and state requirements.

B. Wiring

Wiring shall be UL listed and in accordance with local, state and national codes 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 for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG for Notification Appliance Circuits. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

C. Terminal Boxes, Junction Boxes and Cabinets

All boxes and cabinets shall be UL listed for their use and purpose.

D. Arrangement of Circuit Wiring

Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. Grounding of Fire Alarm Control Panel

The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 FIRE ALARM CONTROL PANEL (FACP)

Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. 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, and other system controlled devices. This system shall also include a voice evacuation system integral to or as an adjunct (slave) to the control panel.

A. Operator Controls

1. Acknowledge Switch: Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel audible 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 LCD display to the next alarm or trouble condition. Depression of the Acknowledge switch shall also silence all remote annunciator audible signals.

2. Alarm Silence Switch: 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 silenced by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch: The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch: 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.

5. Lamp Test: The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

B. FACP System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to a minimum of 100 intelligent/addressable devices.

2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance

Circuits.

3. The control panel or each network node shall support up to 8 additional output modules (signal, speaker, telephone, or relay), each with 8 circuits for an additional 64 circuits. These circuits shall be either Class A (NFPA Style Z) or Class B (NFPA Style Y) per the project drawings.

4. The system shall include a full featured 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 with easy touch rubber keys for the field programming and control of the fire alarm system.

5. The system shall be 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.

6. The system shall allow the programming of any input to activate any output or group of outputs.

7. The system shall be provided with Drift Compensation to extend detector accuracy and filter out transient noise signals.

8. The system shall be provided with Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

9. The system shall be able to display or print system reports.

10. The system shall be provided with periodic detector test, conducted automatically by the software.

11. The system shall be provided with self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.

12. The system shall be provided with cross-zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.

13. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.

15. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

16. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.

17. Point Read: The system shall be able to display or print the following point status diagnostic functions:

    - Device status
    - Device type
    - Custom device label
    - View analog detector values
    - Device zone assignments
    - All program parameters

18. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. 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.

19. 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, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

20. 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.

21. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.

22. Waterflow Detection: An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display; turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.

23. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

24. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

25. Non-Alarm Input Operation: 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.

26. Combo Zone: A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

C. Central Microprocessor

The microprocessor will communicate with, monitor and control all external interfaces. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall not be lost even if system primary and secondary power failure occurs. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

D. System Display

The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.

E. Signaling Line Circuits (SLC)

Each SLC interface shall provide power to and communicate with the intelligent detectors (ionization, photoelectric or thermal) and modules (monitor or control). Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring. The CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

F. Serial Interfaces

The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

G. Notification Appliance Circuit (NAC)

1. The Notification Appliance Circuit module shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.

2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per module.

3. The module shall not affect other module circuits in any way during a short circuit condition.

4. The module shall provide eight green ON/OFF LEDs and eight yellow trouble LEDs.

5. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.

6. Each notification circuit shall include a custom label inserted to identify each circuit's location. Labels shall be created using a standard typewriter or word processor.

7. The notification circuit module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 12 AWG wire.

8. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.

9. Electrical Contractor shall be responsible for furnishing a system smoke detector at the location of any field located NAC modules not shown on the drawings in compliance with NFPA.

H. Control Relay Module

1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 5 amperes, 28 VDC. An expansion circuit board shall allow expansion to eight Form-C relays per module.

2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.

3. The relay module shall provide 8 green ON/OFF LEDs and 8 yellow LEDs to indicate disabled status of the relay.

4. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.

5. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or word processor.

6. The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 12 AWG wire.

I. Enclosure

The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall be provided with a key lock and shall include a glass or other transparent opening for viewing of all indicators.

J. Power Supply

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.

2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

3. 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 for use with batteries up to 60 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.

4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
   - Ground Fault LED
   - AC Power Fail LED
   - NAC on LED (4)

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 60 AH.

