SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Related Work Specified Elsewhere:
   1. Division 1 – General Requirements is made a part of this section.
   2. Section 02920 – Lawns and Grasses is made a part of this section.
   3. Division 5 – Metals is made a part of this section.

1.2 SECTION REQUIREMENTS

A. For all soils removed from the site, soil classification testing must be performed by an independent testing facility.

B. Unit prices for rock excavation shall be provided by the contractor.

C. Unauthorized excavation consists of excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

D. Do not interrupt existing utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil: ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2 inches (50 mm) in any dimension, debris, waste, frozen materials, vegetation, or other deleterious matter.


C. Backfill and Fill: Satisfactory soil materials.

D. Subbase Material: Unless otherwise noted on the contract drawings, naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Bedding Course: Unless otherwise noted on the contract drawings, naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand;
Wesleyan University Construction Services

ASTM D2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Drainage Course: Unless otherwise noted on the contract drawings, narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Protect and maintain erosion and sedimentation controls during earthwork operations.

B. Protect subgrades and foundation soils from softening and damage by water, freezing temperatures, or frost.

C. Explosives: Do not use explosives.

D. Excavate to subgrade elevations regardless of character of materials and obstructions encountered.

E. Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Owner. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents.

F. Excavate for pavements, and walkways. Trim subgrades to required lines and grades.

G. Utility Trenches: Excavate trenches to indicated slopes, lines, depths, and invert elevations. Maintain 12 inches (300 mm) of working clearance on each side of pipe or conduit.

1. Place, compact, and shape bedding course to provide continuous support for pipes and conduits over rock and other unyielding bearing surfaces and to fill unauthorized excavations.

2. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit. Place and compact final backfill of satisfactory soil material to final subgrade.

H. Plow strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal to receive fill.

I. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface, pulverize, moisture-condition or aerate soil, and recompact.

J. Place backfill and fill in layers not more than 8 inches (200 mm) in loose depth at optimum moisture content. Compact each layer under structures, building slabs, pavements, and walkways to 95 percent of maximum dry unit weight according to ASTM D 698; elsewhere to 90 percent.
K. Grade areas to a smooth surface to cross sections, lines, and elevations indicated. Grade lawns, walkways, and unpaved subgrades to tolerances of plus or minus 1 inch (25 mm) and pavements and areas within building lines to plus or minus 1/2 inch (13 mm).

L. Under pavements and walkways, place subbase course material on prepared subgrades and compact at optimum moisture content to required grades, lines, cross sections, and thicknesses.

M. Under slabs-on-grade, place drainage course on prepared subgrade and compact to required cross section and thickness.

N. Allow testing agency to inspect and test each subgrade and each fill or backfill layer and verify compliance with requirements.

O. Consult with Owner prior to removing any surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris. Legally dispose of it off Owner's property. Disposal procedures shall be in accordance with Wesleyan University Environmental Health and Safety requirements.

END OF SECTION 02300
SECTION 02510 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 – General Requirements is made a part of this section.

B. Summary: This Section includes water system piping for potable-water service and fire-protection service, outside the building.

1. This Section does not include tapping of utility company water main by utility company and charging directly to Owner.


D. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with City of Middletown Water Department (860 343 8085) requirements for products provided in this section. If discrepancies between specifications and local authority exists comply with requirements of local authority.

2.2 PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Glands, Gaskets, and Bolts for Mechanical Joints: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.


B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.


3. Solder Filler Metal: ASTM B 32, lead-free type with 0.20 percent maximum lead content.
2.3 VALVES

A. Nonrising-Stem, Resilient-Seated Gate Valves, NPS 3 (DN 80) and Larger: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Include 200-psig (1380-kPa) minimum working-pressure design, interior coating according to AWWA C550, and mechanical-joint ends.

B. Nonrising-Stem Gate Valves: UL 262, FMG-approved iron body and bonnet with flange for indicator post, bronze seating material, and inside screw; 175-psig (1200-kPa) working pressure, and flanged end connections.

C. Valve Boxes: Cast-iron box with top section and cover with lettering "WATER"; bottom section with base of size to fit over valve and barrel approximately 5 inches (125 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.

D. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve.

E. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.4 SPECIALTIES

A. Fire Hydrants: UL 246, FMG-approved, cast-iron body, compression-type valve opening against pressure and closing with pressure; 150-psig (1035-kPa) minimum working-pressure design, with NPS 6 (DN 150) mechanical-joint inlet and with external hose thread used by local fire department. Include cast-iron caps with steel chains.

B. Backflow Prevention Devices: ASSE standard backflow preventers, bronze body, 150-psig (1035-kPa) working pressure, of size indicated for maximum flow rate and maximum pressure loss indicated.

C. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches (150 mm) wide by 4 mils (0.1 mm) thick, solid blue in color with metallic core and continuously printed black-letter caption "CAUTION--WATER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Connect water system piping and water-supply source and building water-distribution and fire-protection systems at the building wall in optimal locations and in accordance with pipe sizes required.

B. Install restrained joints for buried piping within 60 inches (1500 mm) of building. Use restrained-joint pipe and fittings, thrust blocks, anchors, tie rods and clamps, and other supports at vertical and horizontal offsets.
C. Install fittings for changes in direction and branch connections.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

F. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

G. Bury piping with depth of cover over top of pipe to finish grade of at least 42 inches to provide maximum frost / freezing protection.

H. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, 12” over piping.

I. Clean and disinfect water distribution piping according to authorities having jurisdiction.

END OF SECTION 02510
SECTION 02920 - LAWNS AND GRASSES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 – General Requirements is made a part of this section.

B. Submittals: Product certificates and planting schedule.

C. Sod: Comply with TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

D. Maintenance: Water, fertilize, weed, mow, trim, and establish lawns. Replant non-uniform, bare, or eroded grassed areas and remulch. Maintain for not less than 30 days.

E. CONN-DOT 816: Standard Specifications for Roads, Bridges and Incidental Construction

PART 2 - PRODUCTS

2.1 GRASSES

A. Seed Species: State-certified seed of grass species, as follows:

1. Seed Mixture:
   a. Sun and shade mix
      
      | PERC   | Fine Textured Grasses          | Germ |
      |--------|-------------------------------|------|
      | 39.5%  | Accent Perennial Rye          | 90%  |
      | 39.43% | Aberdeen Creeping Red Fescue  | 88%  |
      | 19.57% | Brooklawn Kentucky Bluegrass  | 85%  |

   b. Submit seed mixture to Owner for approval.

2. Per Owner’s direction, the use of drought resistant, hard, red and chewing fescues. varieties in appropriate new locations identified on campus shall be planted.

B. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding."

   1. Species: Submit species to Owner for approval.

2.2 SOILS AND AMENDMENTS

A. Topsoil: ASTM D5268, free of stones 1 inch or larger.
B. Lime: ASTM C602, Class T, agricultural limestone.

C. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

E. Commercial Fertilizer: Organic grade fertilizer formula including corn gluten and soybean.

F. Grub, Crabgrass, Broadleaf Weeds and Insect Control: Contact Dave Hall @ 860-685-3764 for product requirements.

G. Straw Mulch: Clean, mildew- and seed-free salt hay or threshed straw.

PART 3 - EXECUTION

3.1 PREPARATION

A. Loosen subgrade, remove stones, sticks, existing grass, vegetation, and other extraneous materials.

   1. At newly graded subgrades, spread planting soil mixture to a depth of 4 inches but not less than required to meet finish grades.
   2. At unchanged grades, apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.

B. Grade lawn areas to a smooth, even surface with loose, uniformly fine texture. Moisten before planting.

3.2 PLANTING

A. Seeding Lawns: Evenly distribute seed by sowing with a spreader or a seeding machine. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray. Protect seeded areas by spreading straw mulch 1-1/2 inches in loose depth. During the first 3 weeks, water 3 times daily.

   1. Seeding Rate: 3 to 4 lb/1000 sq. ft.

B. Sodding Lawns: Lay sod with tightly fitted joints, offsetting joints in adjacent courses. Tamp and roll lightly to form a smooth surface. Fill minor cracks between pieces of sod with soil or sand. Anchor sod on slopes exceeding 1:6 with wood pegs. Saturate sod with fine water spray within two hours of planting. During first week, water daily.

C. Disposal: Remove surplus soil and waste material and legally dispose of off Owner's property. Adhere to Urban fill policies related to potential soil contaminants.

D. END OF SECTION 02920
SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

SECTION REQUIREMENTS

A. Division 1 – General Requirements is made a part of this section.

B. Submittals: Product Data and concrete mix designs.

C. Ready-Mixed Concrete Producer Qualifications: ASTM C 94/C 94M.


TESTING

A. Sampling and testing for quality assurance during placement of concrete includes the following:
   1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
   2. Slump: ASTM C 143; one test for each concrete load at point of discharge from truck, and one test for each set of compressive strength test specimens.
   3. Air Content: ASTM C 231 pressure for normal weight concrete, ASTM C173 volumetric method for light weight concrete; one for each set of compressive strength test specimens.
   4. Concrete Temperature: Test hourly when air temperature is 40 degrees F. (4 degrees C.) and below, and when 80 degrees F (27 degrees C), and above; and each time a set of compressive test specimens are made.
   5. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cure test specimens are required.
   6. Compressive Strength Tests: ASTM C 39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 5,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
      a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
      b. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
   7. Test results will be reported to Engineer and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, name of concrete supplier, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, air content, slump, concrete temperature, compressive breaking strength and type of break for both 7-day tests and 28 day tests.
8. Additional Tests: The testing service will make additional tests of in place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when concrete placed does not conform to the specified limits of the Contract Documents or when unacceptable concrete is verified.

B. Mock-ups: Provide samples of smooth formed, rubbed and light broom finishes to demonstrate typical joints, surface finish, color, texture, tolerances and standard of workmanship.

C. Additional Tests: The testing service will make additional tests of in place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure as directed by the Engineer. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when concrete placed does not conform to the specified limits of the Contract Documents or when unacceptable concrete is verified.

SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, moisture barrier and others as requested by the Owner.

B. Shop Drawings; Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI Detailing Manual - 1988, Publication SP-66, showing bar schedules, stirrup spacing, diagrams of bent bars, placing plans and wall elevations showing arrangement of concrete reinforcement. Reproduction of the Owner’s Contract Drawings are not acceptable for use as shop drawings.

C. Certificates of Compliance: Provide the Special Inspector with Certificates of Compliance for welded wire fabric, cement, air-entraining agent, water-reducing agent, and vapor barrier.

D. In addition provide mill test reports for reinforcement bars used for this project.

E. Batch Tickets: The General Contractor shall furnish to the Special Inspector tester with each batch of concrete and before unloading at the site, a delivery ticket on which is printed, stamped, and or written, information concerning said concrete as follows

- Name of ready-mix batch plant,
- Serial number of ticket,
- Date,
- Truck number,
- Name of purchaser,
- Specific designation of job (name and location),
- Specific class or designation of concrete in conformance with that required by job specifications,
- Amount of concrete in cubic yards,
- Time loaded or of first mixing of cement and aggregates,
- Quantity of water added by receiver of concrete and his initials,
- Type and brand, and amount of cement,
- Type and brand, and amount of admixtures,
- Total water content by producer (or W/C ratio),
- Maximum size of aggregate,
- Weights of fine and coarse aggregate,
- Signature or initials of ready-mix representative.

F. Test Reports: Submit for review laboratory test reports for concrete materials and mix design test as specified.

PART 2 - PRODUCTS

ACCEPTABLE SUPPLIERS:

A. SUZIO
B. TILCON
C. Approved equal

MATERIALS

FORM MATERIALS

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-place concrete without bow or deflection.
   1. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
   2. Provide Class A tolerances for concrete exposed to view.

B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
   1. Unitex Farm Fresh Vegetable Oil Form Release

C. Reinforcing Bars: ASTM A615 Grade 60, deformed.

D. Plain Steel Wire: ASTM A82, plane, cold-drawn steel.

E. Plain-Steel Welded Wire Reinforcement: ASTM A185, fabricated from as-drawn steel wire into flat sheets. Size and weight as noted on the drawings.

F. Joint Dowel Systems at patio entries:
1. Expansion Joints: Diamond Dowel System: ¼” thick stainless steel plate, 4.5” x 4.5” square at 24 inches on center with Diamond Dowel pocket former as manufactured by PNA Construction Technologies.

2. Control Joints: Square Dowel Basket Assemblies: ¾” x 14” stainless steel square dowel at 14” on center. Side frame supports fabricated from ¼” diameter cold drawn wire per ASTM A108 grade 1010-1020. Square dowel clips extend at least 2” past center of the dowel. PNA clip with foam on each side of dowel extending to within +/- 3/16” of 2/3 length of the dowel to allow for horizontal movement. System as manufactured by PNA Construction Technologies.

G. Joint Dowel System at street line sidewalk:

1. #5 epoxy painted rebar dowels shall be cast-in place 12” O.C. with an 18” leg sheath. Expansion joint filler and joint sealant shall be as specified. Concrete joints between expansion joints shall be tooled.

**CONCRETE MATERIALS**

A. Portland Cement: ASTM C150, Type I unless otherwise acceptable to the Owner. Use one brand of cement throughout project, unless acceptable to Engineer/Owner. Select cement color acceptable to the Owner.

B. Pozzolonic materials which will darken the concrete surface, such as fly-ash and microsilica, are not permitted.


**FIBER REINFORCEMENT**

A. Synthetic Fiber: ASTM C1116, Type III, polypropylene fibers, 1/2 to 1-1/2 inches long.

B. Water: Potable.

C. Water-Reducing Admixture: ASTM C494, Type A and not containing more chloride ions than are present in municipal drinking water.


E. Waterproofing Membrane: Bituthene 3000 self-adhesive rubberized asphalt/polyethylene waterproofing membrane adjacent to the building structure by Grace Construction Products www.graceconstruction.com or approved equal. Contractor shall apply WP 3000 or Primer B2 prior to installing the waterproofing membrane.

F. WaterStop: Continuous bentonite waterstop along the abutting building structures – provide 3” of coverage.

1. Waterstop shall be Volclay RX-101RH and adhered to the building structure with Volclay WB adhesive.

2. Waterstop shall be installed below the expansion joint filler.
G. Vapor Retarder: Clear 12-mil thick polyethylene sheet or reinforced polyethylene sheet, ASTM E 1745, Class C.

H. Expansion joint filler shall be Sealight® Fibre Expansion Joint by W.R. Meadows, Inc., www.wrmeadows.com – 1-800-342-5976 or approved equal. Thickness shall be ½”. Expansion joint filler shall also be placed against abutting building structures, columns, curbs and at all interrupting objects. Expansion joints shall be set ½” below the concrete surface and filled with the appropriate specified joint sealant.

I. Contractor shall install joint sealant over all expansion joint filler installed. Joint sealant shall be DynaTred® non-sag, traffic-grade polyurethane sealant by Pecora Corporation www.pecora.com – 1-800-523-6688 or approved equal. Submit manufacturer’s standard color options to Owner for review and selection.

CONCRETE REPAIR MATERIALS

A. Bonding Agent / Primer: Ardex Bonding & Anti Corrosion Agent, Silpro C-21 All Acrylic Bonding Agent / Primer or approved equal.

B. Concrete Patch Material: Ardex CP Concrete Patch, Silpro Easy Patch or approved equal.

C. Concrete Resurfacing Material: Ardex CD Concrete, Silpro Fasterete or approved equal.

CURING AND SEALING COMPOUND

A. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

B. Concrete Color Admixture: Submit color samples for Owner approval.

C. Sidewalks

1. Concrete for sidewalks and aprons shall conform to the requirements of Section 9.21 and M.03 of the State of Connecticut Department of Transportation “Standard Specifications for Roads, Bridges and Incidental Construction”, Form 814A, including current supplemental. Higher compressive strengths may be required by the Owner.

2. The gravel or reclaimed miscellaneous aggregate base shall be placed in layers not less than 8 inches in depth and to such a depth that after compaction it shall be at the specified depth below the finished grade of the walk. The base shall be wetted and rolled or tamped after the spreading of each layer.

3. The sidewalk expansion joints at the street line (EJ@SL) shall be at a maximum of 20’-0”. #5 epoxy painted rebar dowels shall be cast-in place 12” O.C. with an 18” leg sheath. Expansion joint filler and joint sealant shall be as specified. Concrete joints between expansion joints shall be tooled.

4. Expansion joint filler shall be Sealight® Fibre Expansion Joint by W.R. Meadows, Inc., www.wrmeadows.com – 1-800-342-5976 or approved equal. Thickness shall be ½”.
Expansion joint filler shall also be placed against abutting building structures, columns, curbs and at all interrupting objects. Expansion joints shall be set ½” below the concrete surface and filled with the appropriate specified joint sealant.

5. Contractor shall install joint sealant over all expansion joint filler installed. Joint sealant shall be DynaTred® non-sag, traffic-grade polyurethane sealant by Pecora Corporation [www.pecora.com](http://www.pecora.com) – 1-800-523-6688 or approved equal. Submit manufacturer’s standard color options to Owner for review and selection.

6. Expansion joint filler shall be installed against the existing concrete curb and sealed with the specified joint sealant.

**PROPORTIONING AND DESIGN OF MIXES**

Prepare design mixes for each type and strength of concrete in accordance with ACI 318 Section 5.3 "Proportioning on the Basis of Previous Field Experience or Trial Mixtures", as indicated on drawings.

Use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix design. The testing facility shall not be the same as used for field quality assurance testing unless otherwise acceptable to Engineer.

Submit written reports to Engineer for each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved by Engineer.

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job condition, weather test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.

Water Cement Ratio: All concrete to have a water to cementitious materials ratio of not more than 0.45.

Strength: All concrete to have a twenty-eight day compressive strength (f’c) of not less than 4000 psi unless otherwise noted.

Slump Limits: The concrete shall be proportioned and produced to have a slump of 2 inches to 4 inches. Concrete of lower slump may be used provided it is properly placed and consolidated.

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer/Owner before using in Work.

Air Content: Maintain within range permitted by ACI 301. Do not allow air content of floor slabs to receive troweled finishes to exceed 3 percent.

**CONCRETE MIXING**

Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to the batch will not be permitted.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

When outdoor air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes. Select strength from options in subparagraph below or revise to suit Project.

7. PART 3 – EXECUTION

3.1 FORMS

Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structures.

Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. The Contractor is solely responsible for the safe design and installation of formwork and supports.

Design Formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Construct forms complying with ACI 347, "Recommended Practice for Concrete Formwork", to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures.

Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes.

Solidly butt joints and provide back-up at joints to prevent leakage of cement paste. Provide Class A tolerances for concrete exposed to view.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

Chamfer exposed corners and edges unless otherwise specified, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least 1-1/2" inside concrete.
Unless otherwise shown, provide form ties which will not leave holes larger than 1" diameter in concrete surface.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Re-tighten forms and bracing after concrete placement if required to eliminate mortar leaks and maintain proper alignment.

3.2 PLACING REINFORCEMENT

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified. Clean reinforcement of loose rust and mill scale, old concrete, earth, ice, and other materials which reduce or destroy bond with concrete.

Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

Place reinforcement to obtain at least minimum coverages indicated on the Contract drawings for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. All reinforcement must be completely supported and secured against possible displacement prior to placing concrete in any portion of the scheduled placement.

Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lap splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

Concrete reinforcement shall be erected from shop drawings displaying the Engineer's stamp of acceptance only. In the event a conflict exists between the accepted shop drawing and the Contract Documents the conflict shall be brought to the immediate attention of the Engineer for resolution.