7. All circuits shall be power-limited, per UL864 requirements.

8. The batteries are to be completely maintenance free and shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

K. Surge Protection

All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

L. RF Subscriber Unit

Furnish an RF Subscriber Unit as required by the Town of Hartford Fire Department. This unit shall be as manufactured by AES Corporation, Intellinet Model 7788 (or current model required by local Fire Department). Coordinate the purchase, installation, and programming with the Town of Hartford Fire Department.

2.4 VISUAL STROBE NOTIFICATION DEVICES

Notification strobes shall be 24V xenon type, meet the requirements of the ADA, UL Standard 1971, and be fully synchronized. Minimum intensity is 15/75cd unless otherwise shown on the Drawings.

2.5 COMBINATION HORN/STROBE NOTIFICATION DEVICES

Electronic horns shall be 24V, field programmable without the use of special tools, at a sound level of at least 90dBA measured at 10 feet from the device. Strobes shall meet the requirements for Visual Strobe Notification Devices.

2.6 MANUAL PULL STATIONS

Manual fire alarm stations shall be analog addressable type, non-breakglass type, equipped with key

lock so that they may be tested without operating the handle. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset. An operated station shall be visually detected as operated at a minimum distance of 100 feet front or side. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters ½-inch in size or larger.

2.7 PHOTOELECTRIC AREA SMOKE DETECTORS

Photoelectric smoke detectors shall be a 24 VDC, two wire, analog addressable type, ceiling-mounted, light scattering type using an LED light source. Each detector shall contain a remote LED output and a built-in test switch. Detector shall be provided on a twist-lock base. 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. 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 flash at least every 10 seconds, indicating that power is applied to the detector. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet (914.4 m) per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber. All field wire connections shall be made to the base through the use of a clamping plate and screw.

2.8 DUCT SMOKE DETECTORS

Duct smoke detectors shall be a 24 VDC, analog addressable type with integral communications and device identification, and provided with a remote test indicator. Each detector shall be furnished and wired by the electrical contractor and installed by the mechanical contractor in the supply/return air ducts as shown on the Drawings. Duct smoke detectors shall be provided with properly sized air sampling tubes.

A. Operation of Duct Smoke Detectors

Duct smoke detectors shall be provided with 120V rated, form C contacts that open/close upon sensing of smoke or detector failure. Contacts will be used to shut down the associated air handler when detectors are installed in the supply ducts of the air handler.

2.9 HEAT DETECTORS

Automatic heat detectors shall be analog addressable type, and be of combination rate of rise and fixed temperature construction, rated at 135 degrees Fahrenheit for areas where ambient temperatures do not exceed 100 degrees, and 200 degrees for other areas. Heat detectors shall be low profile, ceiling mount type with positive indication of activation, and have smooth ceiling rating of 2500 square feet.

A. Rate of Rise Element

The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.

B. Fixed Temperature Element

The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.

2.10 WATERFLOW INDICATORS

Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type, with alarm transmission delay time adjustable from 0 to 60 seconds. Initial settings shall be 30-45

seconds.

A. Installation Requirements

Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

2.11SPRINKLER AND STANDPIPE VALVE SUPERVISORY SWITCHES

A. Where Used

Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

B. Post Indicator Valve (PIV) Switch

PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves. The switch housing shall be finished in red baked enamel. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

C. Valve Supervisory Switches

Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor. This unit shall provide for each zone: alarm indications using red LED for alarm and yellow LED for trouble and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local electric alarm signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels. 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.

PART THREE: EXECUTION

3.01 INSTALLATION

A. Installation Requirements

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 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.

4. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

5. 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.

6. Smoke detectors shall be provided with dust covers to remain in place during construction to protect smoke detectors from contamination and physical damage. Dust covers shall be removed prior to final acceptance.

7. 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.

8. Manual fire alarm boxes 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.

3.02 TESTING

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system.

A. Testing Requirements

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

3. Verify activation of all waterflow switches.

4. Open initiating device circuits and verify that the trouble signal actuates.

5. Open and short signaling line circuits and verify that the trouble signal actuates.

6. Open and short notification appliance circuits and verify that trouble signal actuates.

7. Ground all circuits and verify response of trouble signals.

8. Check presence and audibility of tone at all alarm notification devices and verify intelligibility and content of voice messages.

9. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

11. When the system is equipped with optional features, the manufacturer's manual 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.

3.03 FINAL INSPECTION AND CERTIFICATION

At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect. Upon completion of testing submit a certification from the major equipment manufacturer indicating that the supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

3.04 INSTRUCTION

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. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.05 GUARANTEE

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.

END OF SECTION 26 31 00

SECTION 26 31 15

LIGHTING FIXTURES

PART ONE: GENERAL

1.1 GENERAL REQUIREMENTS

A. Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work, and section 26 05 33, Raceway and Fittings, apply to the work of this section.

1.2 APPLICABLE CODES AND STANDARDS

A. Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

CBM Labels	Certified Ballast Manufacturers Assoc.
NEC Art. 410	National Electrical Code
FCC, Part 18	RFI and EMI
ANSI C62.41	Line Transient Protection
UL 1570	Fluorescent Lighting Fixtures
UL 1572	HID Lighting Fixtures
UL 1571	Incandescent Lighting Fixtures
UL 924	Emergency Lighting and Power Equipment
UL 1088	Temporary Lighting

1.3 SUBMITTALS REQUIRED

A. Data Sheets, Photometrics and Installation Instructions

Submit manufacturer's product data, photometrics, and installation instructions for each type of light fixture specified. Fixture submittals will be in booklet form with separate sheet for each fixture assembled in "luminaire type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet.

B. Lamp Requirements

Submit on a separate sheet for each light fixture specified, the proposed lamp and manufacturer’s data for that lamp.

1.4 MANUFACTURERS

A. General

The fixture types, manufacturers and model number s are shown on the lighting schedule in the Contract Drawings. These fixtures and manufacturers are listed to establish a baseline type, style and quality of fixture to be provided. Although one manufacturer may be listed on this lighting schedule, other manufacturers’ representatives may submit fixtures for consideration as “equal” fixtures to facilitate the “packaging” of the lighting fixtures within the representative’s product

lines. The architect and engineer however reserve the right to require certain individual fixtures be provided of the model and manufacturer specified in order to meet specific design intent by the architect or engineer.

B. Exterior Fixtures

The Architect and Engineer reserve the right to require that the specified model and manufacturer of some or all of the exterior lighting fixtures be furnished by this contractor, due to approvals of local authorities required prior to Issue of Project Documents. No additional compensation will be furnished to the contractor for "assumptions" that alternate fixtures could be substituted for those specified.

PART TWO: PRODUCTS

2.1 GENERAL

A. Light Fixtures

Light fixtures shall be provided with housings, trims, ballasts, lamp holders, sockets, reflectors, wiring and other components required, as a factory-assembled unit for a complete installation.

B. Electrical Wiring

Provide electrical wiring within light fixtures suitable for connecting to branch circuit wiring in accordance with N.E.C. Article 410, Paragraph 25.

C. Packaging

Deliver interior lighting fixtures shall be delivered in factory fabricated containers and wrapping, in order to properly protect fixtures from damage.

D. Storage

Interior lighting fixtures shall be stored in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, humidity, extreme temperatures, laid flat and on skids to keep off floors and ground.

E. Ceiling Fixtures

Fixtures installed in ceilings, suspended from ceilings or on walls shall be installed with a plastic film covering protecting the lens, louver and lamps from dust, dirt and debris during construction. Plastic film shall be removed upon the completion of construction.

2.2 FLOURESCENT FIXTURES

A. General

Provide fluorescent fixtures of sizes, types and ratings indicated and specified in the Lighting Fixture Schedule on the Contract Drawings. All lamp/ballast combinations shall be listed by the CEE as energy efficient and accepted by Efficiency Maine for rebate purposes. Fixture efficiencies shall also meet those specified for Efficiency Maine rebates.