3.3 JOINTS

A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Engineer/Owner. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints. Reference design drawings.

B. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated. Joint filler and sealant materials are specified in Division 7.
C. Control Joints in Slabs-on-Ground: Construct control joints in slabs-on-ground to form panels or patterns as shown. Use inserts or saw-cut 1/4" wide x 1/5 to 1/4 of the slab depth, unless otherwise indicated.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instruction and directions provided by suppliers of items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.5 PREPARATION OF FORM SURFACES

A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in. Notify other crafts to permit installation of their work. Cooperate with other trades in setting such work. Coat forms with sealer as specified in Section 2.01 of these specifications.

B. Notify testing/inspection agency of intent to place concrete at least 48 hours prior to placement. Perform complete pre-placement inspection of formwork, reinforcement and condition of base prior to arrival of inspector. For each placement Contractor will provide the Special Inspector with a written record of the quality control inspection performed by and signed by the Contractor.

C. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

D. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete", and as herein specified. Deposit concrete continuously or in layers of such thickness that in concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate without causing segregation of mix.

H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

J. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in proper position during concrete placement operations. Do not use calcium chloride, salt and other materials containing anti-freeze agents or chemical accelerators, unless otherwise accepted in mix designs.

3.7 FINISH OF SURFACES

A. Rough Form Finish (RfFm-Fn): For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish (SmFm-Fn): For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Smooth-Rubbed Finish (SmRbd-Fn): Provide smooth rubbed finish (SmRbd-Fn) to scheduled concrete surfaces exposed-to-view, which have received smooth form finish (SmFm-Fn) treatment, not later than one day after form removal. Moisten concrete surfaces and rub with Carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

3.8 MONOLITHIC SLAB FINISHES

A. Scratch Finish (Scr-Fn): Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tiles, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to a tolerance not exceeding 1/4" in 2'-0" when tested with a 2' straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.

B. Floated Finish (Flt-Fn): Apply floated finish to monolithic slab surfaces to receive light broom finish as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

C. After screeding and consolidating concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power driven floats, or both. Consolidate surface with power driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10" when testing with a 10' straight edge. Cut down high spots
and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth granular texture.

D. Light Broom Finish: Apply light broom finish to platforms, steps, landings, and for exterior or interior pedestrian ramps. After completion of float finishing, lightly draw broom over concrete surface and apply chemical-hardener finish at platform as specified above.

3.9 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by moist curing, by

1. Keep concrete surface continuously wet by covering with water a minimum of 7 days.
2. Continuous water-Fog Spray.

C. Surfaces shall be kept continuously moist for not less than 7 - days after finishing.

3. Covering concrete surface with non-staining absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
   a. Ultra Care wet curing blankets or approved equal.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above as applicable.

3.10 SHORES AND SUPPORTS

A. For shoring and reshoring comply with ACI 347 "Recommended Practice of Concrete Formwork", and as herein specified.

B. Remove shores and restore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

C. Keep reshores in place until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.11 REMOVAL OF FORMS

A. Formwork such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees for 24 hours after placing concrete, except as noted below, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork for concrete to receive a rubbed finish shall be removed within 24 hours of placement to allow proper finishing.

C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, when removed for finishing, must immediately be replaced with shoring. Shoring shall remain in place until concrete has achieved its design strength.
3.12 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surface, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.13 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

3.14 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete, but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Before placing cement mortar or proprietary agent, brush-coat the area to be patched with neat cement grout or proprietary bonding agent.

C. For exposed-to-view surfaces, blend white Portland cement and standard portland cement so that when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixtures and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surfaces.

D. Repair of formed Surfaces: Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

E. Repair concealed formed surfaces, where possible, that contain defects that affect the reliability of concrete. If defects cannot be repaired, remove and replace concrete.

F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

G. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

I. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Engineer.

J. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and brush with a neat cement grout, or apply concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
K. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and brush with neat cement grout, or apply concrete bonding agent. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

L. Use epoxy-based mortar, approved by the Engineer, for structural repairs. Structural repairs include, but are not limited to, areas of unsound (honeycombed or spalled) concrete with a surface area greater than 9 square inches and/or with a depth greater than 1.5 inches, areas where reinforcement is exposed or areas with cracks greater than 1/16 inch in width. All areas requiring a structural patch shall be approved by the Engineer prior to commencing patching operations.

M. Concrete Sealer: Contractor shall apply low gloss, surface sealer at after concrete has cured for 28 days. Surface sealer shall be applied to patio entry surfaces, sidewalks and stamped concrete.

N. Patio Sidewalk: Contractor shall apply a compatible sealer over the concrete 28-days after concrete placement.

O. Street Line Sidewalks: Contractor shall apply a compatible sealer over the concrete 28-days after concrete placement


END OF SECTION 03300
SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1: General Requirements are made apart of this requirement.

B. Submittals: Model code evaluation reports for treated wood, engineered wood products, foam-plastic sheathing and building wrap, product data sheets for all products being used, samples of all products being used, shop drawings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. All wood products shall be certified by the Forest Stewardship Council.

B. Lumber: Provide dressed lumber, S4S, 19 percent maximum moisture content for 38-mm actual thickness or less, marked with grade stamp of inspection agency.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

D. Wood Structural Panels: DOC PS 2. Provide plywood complying with DOC PS 1, where plywood is indicated.


2.2 TREATED MATERIALS

A. Preservative-Treated Materials: AWPA C2 lumber and AWPA C9 plywood, labeled by an inspection agency approved by ALSC's Board of Review. After treatment, kiln-dry lumber and plywood to 19 and 15 percent moisture content, respectively. Treat indicated items and the following:

1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Concealed members in contact with masonry or concrete.

3. Wood framing members less than 460 mm above grade.

4. Wood floor plates installed over concrete slabs directly in contact with earth.

B. Fire-Retardant-Treated Materials: Comply with performance requirements in AWPA C20 lumber, labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber. Moisture Content: no greater than 19% for lumber and no greater than 15% for plywood.

2. Use Interior Type A High Temperature (HT), unless otherwise indicated.
2.3 LUMBER

A. Dimension Lumber: The following grades are per inspection agency indicated:

1. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3: Eastern softwoods: NELMA; Northern species: NLGA;

2. Framing Other Than Non-Load-Bearing Partitions: No. 2: Hem-fir: NLGA, WCLIB, or WWPA;

3. Exposed Framing: No. 2, hand selected: Hem-fir: NLGA, WCLIB, or WWPA; Spruce-pine-fir: NELMA, NLGA, WCLIB, or WWPA;

B. Concealed Boards: 19 percent maximum moisture content: Northern species: No. 2 Common per NLGA rules;

C. Miscellaneous Lumber: Construction, Stud, or No. 3 grade of any species for nailers, blocking, and similar members.

2.4 ENGINEERED WOOD PRODUCTS

A. Engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

B. Laminated-Veneer Lumber: Manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.

1. Extreme Fiber Stress in Bending, Edgewise: 17.9 MPa for 286-mm actual-depth members.


C. Wood I-Joists: Prefabricated units complying with APA PRI-400 with timber flanges; depths and performance ratings not less than those indicated.

1. Web Material: Either oriented strand board or plywood, Exposure 1.

2. Structural Capacities: Establish and monitor structural capacities according to ASTM D 5055.


1. Thickness and Grade: 28-mm rim board

2. Trademark: Factory mark with APA trademark indicating thickness, grade, and compliance with APA standard.

2.5 PANEL PRODUCTS

A. Wall Sheathing:
1. Plywood: Exterior, Structural I.

2. Polyisocyanurate-Foam: ASTM C 1289, Type I, Class 2; with aluminum foil facings. Foam-plastic core and facings shall have flame spread of 25 or less, when tested individually.

B. Roof Sheathing:

1. Plywood: Exterior, Structural I.
   a. Sheet size: 4’ x 8’
   b. Thickness: 5/8”

C. Combination Subfloor-Underlayment:

1. Plywood: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.

2. Oriented Stand Board: Exposure 1 single-floor panels.

D. Underlayment:

1. Plywood for Resilient Flooring: 3/8” thick, DOC PS 1, Exposure 1, Multi-ply Underlayment with fully sanded face.

2. Plywood for Ceramic Tile: 3/8” thick, DOC PS 1, Exterior, C-C Plugged, 15.9 mm thick, for ceramic tile set in organic adhesive.

3. Plywood for Carpet: 3/8” thick, DOC PS 1, Exposure 1 Underlayment.

E. Telephone and Electrical Equipment Backing Panels: Plywood, Exposure 1, C-D Plugged, fire-retardant treated, not less than 19 mm thick.

2.6 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M except Type 304 stainless steel with treated lumber.


2. Bolts: Steel bolts complying with ASTM F 568, Property Class 4.6; with ASTM A 563M hex nuts and, where indicated, flat washers.

3. Fire Retardant Materials: hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper fasteners with all pressure-preservative or fire-retardant treated wood products. The coating weight weights for zinc-coated fasteners shall be in accordance with ASTM A-153. Stainless steel fasteners shall be type 304 or 306.

B. Building Wrap: Air-retarder sheeting made from polyolefins; cross-laminated films, woven strands, or spun-bonded fibers; coated or uncoated; with or without perforations; and complying with ASTM E 1677, Type I.

1. Available Products:
a. Tyvek or approved equal.

C. Adhesives for Field Gluing Panels to Framing: APA AFG-01.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Securely attach rough carpentry to substrates, complying with the following:
   1. CABO NER-272 for power-driven fasteners.
   2. Published requirements of metal framing anchor manufacturer.

C. Fastening Methods: Comply with recommendations and "Code Plus" provisions in APA Form No. E30K and the following:
   1. Combination Subflooring-Underlayment: Glue and nail to framing.
   2. Subflooring: Glue and nail to framing.
   3. Sheathing: Nail to framing.
   4. Underlayment: Nail or screw to subflooring.

END OF SECTION 06100
SECTION 06200 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 – General Requirements is made a part of this section.

B. Section 06158 - Over-deck-joist water diversion system.

C. Submittals: Shop drawings, product data sheets and samples of all products being used. Submittal shall include a schedule of the size, type and species of wood being used for all finish carpentry products required.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

1. Certified and stamped by the Forestry Stewardship Council.

B. Lumber:

1. DOC PS 20 and grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.


D. Hardwood Plywood: HPVA HP-1.

2.2 EXTERIOR FINISH CARPENTRY

A. Exterior Finish Trim:

1. AZEK® rigid poly-vinyl-chloride trimboards - www.azek.com
2. Approved equal.

B. Decking: Wood-polymer composite decking with 100% recycled content.

1. TimberTech Floorizon: Used on all second floor decking. Tongue and groove, Vertigrain pattern. Color shall be selected by owner from manufacturer’s standard color selections.

2. TimberTech ValuPlank: Sizes in 4” and 6” widths based on installation. Color shall be selected by owner from manufacturer’s standard color selections.

3. Trex Origins: Sizes in 4” and 6” widths based on installation. Color shall be selected by owner from manufacturer’s standard color selections.

4. Approved equal.

2.3 INTERIOR STANDING AND RUNNING TRIM

A. Interior Softwood Lumber Trim:

1. C Select (Choice), eastern white, Idaho white, lodgepole, ponderosa, or sugar pine or Premium Grade white woods.

2. MDO

a. Door trim - match existing width, thickness and profile.
b. Window trim – match existing width, thickness and profile.
c. Base trim – match existing width, thickness and profile.
d. Wood floor quarter round molding – match existing width, thickness and profile.

B. Wood Molding Patterns: Made to patterns in WMMPA WM 7 from kiln-dried stock graded under WMMPA WM 4.
   1. Moldings for Painted Finish: P-Grade eastern white, Idaho white, lodgepole, ponderosa, or sugar pine.
      a. Match existing profiles.

2.4 CLOSETS, SHELVING AND CLOTHES RODS

A. Vertical Closet Partition: 1-inch Baltic Birch finish boards (width as specified).

B. Shelving: 3/4-inch Baltic Birch finish boards as specified for interior softwood trim or MDO if approved by Owner.

C. Clothes Rods: Steel 1-1/2”. Provide intermediate supports as noted.

2.5 STAIRS AND RAILINGS

A. Interior Treads: 1-1/16-inch, clear, kiln-dried, edge-glued, poplar stepping with half-round nosing unless otherwise noted.

B. Interior Risers: 3/4-inch finish boards as specified for interior softwood trim unless otherwise noted.

C. Interior Railings: Clear, kiln-dried, hard-maple or yellow-poplar railing stock unless otherwise noted.

D. Exterior Treads: 1-1/4-inch TimberTech, Trex Origins™ or approved equal, unless otherwise noted.

E. Exterior Risers: 3/4-inch AZEK® rigid poly-vinyl-chloride trim boards or approved equal, unless otherwise noted.

F. Exterior Fascia Boards: 3/4-inch AZEK® rigid poly-vinyl-chloride trim boards or approved equal, unless otherwise noted.

G. Exterior Railings: Monarch Composite Deck & Railing System
   1. Style: Bermuda™ Railing System.
      a. Provide metal core in railing system.
   2. Balusters: Traditional Square Balusters.
      a. Reinforce composite railing system as required to ensure that lateral load requirements meet or exceed 300 pound static load. Provide structural engineer’s stamp.

H. Exterior Railings: Monarch Composite Deck & Railing System
   1. Style: Chameleon™ Railing System.
a. Provide metal core in railing system.

2. Balusters: Traditional Square Balusters.
   a. Reinforce composite railing system as required to ensure that lateral load requirements meet or exceed 300 pound static load. Provide structural engineer’s stamp.
   b. Provide metal handrails fastened to posts at 36” or 42” high in accordance with code requirements. Handrails shall be 1 ½” diameter custom fabricated. Fabrication shall be based upon field measurements of newly installed railing system. Reference specification section 05500.

2.6 MISCELLANEOUS MATERIALS
B. Fasteners for Trex Decking: SplitStop™ — Star Drive Titan 3 Composite Screw, Dexxter™ Composite Screw, FastenMaster® TrapEase® II Composite Screw, or approved equal.
C. Fasteners for Monarch Decking: 21/2” conventional decking screws in stainless or ceramic are recommended for porch decking installation.
D. Fasteners for Azek Trim Boards: Stainless- steel trim head screws, 2 ¼” minimum lengths. Manufacturer’s approved fillers over screw heads.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Condition finish carpentry in installation areas for 24 hours before installing.
B. Prime and back prime lumber for painted finish exposed on the exterior.
C. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Finger joints are acceptable. Refinish and seal cuts.
D. Install standing and running trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Stagger joints in adjacent and related trim. Cope at returns and miter at corners.
E. Select and arrange paneling for best match of adjacent units. Install with uniform tight joints.
F. Install over-deck-joist water diversion system on all second floor or greater decks, reference Section 06158.

END OF SECTION 06200
SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1: General Requirements is made a part of this section.

B. Submittals: Product Data for solid-surfacing materials, Shop Drawings and Samples showing the full range of colors, textures, and patterns available for each type of finish.


D. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is completed, and HVAC system is operating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

B. Particleboard: ANSI A208.1, Grade M-2.

C. High-Pressure Decorative Laminate: NEMA LD 3.

1. Products:
   a. Student Occupancies: Kitchen Countertops and Full-Height Backsplash:
      1) Wilsonart; 4166-60 Pampas or color as specified by the Owner. Submit manufacturer’s standard color samples for review and final selection.
      2) Nevamar. Submit manufacturer’s standard color samples for review and final selection.
      3) Formica. Submit manufacturer’s standard color samples for review and final selection.
   b. Faculty/Staff Occupancies: See plan/scope of work for specific details.

D. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

   1. Available Products:
      a. Corian
      b. Transolid
      c. Sorel
      d. Fountainhead
      e. Approved equal.
2.2 INTERIOR WOODWORK

A. Complete fabrication before shipping to Project site to maximum extent possible. Disassemble only as needed for shipping and installing. Where necessary for fitting at Project site, provide for scribing and trimming.

B. Plastic-Laminate Countertops and Full-Height Backsplash: Premium grade.
   1. Laminate Grade: HGS for flat countertops, HGP for post-formed countertops.
   2. Grain Direction: Parallel to cabinet fronts.
   3. Edge Treatment: Same as laminate cladding on horizontal surfaces.
   4. Backsplash, 4” minimum.

C. Solid-Surfacing Material Countertops: Premium grade.
   1. Fabricate tops in one piece with shop-applied backsplashes and edges.
   2. Solid-Surfacing Material Thickness: 1/2 inch.
   3. Integral sink bowls: ADA compliant bowl.
   4. Apron around perimeter of counter, width to meet ADA requirements, minimum 6”.
   5. Backsplash, 4” minimum.

D. Bathroom Cubbies
   1. High pressure laminate
   2. Transolid
   3. Phenolic

E. Laminate Shelving:
   1. Fabricate with Medium-Density Fiberboard: ANSI A208.2, Grade MD
   2. Cut cubbies / shelving sections to required sizes.
   3. Laminate all flat surfaces and all edges prior to assembling cubbies or installing shelving.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Island counter tops shall have steel frame.

B. Exposed side of bar cabinets shall be treated with kitchen cabinet façade material. Coordinate with Owner in the field.

C. Condition woodwork to prevailing conditions before installing.

D. Install woodwork to comply with referenced quality standard for grade specified.

E. Shop fabricated countertops. No field lamination.
F. All outside corners to have a 5” radius.

G. Minimize number of joints.

H. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches for level and plumb.

I. Provide 4” backsplash.

J. Scribe and cut woodwork to fit adjoining work, seal cut surfaces, and repair damaged finish at cuts.

K. Install trim with minimum number of joints possible, using full-length pieces to greatest extent possible. Stagger joints in adjacent and related members.

L. Anchor countertops securely to base units. Seal space between backsplash and wall.

END OF SECTION 06402
SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 - General Requirements is made a part of this section.

B. Submittals: Product Data, schedule outlining location, area and type of insulation being installed

C. Surface-Burning Characteristics: ASTM E 84, and as follows:
   1. Flame-Spread Index: 25 or less where exposed; otherwise, as indicated in Part 2 "Insulation Products" Article.
   2. Smoke-Developed Index: 450 or less.

PART 2 - PRODUCTS

2.1 INSULATION PRODUCTS

A. Cellulosic-Fiber Loose-Fill Insulation: ASTM C 739; chemically treated for flame-resistance, processing, and handling characteristics.

B. Natural Cotton Fiber Insulation: ASTM E-84, UL-723; ASTM C 739; Ultra Touch natural cotton fiber building insulation with flame spread 5 (Class 1) as manufactured by Bonded Logic, Inc.

C. SafeTouch Fiberglass-Free Insulation: thermo-acoustic quilt manufactured from polyester fibers.

D. Self-Supported, Spray-Applied, Cellulosic Insulation: ASTM C 1149, wood-based cellulosic fiber, Type II, applied with dry adhesive activated by water during installation); chemically treated for flame-resistance, processing, and handling characteristics.

E. Foam-in-place Insulation: Self-expanding foam Icynene with no CFC content.

F. Acoustical Fire Batts: Mineral wool fiber insulation. CFC and HCFC free product and process. Made from natural and recycled materials.

G. Board Insulation: Foam board insulation under vinyl siding, 1” thickness.

2.2 ACCESSORIES

A. Vapor Retarder: Reinforced polyethylene, 8 mils thick.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed to fit between roof framing members and to provide cross-ventilation between attic spaces and vented eaves.

C. Attic Hatch Weather Stripping: Self-adhesive foam weatherstrip tape or approved equal as required based on differing attic hatch conditions.

PART 3 - EXECUTION
3.1 GENERAL INSTALLATION

A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Install foam and place insulation tightly around obstructions and fill voids.

B. Place loose-fill insulation to comply with ASTM C 1015.


C. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape.

D. Acoustical fire batts: provide thicknesses to meet required acoustical performance.

3.2 ATTIC AREA INSTALLATION

A. All open joisted areas shall be blown with class 1 cellulose blown-in insulation, R-60 minimum.

B. All floorboard attic areas shall be insulated with class 1 cellulose blown-in insulation below floorboards to prevent heat loss and air infiltration, R-38 minimum and provide batt insulation on top of floor boards for a total R-value of 60.

C. Attic area floorboards shall be removed as required to fill the cavity below with blown cellulose. Floorboards shall be re-installed with screws upon completion of the work.

D. All floorboard attic areas shall have cotton batt insulation installed on top of floorboards, for a total R-value of 60.

E. All attic hatches, kneewall doors and entrances shall be covered with R-38 cotton batting over and around the opening area. Securely fasten batting to attic hatches, kneewall doors and entrances as required.

F. Install self adhesive foam weatherstripping tape or approved weatherstripping style required to accommodate the various opening field conditions. Install weatherstripping around the perimeter of all attic hatch openings, kneewall doors and walk-up door entrances.

G. All sprinkler pipes shall be wrapped with foil-backed duct wrap insulation, in order to capture heat from conditioned space as well as insulate from unheated space.

H. All kneewalls shall be insulated with R-38 cotton batting, stapled in place.

I. Avoid disturbing existing insulation - especially loose-fill. Moving it around can create gaps where air can leak through.

J. When adding batts or blankets, install them at right angles to the first layer.

3.3 EXTERIOR WALL INSTALLATION

A. Remove two rows of siding high and low around the perimeter of each house, two rows per floor (excluding attic area walls).
Wesleyan University Construction Services

B. Drill two holes per bay (one high and low) on each bay center as required for insulating.

C. Furnish and install class 1 cellulose.

D. Plug holes with insulated foam plugs.

E. Reinstall siding with #6 galvanized nails for clapboard, galvanized shake nails for asbestos and cedar shakes or galvanized 1 ½” nails for aluminum and vinyl.

F. Caulk siding as required, clean up insulation debris and remove from site. Rake ground of wood chips and insulation, sweep steps and walks.

G. All work areas shall be flagged with caution tape or barricaded as required to maintain a safe work site.

END OF SECTION 07210
SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 – General Requirements is made a part of this section.

B. Submittals: Product Data and product certificates signed by manufacturer certifying that products furnished comply with requirements.

C. Provide firestopping systems with fire-resistance ratings indicated by reference to UL designations as listed in its "Fire Resistance Directory," or to designations of another testing agency acceptable to authorities having jurisdiction.

D. Provide through-penetration firestopping systems with F-ratings indicated, as determined according to ASTM E 814, but not less than fire-resistance rating of construction penetrated.

1. Provide through-penetration firestopping systems with T-ratings as well as F-ratings, as determined according to ASTM E 814, where indicated.

E. For exposed firestopping, provide products with flame-spread indexes of less than 25 and smoke-developed indexes of less than 450, as determined according to ASTM E 84.

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Any through-penetration firestop system that is classified by UL or listed by ITS for the application and with F-rating and T-rating indicated may be used.

B. UL-classified systems shall be submitted for the following:

C. Firestop Systems with No Penetrating Items

D. Firestop Systems for Metallic Pipes, Tubing, or Conduit

E. Firestop Systems Nonmetallic Pipes, Tubing, or Conduit

F. Firestop Systems Insulated Pipes

G. Firestop Systems for Electrical Cables

H. Firestop Systems for Air Ducts
2.2 MATERIALS
A. Fire Barrier Devices: Factory-assembled devices formed from galvanized steel and lined with intumescent material sized to fit specific opening in the substrate.

2.3 MANUFACTURED UNITS
A. Where scheduled, provide the following UL classified fire barrier device. Device consists of a metal enclosure with intumescent materials, factory-painted red, foam inserts, and mounting brackets, in the size(s) appropriate for the installation.
B. Metal Enclosure: 0.0276 inch zintec-coated steel.
   1. Enclosure Finish: Manufacturer's standard powder coating of lead-free epoxy-polyester.
C. Foam Inserts: Flexible polyurethane, Class O Non-Flammable foam treated with water-based latex, properly sized by device manufacturer base on size of device.
D. Mounting Brackets: 0.0472 inch galvanized steel.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Install firestopping systems to comply with requirements listed in testing agency's directory for indicated fire-resistance rating and per manufacturer's written instructions.
B. In existing conditions, open device, fit around the penetrants and then slide into the opening.
C. In new construction, prepare opening by cutting correct size hole. Remove foam visual/smoke seals and safely store until time for their installation. Slide device into opening
D. Dependent upon installation, secure device with manufacturer's standard mounting brackets, stud brackets, or manufacturer's recommended fire barrier sealant. Install penetrants as specified and secure per local codes. Install foam visual/smoke seals flush with device ends.

3.2 EXAMINATION
A. Examine substrates and conditions for compliance and ratings. Requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of Work.

3.3 THROUGH-PENETRATION FIRE BARRIER SYSTEM INSTALLATION
A. General: Install fire barrier systems and fire barrier products to comply with Part 1 "Performance Requirements" Article and with fire barrier products manufacturer's written installation instructions and published drawings for products and applications indicated.

3.4 IDENTIFICATION OF OPENINGS
A. Identify fire barrier penetrations with preprinted paper labels. Attach labels permanently to surfaces attached to or within 6 inches of edge of fire barrier products so that labels will be visible to anyone seeking to remove fire barrier product(s). Use appropriate fastening methods for labels. For paper plastic or metal labels that are self made, use adhesive that will result in partial destruction of label if removal is attempted. Include the following information on labels:
1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration fire barrier system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration fire barrier system manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Engage a qualified local building inspector or independent inspecting agency to inspect through-penetration fire barrier installations. Independent inspecting agency shall comply with ASTM E2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Repair, update or replace fire barrier systems that are deficient so they comply with requirements.

C. Proceed with enclosing fire barrier systems with other construction only after inspection reports are issued and fire barrier system installations comply with requirements.

3.6 CLEANING

A. After installation, remove left over material and debris from work area.

3.7 PROTECTING

A. Protect fire barrier materials and maintain conditions during and after installation that ensure that through-penetration fire barrier systems are without damage or deterioration at time of substantial completion. Cut out and remove damaged or deteriorated through-penetration fire barrier systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION 07841
SECTION 08311 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 - General Requirements shall be made a part of this section.

B. Submittals: Product Data.

C. Fire-Rated Access Doors and Frames: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing per the following:
   1. Vertical Access Doors: NFPA 252 or UL 10B.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 1011/A 1011M.

B. Cold-Rolled Steel Sheets: ASTM A 1008/A 1008M or ASTM A 620/A 620M.

C. Stainless-Steel Sheets: ASTM A 666, Type 304.

2.2 ACCESS DOORS AND PANELS

A. General: Provide Stainless steel access doors in areas with showers.

B. Flush, Insulated, Fire-Rated Access Doors: Prime-painted or Stainless-steel, self-latching units with automatic closer, with trimless frame.

C. Flush Access Doors with Exposed Trim: Prime-painted or Stainless-steel units.

D. Trimless, Flush Access Doors for Gypsum Board: Prime-painted steel or Stainless-steel units.

E. Locks: Flush to finished surface, key operated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install access doors and panels accurately in position. Adjust hardware and door and panels for proper operation.

B. Install fire-rated access doors and panels according to NFPA 80.

C. After installation, remove protective wrappings from doors and frames and touch up prime coat with compatible air-drying primer. Apply finish coats in accordance with Division 9 specifications.

END OF SECTION 08311
SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 - General Requirements is made a part of this section.

B. Division 6 – Wood and Plastics is made a part of this section.

C. Division 10 – Specialties is made a part of this section.

D. Submittals: Product Data, certification stating that all gypsum board products being provided contain no asbestos containing material.

E. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

F. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

G. Any materials provided and installed to complete the work shall be free of any asbestos, PCB’s, lead containing materials, sulfur and any other hazardous materials. MSDS sheets to be provided for all materials prior to acceptance and installation

1.2 PRODUCTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following

1. Steel Framing and Furring:

   Incor, Inc.
   Marino Industries Corp.
   United States Gypsum Co.

2. Gypsum Boards and Related Products

   United States Gypsum Co.
   Gold Bond Building Products Div., National Gypsum Co.

1.3 METAL FRAMING AND SUPPORTS

A. Steel Framing Members, General: ASTM C 754.

   Steel Sheet Components: ASTM C 645, with manufacturer's standard corrosion-resistant zinc coating.
B. Suspended Ceiling and Soffit Framing:
   1. Grid Suspension System for Interior Ceilings: Interlocking, direct-hung system, 15/16” width unless noted otherwise.

C. Partitions, closet partitions and soffit framing:
   1. Studs and Runners: In depth indicated and 0.0179 inch thick, unless otherwise indicated.
   2. Flat Strap and Backing: 0.0179 inch thick.
   3. Rigid Hat-Shaped Furring Channels: In depth indicated and 0.0179 inch thick.
   4. Resilient Furring Channels: 1/2 inch deep, with single- or double-leg configuration.

1.4 PANEL PRODUCTS

A. Provide in maximum lengths available to minimize end-to-end butt joints and minimize the need for trimming

B. Gypsum Wallboard: ASTM C 36, in thickness indicated, with manufacturer's standard edges. Regular type, unless otherwise indicated except Type X where required for specific fire-resistance-rated assemblies.

C. Water-Resistant Gypsum Backing Board: ASTM C 630, in thickness indicated. Regular type, except Type X where required for fire-resistance-rated assemblies. Resists the growth of mold per ASTM G21 with a score of 0 and D 3273 with a score of 10.

D. Acoustically Enhanced Gypsum Wallboard: 5/8" thick gypsum board consisting of a layer of viscoelastic damping polymer sandwiched between two pieces of high density mold resistant gypsum board, providing constrained layer damping for high STC rated areas. Pass full scale ASTM E90 test procedure.

E. Glass-Mat, Water-Resistant Gypsum Backing Board: ASTM C 1178, of thickness indicated. Regular type, except Type X where required for fire-resistance-rated assemblies.
   1. Product: "Dens-Shield Tile Backer" manufactured by Georgia-Pacific Corp.

1.5 ACCESSORIES

A. Trim Accessories: ASTM C 1047, formed from galvanized or aluminum-coated steel sheet or rolled zinc. Provide plastic trim accessories at bathrooms with showers
   1. Provide corner bead at outside corners, unless otherwise indicated.
   2. Provide LC-bead (J-bead) at exposed panel edges.
   3. Provide L-bead with tear away strip at dissimilar finishes.
   4. Provide control joints where indicated.

   1. Joint Tape: Paper, unless otherwise recommended by panel manufacturer.
2. Joint Compounds: Setting-type taping compound and drying-type, ready-mixed, compounds for topping.


D. Sound-Attenuation Blankets: ASTM C 665, Type I (unfaced).

E. Miscellaneous Materials: Auxiliary materials for gypsum board construction that comply with referenced standards.

PART 2 - EXECUTION

2.1 INSTALLATION

A. Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation and with United States Gypsum's "Gypsum Construction Handbook."

B. Isolate steel framing from building structure, except at floor, to prevent transfer of loading imposed by structural movement.

C. Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

   1. Isolate gypsum board assemblies from abutting structural and masonry work. Provide edge trim and acoustical sealant.


   3. Multilayer Fastening Methods: Fasten base layers and face layer separately to supports with screws.

D. STC-Rated Assemblies: Comply with ASTM C 919 for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies.

E. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

F. Finishing Gypsum Board Assemblies:

   1. Unless otherwise indicated, provide Level 4 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

   2. At concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies, provide Level 1 finish: Embed tape at joints.

   3. At substrates for tile, provide Level 2 finish: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges.

G. Plaster Repair: At all plaster wall areas that are noted to be patched or repaired, cracked or damaged areas shall be cut out as required and patched with GWB. Joints shall be taped and three coats of joint compound shall be applied. Sand between each coat. Skim coat surrounding area with joint compound as required blending in patch and concealing all other imperfections. All patched areas shall be review and approved by the Owner prior to applying primer and topcoat.
END OF SECTION 09260
SECTION 09910 - PAINTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 – General Requirements is made a part of this section.

B. House / Village Color Schemes study entitled “Exterior Paint Study and Building Analysis – The Village at Wesleyan University” prepared by Elizabeth Randall dated April 20, 1998 is made a part of this section and is available for review at the Office of Construction Services, 170 Long Lane, Middletown, CT 06459.

C. Summary: Paint exposed surfaces, new and existing, unless otherwise indicated.

1. Do not paint prefinished items, items with an integral finish, operating parts, and labels, unless otherwise indicated.

D. Use KILZ general purpose primer to cover any stains or surface imperfections that may bleed through the finish coat.

E. Submittals: Submit paint finish schedule for each project, color samples and product cut sheets to Owner prior to the start of work.

F. Mockups: Full-coat finish sample of each type of coating, color, and substrate, applied where directed.

G. Obtain block fillers and primers for each coating system from same manufacturer as finish coats.

H. Extra Materials: Deliver to Owner 1 gal. of each color and type of finish coat paint used on Project, in containers, properly labeled and sealed.

PART 2 - PRODUCTS

2.1 PAINT

A. Products:

Note: Sherwin William Supplier – National Paint & Wallpaper, 32 Washington Street, Middletown, CT, Ph. 860-346-7705 or approved equal

1. Sherwin Williams (Interior)
   a. Promar 200 Interior Latex Wall Primer
   b. Promar 200 (Flat, Eggshell, Semi-gloss – As Noted)

2. Muralo
   a. Superfinish Premium Acrylic Ceramic (Eggshell, Semi-gloss – As Noted)

3. KILZ® (Interior / Exterior)
   a. General Purpose Primer
4. Zinsser (Exterior)
   a. Peel Stop® Clear Binding Primer

5. Benjamin Moore (Exterior)
   a. Fresh Start® All-Purpose 100% Acrylic Primer 023 (tinted to match approximate shade of topcoat color).
   b. MoorGard® N103 – 100% Acrylic Low Lustre Latex House Paint (field).
   d. DTM-M04, DTM-M29, DTM-M28 based on finish selected.

6. Colors: As selected by the Owner.

B. Material Compatibility: Provide materials that are compatible with one another and with substrates.

C. Material Quality: Manufacturer's best-quality paint material of coating types specified that are formulated and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove hardware, lighting fixtures, wall plates, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.

B. Contractor shall assume that all paint contains lead and shall abide by all local, state, federal and OSHA guidelines and shall meet or exceed Wesleyan University requirements outlined in the project manual.

C. Clean and prepare all surfaces in an area before beginning painting in that area. Cleaning solution shall be submitted to the Owner for approval prior to the start of work. Schedule painting so cleaning operations will not damage newly painted surfaces. Surfaces must be clean and free of grease, wax, mold and mildew. Remove excessive chalk and loose or scaling paint. Glossy surfaces must be dulled. Unweathered areas such as eaves, ceilings, and overhangs should be washed with an environmentally friendly detergent solution and/or rinsed to remove contaminants that can interfere with proper adhesion. Wait a minimum of three days prior to applying paint products to ensure that all surfaces are dry and free of moisture. For metal surfaces, remove rust. Wipe down with paint thinner to remove surface oils. Scrape, sand and remove old paint. Wear a NIOSH approved respirator to control dust exposure. Carefully clean up with a HEPA vacuum and a wet mop.

D. Upon completing all required prep work, contact Owner to review surfaces prior to applying paint products. Provide additional prep work as required based on review comments from Owner.

3.2 APPLICATION

A. Apply coatings by brush, roller, spray or other applicators according to coating manufacturer's written instructions.
1. Use brushes only for exterior painting and where the use of other applicators is not practical.

2. Use rollers for finish coat on interior walls and ceilings.

B. Pigmented (Opaque) Finishes: Completely cover surfaces to provide a smooth, opaque surface of uniform appearance. Provide a finish free of cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections.

C. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

3.3 EXTERIOR PAINT APPLICATION SCHEDULE

A. Concrete, Stucco, and Masonry:

1. Low-Luster Acrylic: One coat Peel Stop® Clear Binding Primer, one coat Fresh Start® All-Purpose 100% Acrylic Primer 023 (tinted to match approximate shade of topcoat color), one coat MoorGard® N103 – 100% Acrylic Low Lustre Latex House Paint.

2. Semi gloss, Acrylic Enamel: **Primer:** MOORE’S® Masonry Sealer (C077) or (066) **Finish:** 2 coats AURA® Waterborne Exterior Paint Semi Gloss Finish (632).

B. Concrete Masonry Units:

1. Low-Luster Acrylic: One coat Peel Stop® Clear Binding Primer, one coat Fresh Start® All-Purpose 100% Acrylic Primer 023 (tinted to match approximate shade of topcoat color), one coat MoorGard® N103 – 100% Acrylic Low Lustre Latex House Paint.

2. Semi gloss, Acrylic Enamel: **Primer:** MOORE’S® Masonry Sealer (C077) or (066) **Finish:** 2 coats AURA® Waterborne Exterior Paint Semi Gloss Finish (632).

C. Wood Siding, Shakes:

1. Low-Luster Acrylic: One coat Peel Stop® Clear Binding Primer, one coat Fresh Start® All-Purpose 100% Acrylic Primer 023 (tinted to match approximate shade of topcoat color), one coat MoorGard® N103 – 100% Acrylic Low Lustre Latex House Paint.

2. Where wood siding, shakes are stained, coordinate with Owner materials to be used. In all cases, multiple coats of finish will be required.

D. Wood Trim:

1. Semi gloss, Acrylic Enamel: One coat Peel Stop® Clear Binding Primer, one coat Fresh Start® All-Purpose 100% Acrylic Primer 023 (tinted to match approximate shade of topcoat color), one coat Moorcraft® Super Spec Latex House & Trim Paint 170.

E. Exterior Doors:

1. Semi gloss, Acrylic Enamel: One coat Peel Stop® Clear Binding Primer, One coat Fresh Start® All-Purpose 100% Acrylic Primer 023 (tinted to match approximate shade of topcoat color), one coat Moorcraft® Super Spec Latex House & Trim Paint 170.

F. Exterior Wood Decks/Porches:
1. Benjamin Moore Floor and Deck Enamel. Apply two (2) coats. Provide manufacturer’s standard color options.

G. Exterior Wood Finishes:

H. Ferrous Metal:
   1. Low-Luster Acrylic: Two coats over rust-inhibitive primer.
   2. Semi gloss, Acrylic Enamel: Two coats over rust-inhibitive primer.
   3. Full-Gloss, Alkyd Enamel: Two coats over rust-inhibitive primer.

I. Zinc-Coated Metal:
   1. Low-Luster Acrylic: Two coats over galvanized metal primer.
   2. Semi gloss, Acrylic Enamel: Two coats over galvanized metal primer.
   3. Full-Gloss, Alkyd Enamel: Two coats over galvanized metal primer.