B. Fluorescent-Lamp Ballasts

Provide low-energy solid state fluorescent lamp ballasts, capable of operating lamp types indicated, with a minimum power factor of 0.90 and Class A sound rating. Ballasts shall have lamp current crest factor of 1.7 or less and total harmonic distortion less than 20%. Ballast factor shall be 0.88-1.0. Ballast shall be program start for maximum efficiency and parallel wired such that if one lamp fails the remaining lamps stay lit.

1. Manufacturers

Subject to compliance with the requirements, provide ballasts by one of the following:

- Osram Sylvania
- General Electric
- Phillips

C. Compact Fluorescent Ballasts

Provide solid-state electronic ballasts capable of operating lamp types specified. Ballasts shall have a total harmonic distortion not to exceed 20%. Ballasts shall have an end of lamp life sensing circuit capable of shutting the lamp down to prevent lamp glass from cracking and preventing lamp base and sockets from melting. Ballasts shall have a ballast factor of 0.90-1.00.

1. Manufacturers

Subject to compliance with requirements provide dimming ballasts by one of the following:

- Osram Sylvania
- General Electric
- Advance

2.3 LED FIXTURES

A. LED Fixture Requirements

Provide LED lighting fixtures of the wattages, initial lumen outputs and color temperatures specified in the fixture schedule. LED fixtures shall be furnished with 0-10V dimmable driver. Fixtures shall be DLC listed and/or approvable by Efficiency Maine for a rebate.

2.4 OCCUPANCY SENSORS

A. General

Occupancy sensors of the type and model specified on the drawings shall be provided, installed and wired into the local lighting circuit in the area that the sensors are installed. The engineer will consider equipment of another equal manufacturer, where suitable coverage can be documented.

B. Passive Infrared Wall-Mount Fixtures

Wall mounted occupancy sensors shall be suitable for dual circuit operation as specified on the contract drawings.

C. Ultrasonic/Infrared Ceiling-Mounted Sensors

Ceiling mounted occupancy sensors shall be self-calibrating type as specified on the contract drawings.

D. Power Packs

Power packs shall be provided as required for each room provided with occupancy sensors as needed.

E. Slave Relay Packs

Slave relay packs shall be provided in rooms with more than one lighting circuit controlled by the occupancy sensor.

F. Installation Requirements

Provide all miscellaneous equipment and wiring for a complete installation.

2.5 LIGHTING CONTROLS

A. General

Operation of exterior lighting is to be provided with a combination of photocell (ON), time clock (ON or OFF), and automatic control override switch (ON) through a UL listed lighting contactor. These controls shall be provided with all components required for a fully-operable system.

B. Lighting Contactors

Lighting contactors shall be provided in a NEMA 1 enclosure sufficiently sized to also house the time clock. Lighting contactors shall be listed for operation with the voltages shown on the Contract Drawings. Lighting contactors shall be multi-pole type sized sufficiently for the number of circuits shown on the contract drawings and a minimum of one spare circuit. Contactors shall be mechanically held with Normally Open (N.O.) contacts which are convertible to Normally Closed (N.C.) type.

C. Photocells

Photocells shall be provided as for the operation of the site lighting drawings. Mounting location and height shall be as shown on the Drawings and further coordinated with the architect and engineer prior to installation for exact location of box. Photocell shall be provided with NEMA 4 enclosure to be mounted on standard 2”x4” exterior junction box.

D. Time Clocks

Time clocks shall be 24-hour type with mechanical rotary dial operator.

PART THREE: EXECUTION

3.1 GENERAL

A. Prior Examination

Examine all areas and conditions under which lighting fixtures are to be installed and structure which will support lighting fixtures. Notify the Contractor in writing of any conditions detrimental to proper installation and completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Coordinate Installation

Coordinate light fixture installations with other trades. Fluorescent light fixtures should be installed at least two feet away from smoke detectors. Coordinate all lighting fixtures with mechanical piping and ductwork to allow for proper clearance.