J. Aluminum:
   1. Semi gloss, Acrylic Enamel: Two coats over primer.
   2. Full-Gloss, Alkyd Enamel: Two coats over primer.

K. Center for the Arts
   1. Exterior Metal Railings
      a. Off-white oil gloss used for exterior metal surfaces such as railings. Pittsburgh base # 54-410 w/ the colorants B-1, C-1Y4, L-16, M-6

L. Van Vleck Observatory Domes

3.4 INTERIOR PAINT APPLICATION SCHEDULE

A. Concrete and Masonry (Other Than Concrete Unit Masonry):
   1. Flat Acrylic: Two coats over primer.
   2. Low-Luster, Acrylic Enamel: Two coats over primer.

B. Concrete Masonry Units:
   1. Flat Acrylic: Two coats over block filler.
   2. Semi gloss, Acrylic Enamel: One coat over block filler.

C. New Gypsum Board:
   1. Flat Acrylic: Two coats over primer.
2. Eggshell Acrylic: Two coats over primer.

D. Existing Gypsum Board:
1. Flat Acrylic: Two top coats, patch and prime as required.
2. Eggshell Acrylic: Two top coats, patch and prime as required.
3. Semi gloss, Acrylic: Two top coat, patch and prime as required.

E. Wood Frame Standards – Sherwin Williams Promar 200 #2532; Submit paint finish schedule for each project, color samples and product cut sheets to Owner prior to the start of work:
1. Flat Acrylic (Ceilings): Two topcoats for existing ceilings – patch and spot prime as required. Two top coats over 100% primer for new ceilings.
2. Eggshell Acrylic (all rooms except Kitchen and Bathrooms): Two topcoats for existing ceilings and walls – patch and spot prime as required. Two top coats over 100% primer for new ceilings and walls.
3. Semi gloss Acrylic (Kitchens & Bathrooms): Two topcoats for existing ceilings and walls – patch and spot prime as required. Two top coats over 100% primer for new ceilings and walls.
4. Semi gloss Acrylic (Trim & Doors): Two topcoats for existing trim and doors – patch and spot prime as required. Two topcoats over 100% primer for new trim and doors.

F. Sprinkler Pipe:
1. Two top coats over primer

G. Existing Plaster:
1. Flat Acrylic: Two top coats, spot prime as required.
2. Eggshell / Velvet: Two top coats, spot prime as required.
3. Semi gloss, Acrylic Enamel: Two top coats, spot prime as required.

H. New Woodwork and Hardboard:
1. Semi gloss Acrylic Enamel: Two coats over primer.

I. Existing Wood Floors:
2. Satin finishes: Vermont Natural Coatings PolyWhey Floor Finish: Two finish coats.

J. Existing Woodwork and Hardboard:
1. Semi gloss Acrylic Enamel: Two finish coats, spot prime as required.

K. Stained Woodwork:
1. Alkyd-Based, Satin Varnish: Two coats over sealer and wood stain.
2. Waterborne, Satin Varnish: Two coats over sealer and waterborne wood stain.


4. Alkyd-Based Stain, Wax-Polished Finish: Two coats paste wax over sealer and wood stain.

L. Natural-Finish Woodwork:
   1. Alkyd-Based, Satin Varnish: Two coats over sealer.
   2. Waterborne, Satin Varnish: Two coats over sealer.
   4. Wax-Polished Finish: Two coats paste wax over sealer.

M. Ferrous Metal:
   1. Flat Acrylic: One coat over ferrous metal primer.
   2. Semi gloss, Acrylic Enamel: One coat over ferrous metal primer.
   3. Full-Gloss, Alkyd Enamel: One coat over ferrous metal primer.

N. Zinc-Coated Metal:
   1. Flat Acrylic: One coat over galvanized metal primer.
   2. Semi gloss, Acrylic Enamel: One coat over galvanized metal primer.

O. Center for the Arts
   1. Interior Walls
      a. Interior off-white latex (eggshell finish) used on sheet-rocked walls & interior non-metal surfaces. Pittsburgh base is # 6-411 w/ L-24, C-16, B-4, M-2, W-1Y (based on mixing one gallon). Two coats, patch and spot prime as required.

   2. Interior Metal Surfaces:
      a. Off-white acrylic/latex semi-gloss used for the interior doors & metal surfaces. Pittsburgh base is Pit-Tech DTM w/ the following colorants: B10, C-1Y4, L-16, M-6. Two coats.

   3. Exterior Metal Surfaces
      a. Off-white acrylic/latex gloss used for the exterior railing surfaces. Pittsburgh base is Pit-Tech DTM w/ the following colorants: B10, C-1Y4, L-16, M-6. Two coats.

   4. Exterior Metal Doors and Metal Enclosures:
      a. Pittsburgh base # 54-200 & the colorants are Pittsburgh standard custom formula # 4756. Two coats.
END OF SECTION 09910
SECTION 15325 – FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 General Requirements

A. The Fire Sprinkler Contractor (hereinafter referred to as “The Contractor”) shall furnish all labor, equipment and materials and perform all operations required to install complete fire protection sprinkler systems for Wesleyan University at the following locations:

1. 136 High Street
2. 35 Home Avenue
3. 37 Home Avenue
4. 27 Brainerd Avenue
5. 29 Miles Avenue
6. 34 Lawn Avenue
7. 200 College Street
8. 210 Cross Street
9. 73 Pearl Street

Each location shall be priced separately and the cost for each shall be identified in the appropriate space on the bid proposal form.

C. At the time of bid, all exceptions taken to, all variances from, and all substitutions of operating capabilities or equipment called for in these specifications shall be listed in writing and forwarded to the Project Manager. Any such exceptions, variances, or substitutions which were not listed at the time of bid and are identified in the submittal shall be grounds for disapproval without comment.

1.2 Quality Assurance

A. This specification identifies the essential performance requirements of the automatic fire sprinkler systems designed to protect the selected buildings at Wesleyan University. All equipment furnished and system configurations as installed shall meet or exceed the functional intent of this specification.

B. Sprinklers, valves, water flow alarms, and supervisory devices shall be Underwriters' Laboratories, Inc. (UL) listed or Factory Mutual Research Corporation (FM) approved.

C. All materials and equipment furnished and installed shall be new, unused and first class without defects; in continuous production and providing satisfactory service in commercial applications for at least one year; and designed to function properly in that portion of the work for which they are intended. Obsolete equipment shall not be used.

1.3 Scope of Work

A. The work covered by this specification includes the installation of a complete fire sprinkler system in various buildings on the Wesleyan University campus.
B. The Contractor shall provide all labor, materials, tools, equipment, supervision, services and testing required to provide complete, code compliant operating systems which interface properly with the fire alarm system (by others) and are acceptable in all respects to the authorities having jurisdiction.

C. It is the responsibility of the Contractor to visit the site, evaluate the existing conditions, perform calculations, create shop drawings, and determine both the quantities of materials required and suitable locations for sprinklers, piping, hangers, and seismic bracing supports in accordance with applicable codes and standards.

1.4 Qualifications of Bidders

A. The Contractor shall provide a statement of qualifications for both the company and the individual foreman assigned to this project in terms of installing fire sprinkler systems.

B. All Contractors shall document their record of complete, satisfactory installation of fire sprinkler systems.

1.5 Codes and Standards

A. The systems installed, without exception, shall comply with all applicable state and local codes, variances and regulations and shall be approved by the authorities having jurisdiction.

B. All equipment furnished shall be listed by Underwriters Laboratories, Inc., under the following applicable standards:

UL 193  Alarm valves for fire protection service
UL 260  Dry pipe and deluge valves for fire protection service
UL 312  Check valves for fire protection service
UL 753  Alarm accessories for automatic water supply control valves for fire protection service
UL 393  Indicating pressure gauges for fire protection service
UL 213  Rubber gasketed fittings for fire protection service
UL 1486 Quick opening devices for dry pipe valves for fire protection service
UL 199  Automatic sprinklers for fire protection service
UL 1091 Butterfly valves for fire protection service
UL 262  Gate valves for fire protection service
UL 203  Pipe hanger equipment for fire protection service
UL 203A Seismic bracing for fire protection service
UL 405  Fire department connections
UL 508  Industrial control equipment
UL 1479 Fire tests of through-penetration firestops

C. The following manufacturing standards and specification are applicable to fire sprinkler systems and are referenced within this specification.

ANSI/ASME B36.10M Welded and seamless wrought steel pipe
ANSI/ASME B1.20.1 Pipe threads, general purpose
ANSI/ASME B16.4  Cast iron threaded fittings

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ANSI/ASME B16.3  Malleable iron threaded fittings
ASTM A53  Standard specification for pipe, steel, black and hot-dipped, zinc-coated, welded, and seamless
ASTM A47  Specification for malleable iron castings
ASTM A135  Standard specification for electric-resistance welded steel pipe
ASTM A148  Specification for steel castings for high-strength, structural purposes
ASTM B633  Specification for electrodeposited coatings of zinc on iron and steel
ASTM A165  Specification for electrodeposited coatings of cadmium on steel
ASTM A536  Specification for ductile iron castings
ASTM A582  Specification for free-machining stainless and heat-resisting steel bars, hot-rolled or cold-finished
ASTM A795  Standard specification for black and hot-dipped zinc-coated (galvanized) welded and seamless steel pipe for fire protection use

D. If a UL Listing is unavailable, approval by Factory Mutual is acceptable.

E. Installation shall be made in accordance with the applicable provisions of the edition of the code or standard accepted by the local authority having jurisdiction. Applicable reference standards include:

- NFPA 13 *Installation of Sprinkler Systems*
- NFPA 13R *Installation of Sprinkler Systems in Residential Occupancies*
- NFPA 13D *Installation of Sprinkler Systems in One and Two Family Dwellings*
- NFPA 24 *Installation of Private Fire Service Mains*
- NFPA 70 *National Electric Code* (as amended by Connecticut codes)
- NFPA 72 *National Fire Alarm Code*

E. Equipment installation and acceptance testing shall be in accordance with the manufacturer's guidelines.

G. Systems shall be acceptance tested in accordance with the applicable provisions of the edition of the standards listed below which are accepted by the authority having jurisdiction:

- NFPA 13 *Installation of Sprinkler Systems*
- NFPA 13R *Installation of Sprinkler Systems in Residential Occupancies*
- NFPA 13D *Installation of Sprinkler Systems in One and Two Family Dwellings*
- NFPA 25 *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*
- NFPA 72 *National Fire Alarm Code*

1.6 Order of Precedence

A. Where conflicts arise from discrepancies between referenced documents, the more stringent requirement shall apply. Where the degree of stringency cannot be determined, discrepancies shall be resolved as follows:
1. State and local codes, variances and regulations shall take precedence over this specification.

2. The National Fire Protection Association standards shall take precedence over this specification.

3. This specification shall take precedence over any drawings.

1.7 Related Work

A. The Contractor shall coordinate work in this specification with all related trades.

B. The Contractor shall verify and coordinate the location of the water service with the site contractor. The water service supply line shall be 2". If a larger water service supply is required based on sprinkler calculations and pressure in the street, Sprinkler Contractor shall notify Owner promptly. Site Contractor shall provide and add/alternate cost for a 3” water service supply line.

C. The Contractor’s foreman shall participate in weekly project meetings with the Project Manager.

D. The Contractor shall seal all penetrations with a listed through-penetration seal system tested by a nationally recognized testing laboratory.

E. The Contractor shall be responsible for priming and painting all exposed sprinkler pipe and fittings upon completion of the installation.

F. The Contractor shall be responsible for patching, priming and painting all wall and ceiling areas that have been penetrated or disturbed due to the sprinkler piping installation.

1.8 Submittals

A. The Contractor shall submit to the Project Manager sufficient information to describe his/her qualifications, the work efforts to be performed, and the materials to be provided. The Contractor shall certify that he/she has reviewed the documentation to verify: dimensions; quantities; installation and fabrication techniques, procedures, and sequences; good workmanship and safety precautions; and that they are in conformance with this specification.

1. These reviews are not the responsibility of the Project Manager. The Project Manager will only review these documents for the limited purposes of checking for general compliance with the information provided in the contract documents and general conformance with the design concept of this part of the project, and not to determine accuracy or completeness of other details such as dimensions and quantities. The Project Manager will not approve means, methods or procedures of construction or installation nor will they review for safety precautions. Accuracy and process are the responsibility of the Contractor.

C. The Contractor shall submit to the Project Manager the names of all subcontractors and their qualifications, indicating years in business and prior experience with installations of this type, and includes the type of equipment and service that will be supplied.
D. The awarded Contractor shall submit three (3) copies of the following documents prior to performing any work:

1. A schedule indicating the installation sequence for all systems and equipment and the time frame required to complete each phase of the work. Projected dates of delivery of the equipment to be supplied, installation completion, demonstration test, and final test/acceptance dates shall be included.

2. Submittals shall include original manufacturer's specification and installation instruction sheets; sprinkler fabrication drawings and hydraulic calculations; piping, hangers and appurtenances; sprinkler heads and cabinets; backflow preventer; valves; seismic bracing. All equipment and devices on the shop drawings to be furnished under this contract shall be clearly marked in the specification sheets. If any equipment and/or devices required in the system are not so marked, the Project Manager will return the submittal for correction and clarification.

3. Shop drawings shall be prepared using AutoCAD or a compatible program that will open with AutoCAD version 2006. Contractor shall field measure all houses to create floor plans for each individual project location. Sprinkler layouts shall be designed based on existing field dimensions, layout conditions and identified Add-A-Bed locations.

4. Sufficient information shall be submitted so that the exact function of each installed device is known.

5. It is the responsibility of the contractor to determine how the pipe will be located and provide all required information for sizing the seismic braces in the shop drawing submittal. All seismic brace locations, based on actual field condition, shall be shown on the shop drawing.

E. The Contractor shall not order any equipment nor perform any installations prior to completion of review of the submittals by the Project Manager and receipt of written authority to proceed to the next milestone from the Owner.

PART 2 PRODUCTS

2.1 General Systems Descriptions

A. The new automatic fire sprinkler system shall be connected to the new water supply, starting at the flange connection inside the building. The system when completed shall include at least the following components:

1. A DEP approved and UL Listed double check valve backflow prevention device.
2. Alarm check valves and trim, and inspectors’ test stations.
3. Sprinklers of the temperature ratings and orifice sizes as required.
4. Sprinkler piping and fittings of the materials, schedules, types and configurations as specified herein and as required.
5. All other required system components as specified herein and as required per code.

6. All water flow alarms and supervisory switches and the electrical contacts required to connect them to the fire alarm control panel.

7. All core drilling, cutting, patching, sealing and painting required to install the system and restore floor, wall and ceiling penetrations to a sound, tight condition and neat appearance.

8. Fire department connection with fittings compatible with the equipment used by the local fire department.

2.2 Sprinkler Pipe, Fittings, Hangers, and Supports

A. General

1. All pipe, fittings, hangers, and supports shall be prepared and installed in accordance with all applicable requirements of NFPA 13, 13D and/or 13R, and the manufacturer's published installation instructions including: material, size, wall thickness, and joining methods.

**NOTE:** CPVC and PB Piping (plastic) materials shall not be used for any fire sprinkler projects on campus – no exceptions.

B. Steel Pipe

1. 2-1/2 inch nominal size and larger pipe shall be Schedule 10 steel pipe with roll grooved ends, UL Listed for use in fire protection systems and shall be 175 psi rated.

2. 2 inch nominal size and smaller piping shall be Schedule 40 pipe, UL Listed for use in fire protection systems and shall be 175 psi rated.

D. Fittings

1. Mechanical couplings for steel pipe: couplings shall consist of a one piece or multiple piece ductile iron (ASTM A536) or malleable iron (ASTM A47) cast housing, a synthetic rubber gasket or a central cavity pressure responsive design with the unit secured by nuts, bolts, locking toggle, or lugs.

2. Fittings for grooved steel sprinkler pipe: fittings shall be full flow designed to accept mechanical groove couplings. Fittings shall be cast iron (ASTM A536) alkyd enamel painted, zinc electroplated (ASTM B633) or cadmium plated (ASTM A165).


E. Hangers and Supports

2. Threaded pipe and fittings: provide at least one hanger for each pipe length greater than 5 feet. Maximum hanger spacing shall not exceed 10 feet for nominal pipe sizes 1-1/4 inches and smaller or 10 feet for nominal pipe sizes 1-1/2 through 6 inches.

3. Grooved pipe and fittings: where full linear movement is required for nominal pipe sizes from 2-1/2 through 4 inches provide one hanger for each 5 feet of pipe supported. For nominal pipe sizes of 6 and 8 inches, provide one hanger for each 10 feet of pipe supported.

F. Seismic Bracing

1. General: The requirements of NFPA 13, Section 4-14.4.3, Protection of Piping Against Damage Where Subject to Earthquakes shall govern.

2. Seismic bracing shall be provided for all sprinkler piping in the buildings for pipe greater than or equal to 2-1/2 inches in diameter. All feeder mains, regardless of size, shall be braced.

3. All seismic braces shall be listed for tension and compression service.

4. All braces shall utilize ordinary black steel piping as the prime support member.

5. Structural connection: All bracing shall be connected to the building’s structural members and all means of connection to the building’s structure and sprinkler pipe shall be listed for the intended use.

6. At a minimum, the bracing shall be provided per NFPA 13 requirements or per manufacturer’s recommendations.

G. Pipe Sleeves and Clearances

1. Proper clearances between penetrating sprinkler system piping, including drains and fire department connections, and any barrier shall be provided.

2. Piping passing through floors, walls, and ceilings shall be provided with steel pipe sleeves.

3. Fill the space between the pipe and the sleeve with a listed flexible 2 hour-rated fire stop system. See SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS.

2.3 Valves

A. General: Indicating type valves shall be OS&Y, UL Listed or FM Approved for fire protection systems.

1. Sizes 2-1/2 inches and larger: 175 psi rated, flanged ends.

2. 2 inches and smaller: 175 psi rated, screwed ends.

B. In lieu of 2 inches and smaller OS&Y gate valves at flow control stations, the Contractor may install Milwaukee Valve Co.’s grooved-end butterfly valve with factory installed internal tamper switch, UL Listed and FM approved.

C. Automatic Drain (Ball Drip) Valves: Bronze body (ASTM B584), steel inlet spring loaded ball mechanism with stainless steel or brass ball and beryllium copper spring.
D. Alarm Check Valves: UL listed and/or FM approved valves, with appropriate trim, 175 psi rated.

E. Check Valves: Butterfly type, wafer check valves; O-ring sealed clapper, torsion spring loaded, suitable for vertical or horizontal installation. Bronze seat rings (ASTM B584), aluminum bronze clappers (ASTM B148), EPDM O-ring seals, stainless steel hinge pins (ASTM A582), rated at 175 psi. Provide accessory kits for flange fittings as required; stud bolts and heavy hex nuts of carbon steel zinc, or cadmium plated.

F. Ball Valves: Standard port, end entry, 175 psi rated; bronze body, adjustable packing gland, reinforced Teflon seats, non-blowout stem design, chrome plated brass ball, cadmium plated vinyl insulated handle. When used for manual drains provide pressure gauge and inspector’s test plug at drains per NFPA 13R.

G. Air Vent and Release Valves: Cast iron body and cover primed with red oxide exterior primer, brass internal parts, stainless steel float and needle, 175 psi rated.

2.4 Automatic Sprinklers

A. Sprinklers of the temperature rating and orifice size as required by NFPA 13R shall be installed.

B. Provide a reserve supply cabinet of spot welded low carbon steel construction at least 0.042 inch thick, bright red enamel painted inside and out. Provide spare sprinklers and suitable sprinkler wrenches for each sprinkler type and temperature rating installed in the systems.

C. The Contractor shall coordinate and verify the cap color of all sprinklers specified as concealed sprinklers. Each area shall be coordinated with the Owner separately. The cap color shall be a factory-applied finish, meeting the requirements of the listing agency.

D. The Response Time Index (RTI) shall be supplied by the manufacturer for each sprinkler supplied. The Contractor shall supply this information to the Project Manager in the equipment submittal package.

2.5 Alarms and Supervisory Devices

A. General: Wherever monitor modules exist for the purpose of fire alarm supervision, the sprinkler Contractor shall connect the sprinkler system device to these modules.

B. Waterflow Detectors: Vane-type waterflow detectors designed for vertical or horizontal mounting. NEMA Type 1 enclosure; UL Listed and FM Approved.

C. Monitor switches for OS&Y Valves: Potter Electric model PCVS or approved equal with dual set of contacts; Plunger operated SPDT electrical switching device for supervision of the open position of OS&Y gate valves. UL and FM Approved; NEMA type 2 drip tight indoor rated housing.

PART 3 EXECUTION

3.1 Installation

A. The Contractor shall provide and install all required equipment and accessories necessary for the proper operation of the system. The entire system shall be installed in a workman-like manner and all work shall be performed in accordance with the best and most modern practices of the trade. The final installation shall present a neat appearance.
B. The Contractor shall coordinate the work of this specification with all related work of other trades.

C. Piping Installation
   1. The Contractor shall place pipe runs to minimize obstruction to other work.
   2. The Contractor shall, where possible, center sprinklers in ceiling tiles or, at a minimum, align all sprinklers in each space or area.
   3. The Contractor shall install all piping in accordance with applicable provisions of NFPA 13, NFPA 13R or NFPA 13D.
   4. The Contractor shall remove all burrs and ream all pipe and tube ends to full inside diameter.
   5. The Contractor shall remove all scale and foreign matter from the inside and the outside of all pipe and apply joint compound or tape to all threaded pipe ends.
   6. The Contractor shall install mechanical grooved systems in full accord with the manufacturer's instructions.
   7. The Contractor shall not permit piping to penetrate building structural members.
   8. All pipe shall be properly pitched in order to drain.

D. Valve Installation
   1. The Contractor shall install all valves with stems upright or horizontal; not inverted.
   2. The Contractor shall provide drain valves at main shut-off valves, at all piping low points and at all apparatus.

3.2 Scheduling
   A. The Contractor shall, each week, provide a revised schedule indicating the work remaining to be done and the estimated time required to complete the work.

3.3 Final Acceptance Tests
   A. At the time as-built drawings and manuals are submitted, the Contractor shall submit a test plan which shall describe how the system will be acceptance tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be employed. The tests shall demonstrate that the operating and installation requirements of this specification have been met.
   B. A pre-final test shall be conducted to verify proper system operation prior to final acceptance testing to be witnessed by the Fire Department. This pre-test shall include all of the same functions specified for the final acceptance test.
   C. Before the fire suppression systems installations are considered complete and acceptable to the Owner and the authority having jurisdiction, acceptance tests shall be conducted on the systems by the Contractor's job foreman in the presence of representatives of the Owner and the fire department. The fire department shall receive notification of the date and time of the tests at least one week prior to the test date.
D. The Contractor shall provide all personnel and equipment required to conduct the tests.

E. The Contractor shall perform the following tests:
   1. A two hour hydrostatic test at 200 psi, or as recommended by manufacturer, of all fire sprinkler and standpipe piping in accordance with NFPA 13, 13R or 13D.
   2. Main drain tests, inspectors tests (of the water flow alarms) and dry pipe valve trip tests.

F. Upon completion of the tests, the Contractor shall leave the fire sprinkler systems in full working order and, without additional expense to the Owner, shall replace any defective materials, devices, or equipment provided by him under this contract within one (1) year from the date of final systems acceptance by the Owner.

3.4 As-Built Drawings

A. The Contractor shall submit a complete set of as-built drawings to the Project Manager. The Project Manager will only review these drawings for the limited purpose of checking for general compliance with accepted drawing practices and conformance with the design concept and not to determine accuracy or completeness of the design. If for any reason at the discretion of Project Manager the drawings must be resubmitted, the Contractor will correct the drawings at no charge and retention will not be released until corrections are complete.

B. Once the drawings are returned with “No Exceptions Taken” the Contractor shall deliver a complete set of reproducible as-built drawings, two (2) print copies and a AutoCAD disk of the as-built drawings to the Owner upon completion of the system. The AutoCAD drawings shall be compatible with AutoCAD version 2006.

3.5 Training Requirements

A. Prior to final acceptance, the Contractor shall provide operation training to each shift of the Owner's personnel. Each training session shall be of duration acceptable to the Owner, and shall be conducted on shift or at a time acceptable to the Owner. Each session shall include an overview of the system and the devices connected to it, emergency procedures, and safety requirements. Each session shall include a complete demonstration of the system. Dates and times of each training period shall be coordinated through the Owner, not less than two (2) weeks prior to the training session.

3.6 Operating Instructions

A. The Contractor shall provide Operating and User Instruction Manuals prior to testing of the system. Two (2) complete sets of operating and instruction manuals shall be delivered to the Owner upon completion.

3.7 Testing Instructions

A. Upon completion of the installation, the Contractor shall deliver to the Owner complete, simple, comprehensive, step-by-step testing instructions giving recommended and required testing frequency of all equipment, and methods for testing each individual piece of equipment.
1. At a minimum, the instructions must include all applicable sections of NFPA 25 and any relevant information provided by the equipment manufacturer.

3.8 Maintenance Instructions

A. Prior to final acceptance, the Contractor shall provide two (2) complete sets of maintenance instructions to the Owner.

B. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:

1. Applicable sections of NFPA 25 covering maintenance of automatic sprinkler systems, deluge systems, and fire department standpipe and hose systems.

2. Maintenance instructions provided by manufacturers of the equipment and devices installed.

3.9 One Year Maintenance Contract

A. The Contractor shall include as an alternate, a one (1) year maintenance proposal covering the automatic fire sprinkler system and the fire department standpipe system. Inspection, testing, and maintenance shall be carried out in accordance with the applicable provisions of NFPA 25.

B. The proposal shall include quarterly test/inspections for the entire system including the backflow preventer; the preparation and submittal of required test reports to local authorities and the payment of all fees associated with the filing of such reports; and required service, maintenance, and adjustment to systems components and equipment.

C. The proposal shall include coordination with the fire alarm company and the City of Middletown Alarm Division with respect to the required testing of waterflow alarm and supervisory signals for control valves.

3.1 Warranty

A. The Contractor shall warrant all systems components and equipment free from defects in materials and workmanship for a period of one (1) year from the date of final systems acceptance by the Owner and the authority having jurisdiction.

END OF SECTION 15325
SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, Samples

B. Coordinate Arrangement, Mounting, and Support of Electrical Equipment:
   1. Allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. Provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. Allow right of way for piping and conduit installed at required slope.
   4. Ensure that connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 RACEWAYS AND CONDUCTORS

A. Raceways:
   1. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
   2. FMC: Zinc-coated steel.
   3. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
   4. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
   5. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
   6. Raceway Fittings: Specifically designed for raceway type used in Project.

B. Conductors:
   1. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
   2. Conductors, Larger Than No. 10 AWG: Stranded copper.
   3. Insulation: Thermoplastic, rated at 75 deg C minimum.
   4. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.
2.2 ELECTRICAL IDENTIFICATION MATERIALS

A. Raceway Identification Materials:
   1. Snap-around, color-coding bands; flexible, pre-printed, color-coded acrylic.

B. Conductor Identification Materials:

C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, polyethylene tape with continuous metallic strip or core.

D. Tape Markers for Wire: Vinyl, self-adhesive, wraparound type with pre-printed numbers and letters.

E. Warning Labels and Signs: Baked-enamel, pre-printed signs, punched or drilled for fasteners; with colors, legend, and size required for application.

F. Equipment Identification Labels: Engraved, laminated acrylic or melamine label; punched or drilled for screw mounting. White letters on a dark-gray background; red letters for emergency systems.

  1. Fasteners: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.3 SUPPORT AND ANCHORAGE COMPONENTS

A. Steel Slotted Support Systems: MFMA-3, factory-fabricated components for field assembly.

B. Raceway and Cable Supports: As described in NECA 1.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and fittings.

D. Pipe Sleeves: Schedule 40, galvanized steel, plain ends.

E. Mounting, Anchoring, and Attachment Components:

  2. Expansion Anchors: Steel, insert-wedge type, for use in concrete.
  3. Concrete Inserts: Steel or malleable-iron slotted-support-system units.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, high strength; comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.

2.4 SEISMIC-RESTRAINT COMPONENTS
A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.
   1. Seismic Mountings, Anchors, and Attachments: Select to resist seismic forces.
   2. Hanger Rod Stiffener: Steel slotted-channel support clamped to hanger rod.

D. Sleeve Seals: Modular, to fill annular space between sleeve and raceway or cable; EPDM interlocking links with pressure plates, and connecting bolts and nuts.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Sleeve and Sleeve Seals: Use type and number of sealing elements recommended by manufacturer; comply with NECA 1.

B. Woodframe bedrooms: Circuit breakers shall be 20 amp, arc fault. Maximum 2 receptacles per breaker.

C. Kitchens/Bathrooms/Dining Rooms: Circuit breakers shall be 20 amp, receptacles shall be GFI.

3.2 RACEWAY APPLICATION

A. Outdoor Installations:
   1. Exposed or Concealed: IMC.
   2. Underground, Single Run: RNC.
   3. Connection to Vibrating Equipment: LFMC.
   4. Boxes and Enclosures: Metallic, NEMA 250, Type 3R or Type 4.

B. Indoor Installations:
   1. Exposed or Concealed: EMT.
   2. Connection to Vibrating Equipment: FMC; in wet or damp locations, use LFMC.
   3. Damp or Wet Locations: IMC.
   4. Boxes and Enclosures: Metallic, NEMA 250, Type 1, unless otherwise indicated.
3.3 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

C. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch thick concrete cover.
   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   2. Space raceways laterally to prevent voids in concrete.
   3. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
   4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

D. Install pull wires in empty raceways.

E. Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent.

F. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch maximum length of flexible conduit. Install LFMC in wet or damp locations.

3.4 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Type THHN/THWN insulated conductors in raceway.

B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Metal-clad cable where concealed in ceilings and gypsum board partitions.

E. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Armored or nonmetallic sheathed cable where permitted by authorities having jurisdiction and where concealed in ceilings and gypsum board partitions.

F. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.5 APPLICATION OF IDENTIFICATION MATERIALS
A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive color coding tape-in bands:

1. Fire Alarm System: Red.
3. Telecommunication System: Green and yellow.

B. Power-Circuit Conductor Identification: For No. 3 AWG conductors and larger, at each location where observable, identify phase using color-coding conductor tape.

C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.

D. Warning Labels for Enclosures for Power and Lighting: Comply with 29 CFR 1910.145; identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

E. Equipment Identification Labels:

1. Labeling Instructions: Provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label.
2. Equipment to Be Labeled:
   a. Panelboards.
   b. Electrical switchboards.
   c. Transformers.
   d. Motor starters.
   e. Push-button stations.
   f. Contactors.
   g. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
      1) Data Outlets shall be Hubbel

3.6 INSTALLATION OF IDENTIFICATION MATERIALS

A. Verify identity of each item before installing identification products.

B. System Identification Color Banding for Raceways and Cables: At 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

C. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Ungrounded service, feeder, and branch-circuit conductors.

1. 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

2. 480/277-V Circuits:
b. Phase B: Orange.
c. Phase C: Yellow.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points.

D. Underground-Line Warning Tape: Continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade.

3.7 INSTALLATION OF SUPPORTS

A. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.

B. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.8 SEISMIC REQUIREMENTS

A. Installation Of Seismic-Restraint Components:

1. Install bushing assemblies for anchor bolts for wall- and floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in substrate.

2. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

B. Accommodation of Differential Seismic Motion: Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element than the one supporting them as they approach equipment.

3.9 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION 16050
SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Division 1 - General Requirements is made a part of this section.

B. Submittals: Product Data, Samples.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 DEVICES

A. General: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Color: Ivory, Brown, Gray, or White. Submit color options to Owner for review and final color selection for each project.

C. Receptacles: Heavy or General-Duty grade, NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498 depending upon service and code requirements or as noted on the drawings or scope of work.

D. Ground-Fault Circuit Interrupter Receptacles: GFCI with integral duplex receptacle complying with UL 498 and UL 943; for installation in a 2-3/4-inch- deep outlet box without an adapter.

E. Arc-Fault Circuit Interrupter Breakers: To be installed for all circuits feeding the bedrooms in accordance with the requirements outlined in the National Electric Code.

F. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.

2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.

3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

G. Automatic Wall Switch (motion sensors)

1. Shall be installed in all common corridors and at top of stairs were fixtures are installed.

2. Products:
a. The Wattstopper – Model shall be selected based on location and appropriate function (ceiling or wall mounted as required);
b. Model #WS-200, CW-100, CI-200, DT 200, DT 300 and as approved by Owner (www.wattstopper.com).  

H. Wall Plates, Finished Areas: Smooth, high-impact thermoplastic, Ribbed plastic, Satin-finish stainless steel, Brushed brass, lacquered or Polished brass, lacquered; fastened with metal screws having heads matching plate color. Submit color options to Owner for review and final color selection for each project.

I. Wall Plates, Unfinished Areas: Smooth, high-impact thermoplastic with metal screws.

J. Wall Plates, Wet Locations: Thermoplastic or Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet locations. Submit options to Owner for review and final approval.

K. Floor Service Fittings
   1. Modular, flush-type, dual-service units suitable for wiring method used.
   2. Service Plate: Rectangular or Round, die-cast aluminum with satin finish. Review options with Owner for final approval.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb, level, and square with building lines.

B. Install unshared neutral conductors on line and load side of dimmers.

C. Mount devices flush, with long dimension vertical, and grounding terminal of receptacles on top, unless otherwise indicated. Group adjacent devices under single, multi-gang wall plates.

D. Install in entry halls and common corridor fixtures. May require installation of 2 units to provide sufficient coverage.

END OF SECTION 16140
SECTION 16722: BUTTERFIELD C - ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections:

1. Division 01 General Requirements
2. Division 07 Thermal and Moisture Protection, Section 078413 Penetration Firestopping
3. Division 08 Openings, Section 087100 Door Hardware
4. Division 21 Fire Suppression
5. Division 23 Heating Ventilating and Air Conditioning Monitoring & Control (HVAC).
6. Division 26 Electrical, Section 260500 Common Work Results for Electrical

1.02 SUMMARY

A. Section Includes:

1. This specification describes an addressable Fire Detection and alarm signaling system. The control panel shall be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.

2. The system shall be in full compliance with National and Local Codes.

3. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.

4. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years.

5. The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.

6. In the interest of job coordination and responsibilities the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests, and shall be capable of providing a “UL Listing Certificate” for the complete system.
7. The system specified shall be that of Siemens Fire Safety or Notifier which meets the project requirements.

1.03 ALLOWANCES

A. Specify products and work included in this Section that are covered by cash or quantity allowance. Do not include amounts. Insert descriptions of items in Part 2 or 3 to provide information affecting the cost of the Work that is not included under the allowance.

1.04 DEFINITIONS

A. ASME: American Society of Mechanical Engineers
B. FACP: Fire alarm control panel.
C. FM: FM Global (Factory Mutual)
D. Furnish: To supply the stated equipment or materials.
E. Install: To set in position and connect or adjust for use.
F. LED: Light-emitting diode.
G. NCC: Network Command Center
H. NFPA: National Fire Protection Association. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
J. Provide: To furnish and install the stated equipment or materials.
K. UL: Underwriters Laboratories

1.05 SYSTEM DESCRIPTION

A. Basic FireFinder XLS System - The system shall be a complete, electrically supervised fire detection and notification system, with a microprocessor based operating system having the following capabilities, features, and capacities:


2. The control panel shall allow control and monitoring from a wireless handheld display device during maintenance, inspection and trouble shooting tasks
   a. The control panel shall allow complete control and monitoring from a wireless handheld display device during one-man testing of the system
   b. Testing supported should be real smoke testing of devices, automatically logged and made available in NFPA format reports. Manual test entries will not be accepted.
3. System shall provide an output port for monitoring purposes by external systems. Communications to an external system shall be RS-232 or RS-485 communications.

4. A single node or system shall support at least 50 remote transponders

5. The local system shall provide status indicators and control switches for all of the following functions:
   a. Audible and visual notification alarm circuit zone control.
   b. Status indicators for sprinkler system water-flow and valve supervisory devices.
   c. Any additional status or control functions as indicated on the drawings, including but not limited to; emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.
   d. The system shall be listed by UL for configuration as an approved release system for deluge or preaction sprinkler systems and clean agent fire extinguishing systems.

6. The system shall be UL 1076 listed for monitoring and reporting security System Zoning.

7. Each intelligent addressable device or conventional zone on the system shall be displayed at the Central Alarm Receiving Terminal and the local fire alarm control panel by a unique alphanumeric label identifying its location.

B. FireFinder XLS with Digital Voice Evacuation - The system shall be complete, electrically supervised fire detection and evacuation system using one way communication and Firefighters telephone and smoke control systems with microprocessor based operating system having the following capabilities, features and capacities:

1. Voice amplification shall be supervised and backed up with like amplifiers. Back up shall be one for one. Backup amplifiers shall not share components and must be fully stand-alone.

2. Amplifiers shall be rated for 25V or 70.7V RMS, 40 watts.

3. Amplifiers shall be rated for 25V or 70.7V RMS, 180 watts.

4. Amplifiers shall be sized as minimum, to accommodate speakers in corridors at 2 watts and other locations 1 watt.

5. The system shall have the capability to support Peer-to-Peer or Master-Slave network and voice configurations.

6. Multiple nodes shall provide peer-to-peer voice capability in order to eliminate a single point of failure.

7. Audio shall be synchronized between nodes in order to take into account common areas.

8. The network, audio, and telephone risers between nodes shall be copper and support Class A loop configuration to allow communication to continue in the event of a fault.
9. Speakers shall have the ability to play coded audio tones.

10. The system shall provide status indicators and control switches for all of the following functions:
    a. Firefighters' override functions controlling smoke management.
    b. Audible and visual notification alarm circuit zone control.
    c. Two-way firefighters' telephone communications circuit zone control.
    d. Speaker circuit zone control.
    e. Status indicators for sprinkler system water flow and valve supervisory devices.
    f. Any additional status or control functions as indicated on the drawings, including but not limited to emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.
    g. NFPA 2001 for Clean Agent Extinguishing Systems.

1.06 PERFORMANCE REQUIREMENTS

   A. General Performance: Comply with NFPA 72 and all contract documents and specification requirements.

   B. All interconnections between this system and the monitoring system shall be arranged so that the entire system can be UL-Certificated.

   C. System shall be a complete, supervised, non-coded, addressable multiplex fire alarm system conforming to NFPA 72.

   D. The system shall have Style 4 circuits for each floor. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until all initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal.