3.2 INSTALLATION

A. Locations and Heights

Install all lighting fixtures at locations and heights indicated, in accordance with the architectural reflected ceiling plans.

B. Recessed Lighting Fixtures

All recessed lighting fixtures installed in ceiling which require a fire resistance rating shall be installed in accordance with the 1996 BOCA National Building Code Section 713.

C. Fastening and Supporting Fixtures

Provide fixtures and/or fixture outlet boxes with hangers, channel or other method of fastening and supporting fixtures required for proper installation.

D. Pendant Mounted Fixtures

All pendant mounted fixtures shall be installed plumb and level or as detailed on the Contract Drawings. Pendant mounted fixtures longer than 18" shall have twin hangers of type specified.

E. Tightening Values

Tighten connectors and terminals, including screws and bolts in accordance with equipment manufacturer's published torque tightening values for equipment connectors. All screws and bolts shall have washers.

3.3 SPLICES AND TERMINATIONS

A. General

Twist on wire connectors shall be installed which utilize square-wire spring grips and thermo plastic shells. Install connectors to meet the manufacturer's torquing requirements. Install wire connectors of size required as not to exceed the manufacturers UL-listed CSA recognized wire combinations

3.4 FIELD QUALITY CONTROL

A. Replacement of Lamps

At date of substantial completion, all lamps that are not functioning, have color deficiencies, or are noticeably dimmed shall be replaced with new lamps as determined by the Engineer.

B. Temporary Lighting Replacement

All lamps used for temporary lighting in new light fixtures shall be replaced with new lamps.

C. Cleaning Light Fixtures

All light fixtures shall be cleaned of dirt and debris upon completion of construction. All finger prints and smudges shall be cleaned.

D. Protection During Construction

All installed fixtures during remainder of construction shall be protected in accordance with section 2.1.5 of this specification section.

E. Grounded

All light fixtures shall be grounded in accordance with article 250 and 410 of the NEC. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

F. Damaged Light Fixtures

All light fixtures damaged in shipping or during installation shall be replaced with new fixtures at no cost to the owner.

END OF SECTION 26 31 15

SECTION 27 05 14

TELEPHONE/DATA SYSTEM

PART 1 – GENERAL

1.01 General Requirements

A. Provisions

The provisions of Section 16000, General Requirements for Electrical Work apply to the work of this section.

B. Project Conditions

Telephone and Data locations shall be fed from the mechanical room. The electrical contractor shall furnish and install all conduits, plywood back panels and work boxes complete in place for installation of wiring, devices, cover plates and equipment by the Owner's Telecommunications/Data Contractor. Any discrepancies shall be coordinated with the owner.

1.02 Applicable Qualifications

A. Telephone Service Provider

The local telephone Utility is Fairpoint Communications. All work and materials shall comply with all rules, regulations and requirements of Fairpoint Communications.

1.03 Submittals Required

A. Data Sheets

Manufacturer's product data sheets.

PART 2 - PRODUCTS

2.01 Backboards

A. General

Telephone backboard shall be a 4' x 8' sheet of ¾" Grade AC Plywood securely mounted to the wall in the location shown on the Project Plans. Backboard shall be painted flat black with fire retardant paint.

2.02 Terminal Blocks

A. Wiring Block

Wiring block shall be furnished by the Owner, installed by the electrical contractor.

B. Connecting Block

Connecting block shall be furnished by the Owner and installed by the electrical contractor.

2.03 Conduits

A. Conduits shall be as specified in section 26 05 00 GENERAL ELECTRICAL.

PART 3 - EXECUTION

3.01 General

A. Installation

All telephone and data locations shown shall be furnished with EMT (minimum ¾") conduits in walls and inaccessible locations into accessible ceiling spaces. Pull strings shall be installed all conduits.

B. Identification

All pull strings shall be properly labeled at the location that the conduit enters the accessible ceiling space to designate from where they originate.

END OF SECTION 26 05 14