   E. The system shall provide the following functions and operating features:

   1. The FACP and auxiliary power panels shall provide power, annunciation, supervision and control for the system.

   2. Provide Class B initiating device circuits.

   3. Provide Class B notification appliance circuits. Arrange circuits to allow individual, selective, and all-call voice and visual notification by zone. Notification Appliance circuits shall be zoned to correspond with the building fire barriers and other building features.

   4. Stair-towers: Each Stair-tower NAC shall be separately zoned

   5. Strobes shall be synchronized throughout the entire building.
6. If a voice evacuation system is specified, the system amplifiers shall be configured as distributed, bulk, or a combination of distributed and bulk audio. If necessary, convenience paging and/or background music shall be available via UL-listed speakers.

7. Provide 8 channel for live and recorded voice messaging.

8. Provide 2 channel for live and recorded voice messaging.

9. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.

F. The system shall provide a field test function where one person can test the complete system or a specific area while maintaining full operational function of other areas not being tested. Alarms, supervisory signals, trouble signals shall be logged on the system printer and in system history during the walk-test.

G. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

H. Fire alarm signal initiation shall be by one or more of the following devices:

1. Manual pull station
2. Heat detector
3. FirePrint® Addressable area smoke detector
4. Duct smoke detector
5. Projected beam detector
6. Automatic sprinkler system water flow switch.

I. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications at all network Person Machine Interfaces using basic graphics and multiple detail screens.

1. Fire Alarm Condition:
   a. Sound an audible alarm and display a custom screen/message defining the building in alarm and the specific alarm point initiating the alarm in a graphic display.
   b. Log into the system history archives all activity pertaining to the alarm condition.
   c. Print alarm condition on system printer.
   d. Sound the ANSI 117-1 signal with synchronized audibles and synchronized strobes throughout the facility.
   e. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.
f. A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.

g. Activation of any smoke detector in a single elevator lobby or an elevator equipment room shall, in addition to the actions described, cause the recall of that bank of elevators to the 1st floor and the lockout of controls. In the event of recall initiation by a detector in the first floor lobby, the recall shall be to the alternate floor as determined by the AHJ.

h. Where indicated on drawings heat detectors in elevator shaft and machine rooms shall activate an elevator power shunt trip breaker. The heat detectors shall be rated at a temperature below the ratings of the sprinkler heads in respective locations to insure that the power shall be shut off before activation of sprinkler system.

i. System operated duct detectors as per local requirements shall accomplish HVAC shut down.

j. Door closure devices shall operate by floor or by local requirements.

2. Additional system operation for Fire Alarm Condition for Voice:

a. Sound a pre-announce tone followed by a field programmable digitized custom evacuation message, on the floor of alarm, the floor below and the floor above. The visual signals shall operate in a similar pattern.

b. A simultaneous message shall be delivered via all alarm speakers installed on the remaining floors indicating the requirement for occupants of these floors to remain alert for further instructions.

c. A simultaneous message shall be delivered via all alarm speakers installed in stairways and elevators informing occupants of the imminent shutdown of elevator circuits and the expected high traffic load in the stairwells.

d. An automatic announcement or tone evacuation signal shall be capable of interruption by the operation of the system microphone to give voice evacuation instructions overriding the pre-programmed sequences.

e. Status lights next to speaker selection switches on the control panel shall indicate speaker circuit selection.

f. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmed to flash until system reset or alarm silencing, as required by the AHJ.

3. Supervisory Condition:

a. Display the origin of the supervisory condition report at the local fire alarm control panel graphic LCD display.

b. Activate supervisory audible and dedicated visual signal.
c. Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.

d. Record within system history the initiating device and time of occurrence of the event.

e. Print supervisory condition to system printer.

4. Trouble Condition

a. Display at the local fire alarm control panel graphic LCD display, the origin of the trouble condition report.

b. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.

c. Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.

d. Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not preclude the logging of trouble events to the historical file.

e. Trouble reports for primary system power failure to the master control shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.

f. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

g. Print trouble condition to system printer.

1.07 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Complete manufacturer’s catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.

B. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement. Provide the following supporting information:

1. Supervisory power requirements for all equipment.

2. Alarm power requirements for all equipment.
3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.

4. Voltage drop calculations for wiring runs demonstrating worst-case condition.

5. NAC circuit design shall incorporate a 15% spare capacity for future expansion.

C. Submit manufacturer’s requirements for testing Device Loop Card circuits and device addresses prior to connecting to control panel. At a minimum the following tests shall be required; device address, the usage (Alarm, Supervisory etc), environmental compensation, temperature ratings for thermal detectors and smoke detector sensitivities. This requirement shall need approval before any wiring is connected to the control panel.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

3. Complete drawings covering the following shall be submitted by the contractor for the proposed system:
   a. Floor plans in a CAD compatible format at a scale of 1/8”=1'-0" showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
   b. Provide a fire alarm system function matrix as referenced by NFPA 72, Figure A-7-5.2.2 (9). Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.

4. Installation drawings shop drawings, and as-built drawings shall be prepared by an individual experienced with the work specified herein.

5. Incomplete submittals shall be returned without review, unless with prior approval of the Engineer.

E. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Light fixtures.

2. HVAC registers

3. Fire protection equipment interfaces

4. Special suppression system interfaces

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F. Qualification Data: For qualified Installer, Applicator, manufacturer, fabricator, professional engineer, testing agency, and factory-authorized service representative.

G. Source quality-control reports.

H. Field quality-control reports.

I. Operation and Maintenance Data: For all fire alarm equipment, to include in operation and maintenance manuals.

J. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

K. Warranty: Sample of special warranty.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

1. FM Global (Factory Mutual (FM)):FM Approval Guide

2. National Fire Protection Association (NFPA)
   a. NFPA 70 National Electrical Code
   b. NFPA 72 National Fire Alarm Code
   c. NFPA 90A Standard For The Installation of Air Conditioning and Ventilating Systems

   a. UL Fire Protection Equipment Directory
   b. UL Electrical Construction Materials Directory
   c. UL 38 – Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems
d. UL 228 – Door Holding Devices

e. UL 268 - Smoke Detectors for Fire Protective Signaling Systems

f. UL 268A - Smoke Detectors for Duct Application


g. UL 464 - Audible Signal Appliances

h. UL 497A – Secondary Protectors for Communications Circuits

i. UL 521 - Heat Detectors for Fire Protective Signaling Systems

j. UL 864 - Control Units for Fire Protective Signaling Systems

k. UL 1076 – Security

l. UL 1283 – Electromagnetic Interference Filters

m. UL 1449 - Transient Voltage Surge Suppressors

n. UL 1480 - Speakers for Fire Protective Signaling Systems

o. UL 1971 - Signaling Devices for the Hearing Impaired

4. Underwriters Laboratories Canada (ULC)

5. International Code Council

   a. International Building Code


6. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.

7. California State Fire Marshal

8. NY-MEA

9. ISO 9002

B. Supplier Qualifications

1. Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State if required by law.

2. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation and maintenance.
3. The supplies shall furnish evidence they have an experienced service organization, which carries a stock of spare and repair parts for the system being furnished.

4. The equipment supplier shall be authorized and trained by the manufacturer to calculate, design, install, test, and maintain the air sampling system and shall be able to produce a certificate stating such upon request.

C. Installer Qualifications:

1. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified.

2. The contractor shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.

3. The contractor shall employ on staff a minimum of one NICET level II technician or a professional engineer, registered in the State of the installation.

4. The contractor shall be qualified by UL for certifying fire alarm systems. Upon completion of the installation the contractor shall certify the final system meets UL ongoing maintenance.

D. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required qualified testing agency, and marked for intended location and application.

E. Pre-installation Conference: Conduct conference at Project site.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers’ labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.10 PROJECT CONDITIONS

A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.

B. Environmental Limitations: Do not deliver or install products or materials until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire alarm equipment that fail(s) in materials or workmanship within specified warranty period.
1. Warranty Period: 1 year from date of Substantial Completion.

1.12 SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for 1 year.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.13 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements all equipment shall be provided by Siemens Industry, Inc. 106 Sebethe Drive, Cromwell, CT.

2.02 CONTROL PANEL

A. The fire alarm control panel shall be microprocessor based using multiple microprocessors throughout the system providing rapid processing of smoke detector and other initiation device information to control system output functions.

B. There shall be a watchdog circuit, which shall verify the system processors and the software program. Problems with either the processors or the system program the panel shall activate a trouble signal, and reset the panel.

C. The system modules shall communicate with an RS 485 network communications protocol. All module wiring shall be to terminal blocks, which will plug into the system card cage. The control panel shall be capable of expansion via up to 100 SLC’s. Maximum system capacity shall be at least 2500 intelligent initiation devices.

D. The system shall be capable of supporting unshielded wiring applications.

E. System Components:

1. The Device Loop Card (DLC) shall be capable of 252 intelligent devices distributed between two SLC circuits. Any trouble on one circuit shall not affect the other circuit. This module controls the signaling from the initiation devices reporting alarms and troubles to the control panel. This module shall also provide the signaling to the field devices for the controlling the output of specific initiation devices. The on board microprocessor provides the DLC with the ability to function even if the main
The microprocessor fails. LED’s on the board shall provide annunciation for the following; Power, Card Failure, Network Failure, Gnd. Fault, Alarm, Trouble, Short Zone 1, Short Zone 2, Style 6 Open Zone 1, Style 6 Open Zone 2. This card shall plug into the system card cage. The card shall be model number DLC. [***circuit shall be capable of either input or output devices on any address without limitations. You can split the SLC in any ration while maintaining short circuit isolation between the two legs of the circuit***]

2. The Signal Line Circuits (SLC) shall be tested for opens, shorts and communications with all addressable devices installed before connection to the control panel. Systems without this capability shall have a test panel installed for initial testing to eliminate any possible damage short term or long term to the control panel. After initial testing replace the test panel and proceed with complete testing.

3. The Person Machine Interface (PMI) shall provide the system information on ¼ VGA monochrome LCD, with Touch Screen and LED display. Graphic user interface shall be menu driven with 4 tabs showing the level and the total events for each tab. The tabs shall be; Alarm, Supervisory, Trouble and Security. At least 5 events shall be shown simultaneously with two full lines of text message for each event. Each event shall have a 32 character custom message describing the event’s location. In addition, the time stamp and category of the event (ie. Smoke, Water flow, Manual, etc) shall be displayed. When configured for Canadian operation, nine events shall be displayed simultaneously. The LED displays shall indicate Power, Audibles On or Silenced, and Partial System Disabled. Systems not having the above LED’s shall provide separate LED’s within the control panel enclosure with appropriate labels. Selection buttons shall be backlit to aid the operator in the selection process. There shall be controls for scrolling throughout the event list. A button shall provide zoom in zoom out for the amount of information desired for a specific entry. The PMI shall be capable of monitoring the power supply loading and show available capacity for future expansion planning. The PMI shall provide a More Info button that can display addition device information such as the device type and device address. This More Info shall also have the ability to display a detailed screen that provides the following:

a. 200 character custom message associated with the group of the device

b. NFPA symbols representing fire service equipment in the area

c. NFPA symbols representing hazards in the area

d. NFPA symbols representing people in the area

e. Number of devices in the associated group that are in alarm

f. Name and phone number of emergency contact

4. The PMI shall also have the ability to display a bitmap of a floor plan showing a “You are Here” symbol to tell the responding person exactly where they are in the building in relation to the event. Systems without this type of display shall supply a UL listed Graphics package with their system. The LCD shall have a keyboard screen to allow the technician ability to enter test and numbers for passwords or text changes. The PMI shall also have a Context Sensitive Help button. A globally configured PMI shall have the ability to view events, acknowledge, silence and reset networked FireFinder XLS and
MXL systems. A globally configured PMI shall also have the ability to arm and disarm input and output points on FireFinder XLSs and MXLs. A globally configured PMI shall have the ability to be configured for control of the entire network, control of the local FireFinder XLS, or annunciation only. In a networked configuration, the Partial System Disable LED shall be indicative of all networked FireFinder XLSs. A globally configured PMI in a networked configuration shall have the ability to store 6 maps for every FireFinder XLS panel. At least 10 globally configured PMIs shall be supported in a network. The module shall be model number PMI.

5. The PMI International (PMI-INT) shall provide Spanish, Portuguese or Canadian overlays. The PMI-INT or PMI shall have the ability to be configured display text in Spanish, Portuguese, Hebrew or French while having the ability to swap in English text at anytime by a simple button press at the panel. Printers shall also have the ability to be configured for Spanish, Portuguese or French.

6. The System Status Display (SSD) shall provide a remote LED/LCD display that shows the local status of a FireFinder XLS system. An LED shall illuminate when alarm, supervisory, trouble and security events occur on the system. The SSD shall consist of a LCD display that has four lines of forty characters each that provides details of the event in alphanumeric form. The SSD-C and SSD-C-REM shall have three additional control buttons for acknowledging events, silencing audible circuits, and resetting the system. The SSD-C shall have an integral keyswitch that enables these control buttons to operate. The SSD-C-REM shall have the ability to be located within a locked cabinet, so no additional keyswitch is required for enabling the control buttons. The SSD and SSD-C shall be mountable in a 2-gang electrical box or 4-inch square electrical box. The SSD-C-REM shall be mountable in a model REMBOX2 or REMBOX4 Remote Lobby Enclosure.

7. The Zone Indicating Card (ZIC-4A) shall contain 4 NAC circuits rated at 4 amps each with power-limited outputs. The zone inputs for the card shall be isolated and independently supervised. There shall be at least 3 unique codes/signals for each circuit based on system logic. These signals shall be Temporal Code 3 (Evacuation), Steady (Such as “Recall”), and Alert (Such as “Tornado Alert”). The card shall be listed for notification appliances, horns, bells, strobes, and speakers. The card shall also be listed for NFPA 13 Pre-Action Release, Halon 1301, FM200, Lease Line, and Municipal Tie. The card shall have the ability to wire the circuits Style Y or Style Z with outputs synchronized. The card shall have the following LED’s to provide trouble shooting and annunciation; Power, Card Failure, Network Failure, Gnd. Fault, Zone Activation or Trouble. This card shall plug into the system card cage. The card shall be model number ZIC-4A.

8. The Zone Indicating Card (ZIC-8B) shall contain 8 NAC circuits rated at 2 amps each with power-limited outputs. The zone inputs for the card shall be isolated and independently supervised. There shall be at least 3 unique codes/signals for each circuit based on system logic. These signals shall be Temporal Code 3 (Evacuation), Steady (Such as “Recall”), and Alert (Such as “Tornado Alert”). The card shall be listed for notification appliances, horns, bells, strobes, and speakers. The card shall have the ability to wire the circuits Class B with outputs synchronized. The card shall have the following LED’s to provide trouble shooting and annunciation; Power, Card Failure, Network Failure, Gnd. Fault, Zone Activation or Trouble. This card shall plug into the system card cage. The card shall be model number ZIC-8B.
9. The Control Relay Card (CRC) shall contain 6 fully programmable relays each rated at 4A, 30VDC/120VAC resistive and 3.5A, 120VAC 0.6 PF inductive. The card shall have the following LED’s to provide trouble shooting and annunciation; Power, Card Fail, HNET Fail, Relay 1 Active, Relay 2 Active, Relay 3 Active, Relay 4 Active, Relay 5 Active, Relay 6 Active. The card shall be model number CRC-6.

10. The system card cage shall provide the mounting of all system cards, field wiring, and panel’s inter-card wiring. All power limited field wiring shall connect to the top of the card cage. All non-power limited internal wiring shall be connected to the bottom of the card cage. The card cage shall hold the systems cards and have capability of connecting multiple card cages to meet system demands. All terminal blocks are removable. The card cage shall be model number CC-2 or CC-5.

11. The Remote Printer Module (RPM) shall provide a means for connecting FireFinder XLS system to a serial or parallel printer for creating a hard copy of system status and configuration reports. The RPM shall also provide a Foreign System Interface (FSI) output port that can be configured to communicate with external systems, such as Building Management Systems. The RPM shall consist of two RS-232 (serial) ports and a single parallel port allowing connection to a parallel printer (such as the PAL-1). The FSI serial port shall have the ability to be configured as RS-232 or RS-485.

12. The Internal Thermal Strip Printer (TSP-40A) shall act as an event logging device providing a permanent history report of all system activity. It shall also provide various system status reports that include detector sensitivities, thresholds, device types and custom messages. It shall mount in the FireFinder XLS CAB1, CAB2 or CAB3 enclosure and its printout is visible through a window in the locked enclosure door. Printouts shall be automatically spooled on a take-up reel for easy record storage. The module shall be model number TSP-40A.

13. The Supervised Input Module (SIM-16) shall provide sixteen input circuits for remote system monitoring. Each input shall have the ability to be individually programmed as supervised (dry contact only) or unsupervised (general purpose input). The SIM-16 shall provide two programmable Form C relays. The SIM-16 shall be mountable in an enclosure that is remotely located from the main control panel. The SIM-16 shall be capable of supervising inputs 500 feet away.

14. The Output Control Module (OCM-16) shall provide sixteen open collector outputs to drive LEDs, incandescent lamps or external relays. There shall also be an additional output for a local audible and two inputs for momentary lamp test as well as local audible silence switches. The OCM-16 shall be mountable in an enclosure that is remotely located from the main control panel.

15. The Switch Control Module (SCM-8) shall be a supervised module with 8 switches and two LED’s per switch for controlling such items as speaker/strobe or telephone circuits. The switches shall also be used as generic inputs into the system. The SCM-8’s shall be mounted in the door for easy access. These modules shall be connected to the control area network, and have a maximum distance of 1000 ft. The module shall be model number SCM-8.

16. The LED Control Module (LCM-8) shall contain eight groups of 2 LED’s that shall be programmable by Zeus programming software. Eight LED’s shall be dual color capable
that can be lighted either RED or GREEN flashing or steady. The remaining LED’s shall be AMBER flashing or steady. A space shall be provided for labeling of LED functions. The label shall slide behind a clear protective membrane. The LCM-8s shall be mounted in the door for easy access. These modules shall be connected to the control area network, and have a maximum distance of 1000 ft.

17. The Fan Control Module (FCM-6) shall provide manual control of building HVAC system fans, motors and dampers. Each FCM-6 module shall provide six sets of 3 push button switches for manual system control. Each switch shall have 3 associated LEDs to indicate Fan/Damper/Motor status: with OFF shown by a Red LED, ON shown by a Green LED and TROUBLE shown by a Yellow LED. The FCM-6’s shall be mounted in the door for easy access. These modules shall be connected to the control area network, and have a maximum distance of 1000 ft.

18. The Live Voice Module (LVM) shall have the supervised Microphone and pre-amplifier. The module shall contain 6 programmable switches. The module shall connect to the control area network, and also connect to the PMI. The module shall have remote capability using a Remote Network Interface (RNI). The module requires a Local Page Board (LPB) to convert the audio to a digital signal. The module shall contain a Local Speaker w/control, Ready to Page LED, and a Pre-Announcement tone LED. The module shall be mounted in the door for easy access and viewing. The module shall be model number LVM.

19. The Digital Audio Card (DAC) shall provide 8 channels of digital audio and control of all voice and telephone functions including Background Music or Conventional Paging. This module communicates with the PMI and to all other audio modules via the control area network. The module also contains an async serial interface buss to distribute the audio signals between the zone amplifiers and the Audio Input Card (AIC). The Local Page Board (LPB) shall plug into this card converting the LVM audio to a digital signal. The DAC shall plug in to the system card cage. The card shall be model number DAC-NET.

20. The Zone Amplifier Card (ZAC-40) shall be a 40-watt amplifier supporting Class A or B speaker zone wiring configurations. The ZAC-40 shall be power limited and be configurable to provide 40 watts of audio at 25, 70.7 or 100 VRMS speakers. The ZAC-40 shall be able to reproduce signals from 200 hertz to 12,000 hertz for improved intelligibility of voice communication. The ZAC-40 shall be capable of amplifying any one of the 8 digital audio channels. The ZAC-40 can be used as a single 40 watt speaker zone or as a bulk amplifier for one or two channel applications feeding high level audio to a Zone Indicating Card.

21. The Zone Amplifier Module (ZAM-180) shall be a 180-watt amplifier supporting Class A or B speaker zone wiring configurations. ZAM-180 shall be configurable to provide 150 watts of audio at 25VRMS, 180 watts of audio at 70VRMS or 165 watts of audio at 100VRMS. The ZAM-180 shall be able to reproduce signals from 200 hertz to 12,000 hertz for improved intelligibility of voice communication. The ZAM-180 can be used as a single 180 watt speaker zone or as a bulk amplifier for one or two channel applications feeding high level audio to a Zone Indicating Card.

22. The Audio Input Card (AIC) allows up to 2 external audio sources such as Background music or PBX conventional paging or any source such as CD, and tape player. There are
two relays on the module to control the inputs. The system shall support multiple AIC cards. This card shall plug into the system card cage. The card shall be model number AIC. Output amplifiers and audio zone cards shall perform dynamic supervision, meaning, they can supervise the speaker circuit during operation, meeting UL requirements for the use of fire speakers with background music/paging.

23. The Audio Level Conversion Card (ALCC) shall provide the ability to output line-level audio messages originating from the FireFinder XLSV system to other compatible 3rd party audio systems for enhanced integration.

24. The Firefighter’s Master Telephone (FMT) shall communicate with the firefighters’ telephones in the field. The system shall operate 5 telephones off hook simultaneously without loss of audio quality. The FMT shall have “Warden Page” capability. The FMT shall communicate with the system through the control area network. The FMT shall be door mounted for easy access. With the use of FMT-A-ADPT, the phone riser shall be configurable for Class A operation.

25. The Telephone Zone Card (TZC) shall provide 8 Class B telephone circuits. This card shall produce dial tone and busy signals where appropriate. The TZC shall communicate with the FMT through the control area network. This card shall plug into the system card cage. The card shall be model number TZC-8.

F. System response time from alarm to output shall be an average of three (3) seconds.

G. To expedite system troubleshooting, the system cards shall have ground fault detection, and diagnostic LED’s by card.

H. All system cards and modules shall have Flash memory for downloading the latest module firmware.

I. Passwords:

1. Maintenance/Control Password - There shall be a 5 character password that a user must enter into the control panel in order to perform such maintenance- and control-related functions at the panel as:

   a. Arming and disarming devices.

   b. Activating, deactivating or modifying detector ASD and sensitivity settings.

   c. Activating and deactivating the History Log function, and deleting obsolete entries.

   d. Changing the system time and date.

2. Function Key Password - There shall be a 5 character password that a user must enter into the control panel in order to access the panel's Function Keys: touchscreen buttons which perform custom-programmed system functions.

3. Reports Password - There shall be a 5 character password that a user must enter into the control panel in order to access the panel's reporting functions.
4. Walktest Password - There shall be a 5 character password that a user must enter into the control panel in order to access the panel's walktesting functions.

5. Acknowledge Silenceable Reset Password - There shall be a 5 character password that a system user must enter into the control panel in order to acknowledge events, turn silenceable audibles and visuals on and off, and perform panel resets.

J. Networking:

K. Degrade Mode Alarm Activation:

1. Each data gathering panel shall support the ability to have its corresponding ZIC-4A, ZIC-8B and output devices on a DLC's loop activate when the DLC or CDC-4 is in Degrade Mode (has lost HNET communication with the PMI control panel). For example, if the device loop includes HFP detectors with relay bases and lamps, the relays and lamps will activate upon any system alarm when the DLC is in Degrade Mode.

2. Degrade Mode Alarm Activation with Voice: Each data gathering panel shall support the ability to have its corresponding DAC-NET turn on audio when the DLC or CDC-4 is in Degrade Mode (has lost HNET communication with the PMI control panel).

L. Smoke Control: The FireFinder XLS family of fire alarm panels shall have the ability to be configured as a smoke control station that complies with UL/UUKL (UL 864) and NFPA 92A and ULC/ORD-C100 requirements. The system shall have the capability to monitor and override smoke control systems and equipment provided at designated locations within the same building.

M. Digital Voice Command:

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all global audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.

2. Up to 5 Digital Voice Command Centers shall be supported per system with the ability to limit control to one Digital Voice Command Center via a Request/Grant/Deny mechanism.

3. Function: The Voice Command Center equipment shall perform the following functions:
   a. Operate as a supervised multi-channel emergency voice communication system.
   b. Operate as a two-way emergency telephone system control center.
   c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
   d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
e. Provide all-call Emergency Paging activities through activation of a single control switch.

f. As required, provide vectored paging control to specific audio zones via dedicated control switches.

g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC.

h. Provide a software utility capable of off-line programming for the VCC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the VCC shall not inhibit the emergency operation of other nodes on the fire alarm network.

i. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.

j. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

N. Software Modifications: The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made. Systems that require the use of external programmers or change of EPROMs are not acceptable.

O. Logic: The fire alarm system shall support generic functions that deal with binary states (True/False, high/low), and produce desired outputs from one or more binary inputs (for example, alarm outputs from detector or manual station inputs). AND, OR, NOT, Any N, D Latch, RS Latch, Time Base Control, Start Timer, Restart Timer are generic functions. Generic functions can be used as inputs to other function. The system shall support 1500 logic functions.

P. History: The system shall store 5000 events in history while in straight mode and 4500 in circular mode. In straight mode, trouble warnings will occur at 4000 and 4500 events. In circular mode, the control panels shall maintain a 2000 event Alarm History buffer, which consists of the 2000 most recent alarm events from the 4500 event history file.

Q. Reports:

1. The system shall have the ability to provide configuration, status, queue and history reports.

2. Configuration reports shall provide the following information:

   a. Custom Messages

   b. Database Information
c. Entity Type

d. Device Usage

e. Device Category

f. Firmware revision

3. Status reports shall provide the following information:

a. Disarmed cards and devices

b. ASD settings

c. Sensitivity in %/foot

4. Queue reports shall provide the following information:

a. Alarm events with custom message and event time

b. Supervisory events with custom message and event time

c. Security events with custom message and event time

d. Trouble events with custom message and event time

5. History reports shall provide Address, History Type, Description, Time & Date and Custom Message. The following event types shall be reported:

a. Alarm events

b. Supervisory events

c. Security events

d. Status changes

e. Alarm verification

f. Output activation from logic

g. System Reset

h. Event Acknowledgements

i. Block Acknowledgements
j. Audible Silence System Flag Changes
k. Sensitivity Changes
l. Arm / Disarm Commands
m. Arm / Disarm By Logic
n. Manual Output Overrides
o. Output Overrides By Logic
p. Time Changes
q. Menu Logins
r. ASD Changes
s. Walktest
t. Device Input to Logic Activations/Deactivations

2.03 POWER SUPPLY

A. The system Power Supply/Charger (PSC) shall be a 12-amp supply with battery charger. The power supply shall be filtered and regulated. The power supply shall have a minimum of 1 power limited output rated at 4 amps, and a minimum of 1 output rated at 12 amps. The system power supply can be expanded up to 48 amps. The auxiliary power supply module shall share common batteries with the primary power supply. The system power supply shall have 4 relays, 1 for common alarm, one for common trouble and two programmable relays. The power supply shall be rated for 120/240 VAC 50/60 Hz. The module shall be model number PSC-12 or PSX-12.

B. The battery charger shall be able to charge the system batteries up to 100 AH batteries. Battery charging shall be microprocessor controlled and programmed with a special software package to select charging rates and battery sizes. An optional Thermistor for monitoring battery temperature to control charging rate shall be available.

C. The power supply shall have a plug for an AC adapter cable, which allows a technician to plug in a laptop computer for up or down loading program information or test equipment.

D. Transfer from AC to battery power shall be instantaneous when AC voltage drops to a point where it is not sufficient for normal operation.

2.04 SYSTEM ENCLOSURE

A. Provide the enclosure needed to hold all the cards and modules as specified with at least spare capacity for two cards. The enclosure outer door shall be either black or red. Provide the color as to the local AHJ requirements. The outer doors shall be capable of being a left hand open or a right hand open. The inner door shall have a left hand opening. System enclosure doors shall provide where required ventilation for the modules or cards in the enclosure.
B. Provide system enclosure for all amplifiers. Where required by the manufacturer, provide means for venting heat from the enclosure either by having enclosure sides and top vented or the doors vented.

2.05 SYSTEM PRINTERS

A. The system printer shall be operated from a Remote Printer Module (RPM), which shall be mounted under a table or behind desk. This module shall provide a parallel port and 2 serial ports for RS 232 protocol. One of the serial ports shall be able to be programmed for RS485 protocol. The module shall be model number RPM.

B. The logging printer shall be UL listed with the system. This parallel printer shall be supervised for: On/Off line, out of paper, paper jam, power off, and connection the system. The printer shall be a high speed, 24 dot matrix, wide carriage, and capable of using tractor or friction fed paper. Supervised network connection shall be either Style 4 or 7 as required by local requirements. The printer shall contain diagnostic LED’s for ease in maintenance. The printer shall be module number PAL-1.

C. The Internal Thermal Strip Printer (TSP-40A) shall act as an event logging device providing a permanent history report of all system activity. It shall also provide various system status reports that include detector sensitivities, thresholds, device types and custom messages. It shall mount in the FireFinder XLS CAB1, CAB2 or CAB3 enclosure and its printout is visible through a window in the locked enclosure door. Printouts shall be automatically spooled on a take-up reel for easy record storage. The module shall be model number TSP-40A.

2.06 INTELLIGENT INITIATING DEVICES

A. General

1. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections on either Style 4 or Style 6 circuits.

B. Smoke Detectors – Addressable

1. The detector shall be guaranteed in writing not to false alarm when configured by the factory trained certified technician. The detector must provide up to 11 different environmental algorithms that allow the detector to provide superior false alarm immunity without the need for additional alarm verification delays.

2. The detector shall have a multicolor LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for maintenance required, red for alarm.

3. The multi-criteria smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. So as to minimize the effort required by the installing and maintenance
technician to appropriately configure the detector to ensure optimal system design, the
detectors shall be programmable as application specific. Application settings shall be
selected in software for a minimum of eleven environmental fire profiles unique to the
devices installed location.

4. The detector shall be designed to eliminate the possibility of false indications caused by
dust, moisture, RFI/EMI, chemical fumes and air movement while factoring in conditions
of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon
into the alarm decision to give the earliest possible real alarm condition report.

5. The intelligent smoke detector shall be capable of providing three distinct outputs from
the control panel. The outputs shall be from an input of smoke obscuration, a thermal
condition or a combination of obscuration and thermal conditions. The detector shall be
designed to eliminate calibration errors associated with field cleaning of the chamber.

6. The detector shall support the use of a relay, or LED remote indicator without requiring
an additional software address. Low profile, white case shall not exceed 2.5 inches of
extension below the finish ceiling.

7. For the detector where required, there shall be available a locking kit and detector guard
to prevent unauthorized detector removal.

8. The smoke detector shall be model number HFP-11.

9. Where required, there shall be available a programmable remote lamp configurable to
remotely duplicate the on-board LED status of another system device with the same
software address. It shall be model ILED-H.

C. Heat Detectors – Addressable

1. Thermal Detectors shall be rated at 135 degrees fixed temperature and 15 degrees per
minute rate of rise. Detectors shall be constructed to compensate for the thermal lag
inherent in conventional type detectors due to the thermal mass, and alarm at the set point
of 135 degrees Fahrenheit. The choice of alarm reporting as a fixed temperature detector
or a combination of fixed and rate of rise shall be made in system software and be
changeable at any time without the necessity of hardware replacement.

2. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet
and shall be installed according to the requirements of NFPA 72 for open area coverage.
The thermal detector shall be model number HFPT-11.

D. Duct Smoke Detectors – Addressable

1. For duct detector applications, the smoke detector shall be an intelligent digital
photoelectric detector with a programmable heat detector. Detectors shall be listed for
use as open area protective coverage, in duct installation and sampling assembly
installation and shall be insensitive to air velocity changes.

2. The detector communications shall allow the detector to provide alarm input to the
system and alarm output from the system within four (4) seconds. The detector shall be
mounted in a duct detector housing listed for that purpose. The duct detector shall
support the use of a remote test switch, relay or LED remote indicator. The duct detector shall be supplied with the appropriate sampling tubes to fit the installation.

3. Where duct detectors are exposed to the weather a weatherproof enclosure shall be available. The duct housing cover shall include a test port for functional testing of the detector without cover removal. The duct housing shall include a cover removal switch capable of indicating cover removal status to the fire alarm control panel.

4. The intelligent duct detector shall be model number AD2-P Series. Where required there shall be available a duct housing with an on-board relay. Also where required, there shall be a standalone housing available with its own power supply and test/reset switch that does not require connection to a fire alarm control panel. It shall be model AD2-4W.

E. Detector Bases – Addressable

1. Detector bases shall be low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on an industry standard, 4" square or octagonal electrical outlet box.

2. The model number for the standard base shall be DB-11.

3. Where selective localized control of electrical devices is required for system operation, furnish and install detector base with software programmed addressable relay integral to the base. The relay shall switch electrical loads within relay ratings, as indicated on the drawings. Operation of the addressable control circuit shall be independent of the number of detectors and relays on the circuit or the number in an alarm state. Relay bases shall be rated for resistive or inductive load (120VAC or 30VDC) 3 amps. The relay base shall be model number DB-HR.

4. Where indicated on the drawings, furnish detector base with integral approved audible evacuation alarm signal having an output of 85db @ 10'. The audible signal shall be individually addressable and software programmed for operation. The audible base shall be model number ADBH-11.

F. Manual Pull Stations – Addressable

1. Provide addressable manual stations where shown on the drawings, to be flush or surface mounted as required. Manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel. The manual station communications shall allow the station to provide alarm input to the system and alarm output from the system within less than four (4) seconds.

2. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer's prescribed matching red enamel outlet box.

3. The double action pull station shall be model number HMS-D.
4. Where required, there shall also be available pull stations with break glass, capable of explosion proof installation, capable of weatherproof installation, two stage operation, reset key operation, and metal housings.

G. Addressable Interface Devices

1. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive. The addressable interface modules shall be model number HTRI Series.

2. Where needed a Conventional Zone Module shall connect to the Signal Line Circuit, which will allow the use of conventional initiation devices. This module shall have the ability to support up to 15 convention smoke detectors and an unlimited number of contact devices. This module shall also be capable of monitoring Linear Beam detectors and conventional Flame detectors. Where required, there shall be an intrinsically safe detection solution for NEMA defined intrinsically safe installations (model DI-3IS with ISI-1) compatible with the conventional zone module. The module shall be model HZM.

3. Single Device Damper Monitoring and Control: When connected to a FireFinder XLS system, a single HTRI switch input shall be able to monitor all 3 states of a damper – open, closed, and in transit. When connected to a FireFinder XLS system, a single HTRI-R shall be able to fully control a damper (through the relay connected to the motor control) while also using its switch input for monitoring all 3 states of the damper.

2.07 LINEAR BEAM DETECTOR

A. Linear Beam Detector shall be a single unit containing the transmitter and receiver in the same enclosure. This detector can operate over a range from 17 ft to 280 ft. The detector shall have three sensitivity settings, shall have high immunity to extraneous light, and have automatic and comprehensive test. This detector shall be connected to a HZM module. The linear beam detector shall be model number PBA-1191.

B. Where required, there shall be available a reflective linear beam detector that allows for commissioning from a separately mounted and easily accessible control panel, and includes an auto-alignment and tracking feature (F5000) This detector shall be connected to a HZM module.

C. Where required there shall be available a end-to-end linear beam detector for highly reflective environments (F2000). This detector shall be connected to a HZM module.

2.08 DEVICE PROGRAMMING UNIT

A. Device Programming Unit: The programming tool shall program the intelligent devices with addresses. The unit shall test the device to respond to its address. Dipswitches and rotary switches shall not be acceptable. The programmer shall be model DPU with carrying case.

2.09 NOTIFICATION APPLIANCES

A. Series SE – Speaker and Speaker Strobes
1. Speaker appliances shall be Siemens Series SE Speakers, and the speaker-strobe appliances shall be Siemens Series SE Speaker Strobes or approved equals

2. Speakers shall be UL Listed under Standard 1480 for Fire Protective Service, and speakers equipped with strobes shall be listed under UL Standard 1971 for Emergency Devices for the Hearing-Impaired

3. Speaker with strobes shall be certified to meet the requirements of FCC Part 15, Class B

4. All speakers shall be designed for a field-selectable input of either 25 or 70 VRMS; with selectable power taps from 1/8 watt to 2 watts

5. All wall-mount models shall have listed sound output of up to 89 dBA at 10 feet and a listed frequency response of 400 to 4000 Hz

6. All ceiling-mount models shall have listed sound output of up to 87 dB at 10 feet and a listed frequency response of 400 to 4000 Hz

7. Speaker shall incorporate a sealed-back construction

8. All inputs shall employ terminals that accept #12 to #18 AWG wire sizes

9. Strobe intensity, where Multi-Candela appliances are specified, shall have field-selectable settings, and shall be rated per UL Standard 1971 for:
   a. 15/30/75/110cd (wall mounting)
   b. 135/185cd (wall mounting)

10. Strobe intensity, where Multi-Candela appliances are specified, shall have field-selectable settings, and shall be rated per UL Standard 1971 for:
    a. 15/30/75/110cd (ceiling mounting)
    b. 135/185cd (ceiling mounting)

11. Selector switch for selecting the candela shall be tamper resistant

12. The strobe portion, when synchronization is required, shall be compatible with DSC sync modules, FS-250 panel, FireFinder XLS panel, or PAD-3 power supply with built-in sync protocol

13. The strobes shall not drift out of synchronization at any time during operation

14. The strobes shall revert to a non-synchronized flash-rate, if the sync module or Power Supply should fail to operate (i.e. – contacts remain closed)

15. Wall-mount speaker and speaker-strobe appliances shall be designed for indoor-flush mounting to 4” x 2-1/8” electrical boxes without need for an extension ring or surface mounting

16. Ceiling-mount, speaker-strobe appliances shall be designed for indoor-flush mounting
17. Speaker and speaker strobe shall incorporate a speaker-mounting plate with a snap-on grille cover

18. The finish of the Series SE speakers and speakers strobes shall be white or red

19. All speaker and speaker-strobe appliances shall listed for Special Applications: Strobes are designed to flash at 1-flash-per-second minimum over their “Regulated Input Voltage Range”

B. Series SEF – Speakers and Speaker Strobes

1. Speaker appliances shall be Siemens Series SEF Speakers and speaker-strobe appliances shall be Siemens Series SEF Speaker Strobes or approved equals

2. Speakers shall be UL Listed under Standard 1480 for Fire Protective Service, and speakers equipped with strobes shall be listed under UL Standard 1971 for Emergency Devices for the Hearing-Impaired

3. Speaker with strobes shall be certified to meet the requirements of FCC Part 15, Class B

4. All models shall have listed sound output of up to 87 dB at 10 feet and a listed frequency response of 400 to 4000 Hz

5. Speakers shall be designed for a field-selectable input of either 25 or 70 VRMS, with selectable power taps from 1/8 watt to 2 watts

6. Speaker shall incorporate a sealed-back construction

7. All inputs shall employ terminals that accept #12 to #18 AWG wire sizes

8. Strobe portion of the appliance shall produce a flash rate of one (1) flash per second, and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens

9. Strobe shall be of low-current design

10. Strobe intensity, where Multi-Candela appliances are specified, shall have field-selectable settings, and shall be rated per UL Standard 1971 for:

a. 15/30/75/110cd (wall mount) -or-

b. 135/185cd (wall mount)

c. 15/30/75/95cd (ceiling mount) -or-

d. 115/177cd (ceiling mount)

11. Selector switch for selecting the candela shall be tamper resistant
12. The strobe portion, when synchronization is required, shall be compatible with DSC sync modules, FS-250 panel, FireFinder XLS panel, or PAD-3 power supply with built-in sync protocol

13. The strobes shall not drift out of synchronization at any time during operation

14. Strobes shall revert to a non-synchronized flash-rate, if the sync module or Power Supply should fail to operate (i.e. – contacts remain closed)

15. Speaker and speaker-strobe appliances shall be designed for indoor surface or flush mounting

16. Speaker and speaker-strobe shall incorporate a speaker-mounting plate with a grille cover, which is secured with two screws for a level finish

17. Grille cover shall mount to standard electrical hardware requiring no additional trim plate or adapter

18. The finish of the Series SEF speakers and speakers strobes shall be white or red

19. All speaker and speaker-strobe appliances shall be listed for Special Applications: Strobes are designed to flash at 1-flash-per-second minimum over their “Regulated Input Voltage Range”

C. Series ZH & ZR – Strobes, Horns, Horn/Strobes

1. Audible/Visual notification appliances shall be listed for indoor use, and shall meet the requirements of FCC Part 15 - Class B

2. Appliances shall be listed under UL Standard 1971 (Standard for Safety Signaling Devices for Hearing Impaired) and UL Standard 464 (Fire Protective Signaling)

3. Appliances shall use a universal back plate, which shall allow mounting to a single-gang, double-gang, 4-inch-square, 4”-octal, or a 3-1/2”-octal backbox

4. Two-wire appliance wiring shall be capable of directly connecting to the mounting back plate

5. Continuity check shall occur for entire NAC circuit prior to attaching any audible / visual-notification appliances

6. Dust cover shall fit and protect the mounting plate

7. Dust cover shall be easily removed when the appliance is installed over the back plate

8. Removal of an appliance shall result in a trouble condition by the Fire Alarm Control Panel (FACP)

9. Strobe appliances shall produce a minimum flash rate of 60 flashes per minute (1 flash per second) over the Regulated Input Voltage Range, and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens
10. Strobes shall be available with two or four field-selectable settings in one unit, and shall be rated – per UL 1971 – for up to:
   a. 185cd for wall mounting
   b. 177cd for ceiling mounting

11. Strobes shall operate over an extended temperature range of 32°F to 120°F (0°C to 49°C), and be listed for maximum humidity of 95% RH

12. Strobe inputs shall be polarized for compatibility with standard reverse-polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP)

13. Audibles and Audible/Strobe Combinations
   a. Horns and horn / strobes shall be listed for Indoor use under UL Standard 464
   b. Horns shall be able to produce continuous synchronized output or a temporal code-3 synchronized output
   c. Horns shall have at least 2 sound-level settings of 90 and 95 dBA
   d. Synchronization Modules
   e. The strobe portion, when synchronization is required, shall be compatible with DSC sync modules, FS-250 panel, FireFinder XLS panel, or PAD-3 power supply with built-in sync protocol

14. The strobes shall not drift out of synchronization at any time during operation

15. Audibles and strobes shall be able to synchronize on a 2-wire circuit with the capability to silence the audible, if required

16. Strobes shall revert to a non-synchronized flash-rate, if the sync module or Power Supply should fail to operate (i.e. – contacts remain closed)

17. Speaker and speaker-strobe appliances shall be designed for indoor surface or flush mounting

18. All notification appliances shall be listed for Special Applications: Strobes are designed to flash at 1-flash-per-second minimum over their “Regulated Input Voltage Range”

2.10 DIGITAL COMMUNICATOR

A. The Multi-Point Digital Alarm Communicator (MDACT) shall be UL864 listed to provide point identification of alarm, supervisory, security and trouble events to a Central or Remove Receiving Station. The MDACT shall support the following:

1. Ademco Contact ID or SIA protocol

2. Ademco Contact ID selection shall provide the ability to transmit events for up to 999 individual points
3. SIA selection shall provide the ability to transmit events for up to 2040 individual points
4. Programming of accounts and phone numbers
5. Dual phone line interface
7. Automatic 24-hour test

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Perform work in accordance with the requirements of NFPA 70, NFPA 72 and NECA 1-2006, Standard of Good Workmanship in Electrical Contracting.

B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

C. In the event that limited energy cable installation is allowed, all cable runs shall be run at right angles to building walls, supported from structure at intervals not exceeding 3 feet and where installed in environmental air plenums, be rated for such use and tied/supported by components listed for environmental air plenums installation.

D. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

E. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

G. Provide primary power for each panel from normal/ emergency panels as indicated on the Electrical Power Plans. Power shall be 120 VAC service, transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all circuits and devices.

3.03 BOXES, ENCLOSURES AND WIRING DEVICES

A. Boxes shall be installed plumb and firmly in position.
B. Extension rings with blank covers shall be installed on junction boxes where required.

C. Junction boxes served by concealed conduit shall be flush mounted.

D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

E. "Fire alarm system" decal or silk-screened label shall be applied to all junction box covers.

3.04 CONDUCTORS

A. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

C. Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits; 18 AWG twisted shielded, speaker circuits; 18 AWG twisted, telephone circuit; 18 AWG twisted shielded.

D. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer recommendations.

E. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

F. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

G. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.05 DEVICES

A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

B. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

C. All devices and appliances shall be mounted to or in an approved electrical box.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.

C. A consistent color code for fire alarm system conductors throughout the installation.

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Testing General:

1. All Alarm Initiating Devices shall be observed and logged for correct zone and sensitivity. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the initials of the installing technician and date.

2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.

3. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.

4. Test reports shall be delivered to the acceptance inspector as completed.

5. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:

   a. Ladders and scaffolds as required to access all installed equipment.

   b. Multi-meter for reading voltage, current and resistance.

   c. Two way radios, and flashlights.

   d. A manufacturer recommended device for measuring air flow through air duct smoke detector sampling assemblies.

   e. Decibel meter.

   f. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

3.08 ACCEPTANCE TESTING

A. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the engineer in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.
B. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.

C. The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.

D. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the owner and test results recorded for use at the final acceptance test.

E. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that all panel functions were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

F. Final Acceptance Test: Notify the owner in writing when the system is ready for final acceptance testing. Submit request for test at least 14 calendar days prior to the test date. A final acceptance test will not be scheduled until megger test results, the loop resistance test results, and the submittals required in Part 1 are provided to the owner. Test the system in accordance with the procedures outlined in NFPA 72.

1. Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

2. Test each initiating and indicating device and circuit for proper operation and response. Disconnect the confirmation feature for smoke detectors during tests to minimize the amount of smoke or test gas needed to activate the detector.

3. Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturer's operating and maintenance manual.

4. Visually inspect all wiring.

5. Verify that all software control and data files have been entered or programmed into the FACP.

6. Verify that Shop Drawings reflecting as-built conditions are accurate.

7. Measure the current in circuits to assure that there is the calculated spare capacity for the circuits.

8. Measure voltage readings for circuits to assure that voltage drop is not excessive.

9. Measure the voltage drop at the most remote appliance on each notification appliance circuit.

G. The acceptance inspector shall use the system record drawings in combination with the documents specified in this specification during the testing procedure to verify operation as
programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:

1. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
   a. Open, shorted and grounded signal line circuits.
   b. Open, shorted and grounded notification, releasing circuits.
   c. Primary power or battery disconnected.

2. System notification appliances shall be demonstrated as follows:
   a. All alarm notification appliances actuate as programmed.
   b. Audibility and visibility at required levels.

3. System indications shall be demonstrated as follows:
   a. Correct message display for each alarm input at the control display.
   b. Correct annunciator light for each alarm input at each annunciator and graphic display as shown on the drawings.
   c. Correct history logging for all system activity.

4. System off-site reporting functions shall be demonstrated as follows:
   a. Correct zone transmitted for each alarm input.
   b. Trouble signals received for disconnect.

5. Secondary power capabilities shall be demonstrated as follows:
   a. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
   b. System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
   c. System battery voltages and charging currents shall be checked at the fire alarm control panel.

3.09 DOCUMENTATION

   A. System documentation shall be furnished to the owner and shall include but not be limited to the following:
1. System record drawings and wiring details including one set of reproducible drawings, and a CD ROM with copies of the record drawings in DXF format for use in a CAD drafting program.

2. System operation, installation and maintenance manuals.

3. System matrix showing interaction of all input signals with output commands.

4. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.

5. System program showing system functions, controls and labeling of equipment and devices.

3.10 PROTECTION

A. Remove and replace devices and panel components that are wet, moisture damaged, or mold damaged.

3.11 DEMONSTRATION

A. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing and maintenance of the system provided. The instructor shall train the employees designated by the owner, in the care, adjustment, maintenance, and operation of the fire alarm system.

B. Training sessions shall cover all aspects of system performance, including system architecture, signaling line circuit configurations, sensor and other initiating device types, locations, and addresses, fire alarm control panel function key operation, and other functions as designated by the owner.

C. Required Instruction Time: Provide 16 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the owner. The instruction may be divided into two or more periods at the discretion of the owner. One training session shall be videotaped by the contractor. Videotapes shall be delivered to the owner.

D. Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory and trouble. The instructions shall be approved by the owner.

E. Comprehensive system troubleshooting training shall be provided for a single individual designated by the owner. This session shall be separate and distinct from the above described sessions.

F. All training sessions shall be conducted following final system certification and acceptance. Three additional training sessions shall be provided for all security personnel on all shifts six months after final system certification.
G. All training sessions shall be conducted by an authorized fire alarm system distributor representative, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided.

END OF SECTION
SECTION 16722: WOODFRAMES - INTELLIGENT REPORTING FIRE DETECTION SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section of the specifications includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances and wiring as specified herein.

B. The fire alarm system shall comply with requirements of National Fire Protection (NFPA) Standard No. 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. The system shall be an active/interrogative type system where each transponder and/or addressable device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.

D. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

E. The system as specified shall be supplied, installed, tested and approved by the Owner, Owner’s Insurance Co. and the office of the Middletown Fire Marshal (Authority Having Jurisdiction), and turned over to the owner in an operational condition.

1.2 SCOPE OF WORK

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

B. Basic Performance

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

2. Initiation device circuits shall be wired Class B (NFPA Style B).

3. Notification Appliance Circuits shall be wired Class B (NFPA Style Y).

4. Digitized electronic signals shall employ check digits or multiple polling.

5. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
7. Manufacturer’s Representative
   a. Contractor’s personnel shall have a minimum of 2 year’s experience in service and maintenance of fire detection, and alarm systems.
   b. Equipment shall be supplied by Siemens Fire Safety Division, 104 Sebethe Drive, Cromwell, CT 06416, or approved equal.

1.3 BASIC SYSTEM FUNCTIONAL OPERATION

1. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications at all network Person Machine Interfaces using basic graphics and multiple detail screens. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards.

2. All door holdback devices to de-energize to cause all associated fire doors to close.

3. PMI displays on main fire alarm control and all secondary panels with LCD displays shall display alarm condition, device initiating the alarm and location of device.

4. Transmit alarm condition to central alarm monitoring company via addressable digital dialer (DACT). Coordinate with Owner for exact requirements and provisions necessary for a complete interface.

5. Activation of any smoke detector, pull station, heat detector or water flow device shall cause all of the above to occur, plus it shall cause its integral alarm lamp to be energized until the alarm condition of the detector has been reset.

6. Activation of any smoke detector, pull station, heat detector or water flow device shall activate audible bases in all bedrooms as well as all notification appliances.

7. Sprinkler Supervisory Devices and Carbon Monoxide detectors: The activation of any sprinkler supervisory tamper switch or carbon monoxide detectors shall activate the system supervisory service audible signal and cause a discrete LCD readout to indicate supervisory condition at the control panel. Differentiation between valve - tamper activation or carbon monoxide detector activation and opens and/or grounds on the initiation circuit shall be provided. Pressing the supervisory service acknowledge key shall silence the supervisory audible signal while maintaining the supervisory discrete LCD display indication condition. Restoring the valve to the normal position or resetting the carbon monoxide detector shall cause restoration of the fire alarm system to normal.

8. Any alarms shall be displayed on an 80 character LCD display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on.
subsequent alarm received from another zone shall flash the system alarm LED on the control panel.

9. The LCD display shall show the alarm information. The remote status panel shall mimic the control panel operation.

10. Each building will be programmed for selective building activation.

B. Shop Drawings: Indicate and provide system wiring diagram showing each device and wiring connection required, as well as a complete parts list of required equipment.

C. Software Modifications

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours for a fire/life safety emergency, or within 24 hours for a system trouble.

2. Provide all hardware, software, programming tools and documentation necessary to modify the existing fire alarm system communications device on site to the new face. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

D. Battery calculations for each complete system, including all fire alarm control panel components and peripheral devices.

E. Three (3) sets of catalog cut sheet information and a detailed riser drawing.

1. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.

2. Complete drawings covering the following shall be submitted by the contractor for the proposed system:

   a. The submittals shall include drawings (in CAD compatible format) showing a schematic arrangement of the system including the main control unit and all peripherals. The drawing shall show the type, quantity and arrangement of all modular components within the control unit and shall indicate overall cabinet dimensions. The drawings shall show explicit details regarding the positioning and placement of all detection system components. The drawing shall also include building floor plans drawn to a minimum scale of 1/8” = 1’-0”.

   b. Floor plans shall show all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
3. Installation drawings, shop drawings, and as-built drawings shall be prepared by an individual who is experienced with the work specified herein.

F. Certifications
   1. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.4 GUARANTEE
   A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.5 APPLICABLE PUBLICATIONS
   The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only. The project is governed by the edition of the code that has been adopted at the time of the commencement of the project.
   A. National Fire Protection Association (NFPA):
      1. No. 70 National Electric Code (NEC)
      2. No. 72 National Fire Alarm Code
   B. Underwriters Laboratories Inc. (UL):
      1. No. 50 Cabinets and Boxes
      2. No. 268 Smoke Detectors for Fire Protective Signaling Systems
      3. No. 268A Smoke Detectors (HVAC)
      4. No. 864 Control Units for Fire Protective Signaling Systems
      5. No. 521 Heat Detectors for Fire Protective Signaling Systems
      6. No. 228 Door Closers-Holders for Fire Protective Signaling Systems
      7. No. 464 Audible Signaling Appliances
      8. No. 38 Manually Actuated Signaling Boxes
      9. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
     10. No. 1481 Power supplies for Fire Protective Signaling Systems
     11. No. 1971 Visual Notification Appliances
   C. Local and State Building Codes
D. All requirements of the Owner, Owner’s insurance company and the City of Middletown Fire Marshal’s office (Authority Having Jurisdiction).

1.6 RELATED SECTIONS – if used on this project

A. Section 01015: General Project Requirements
B. Section 01700: Project Closeout
C. Section 01740: Warranties and Bonds
D. Section 15325: Fire Sprinkler Systems
E. Section 16050: Basic Electrical Materials and Methods

PART 2 - PRODUCTS

1.7 EQUIPMENT AND MATERIAL, GENERAL

A. All equipment and components shall be new, and the manufacturer’s current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. All equipment and components shall be installed in strict compliance with the manufacturer’s recommendations. Consult the manufacturer’s installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagram for all specific system installation/termination/wiring data.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

1.8 CONTROL PANEL

A. The control panel shall be modular in construction and shall include, but not limited to; the hardware, software and firmware required to perform the following major system functions:

1. Steel, satin black, baked enamel cabinet with indicator viewing window, removable hinged outer door with cylinder lock and dead front construction with the outer door open. The inner dead front doors shall be hinged for ease of system operation by firefighters and access by technicians for testing and maintenance modes.

2. System power supplies, including necessary transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. All system
devices shall display normal and alarm conditions consistently whether operating
from normal power or reserve (standby) power.

3. Surge protection shall be supplied at the power input to each cabinet. The surge
suppression shall be of the phase to neutral (normal mode suppression). Phase to
ground devices, MOV based devices and pure inductive devices shall not be
considered acceptable. Protection shall also be furnished for SLC and NAC
circuits where exiting and entering any structure, connected prior to any system
devices within the structure.

4. System 16 bit core processor, with internal operating system to process incoming
alarm signals and issue output commands required as a result of the alarm
reception, by system programming or by manual commands. Total system
response time shall not exceed 10 seconds on a system configured to the 240
maximum input address maximum capacity. All system processors shall be
supervised by individual watchdog circuitry furnishing automatic restart after
loss of activity. Systems with a single watchdog circuits for all processors shall
not be acceptable unless supplied with a "hot" standby CPU.

5. Capability shall exist within the system to extend the network at any node to the
systems maximum capacity.

6. Selective historical log, up to 800 events of all types, shall be stored in flash
memory and displayed, printed or downloaded by classification for selective
event reports.
   a. The system shall allow selection of events to be logged, including inputs
   such as: alarms, troubles, supervisory signals, status changes, walk tests
   and device verification; and such outputs as: audible control and output
   activation; and actions such as: resets, sensitivity adjustments,
   arm/disarm, overrides, time and date setting and acknowledgements.
   b. Data format for downloading shall be adaptable to a data base
management program allowing custom report generation to track alarms,
   troubles and maintenance.
   c. Audible and visual indications shall be generated when memory is 80%
   and 90% full to allow downloading of data.
   d. Systems not supporting downloading of event history or requiring
   segregated storage for classifications of event history shall include a PC
   based, dedicated historical logging terminal together with hard drive
   storage and necessary software for system performance analysis and
   report generation.

7. System display/keyboard shall be usable at any network node and shall have the
following capabilities, capacities, indicators and controls:
   a. An 80-character back lighted alphanumeric super twist LCD display
   readable at any angle.
   b. Thirty-two character user defined custom messages shall describe the
   location of the active device.
c. Display shall indicate desired message in a sequence, including; English, English/Spanish. Either of the selected languages shall be selectable as the primary display.
d. Systems unable to perform to this level shall supply PC based terminals displaying the required messages.
e. The system shall be capable of programming to allow troubles occurring and restored in the system to be automatically removed from the display queue.
f. As a minimum, an LED display for "ALARM", "AUDIBLES SILENCED", "SUPERVISORY", "TROUBLE", "SECURITY", "POWER ON" and "PARTIAL SYSTEM DISABLED".
g. Touch activated, audible feedback, membrane switches for "ALARM ACKNOWLEDGE", "AUDIBLE SILENCE", "SUPERVISORY ACKNOWLEDGE", "TROUBLE ACKNOWLEDGE", "SECURITY ACKNOWLEDGE", "RESET", "DISPLAY HOLD" and "DISPLAY NEXT".
h. Touch activated, audible feedback, membrane switch functions, programmable to perform a minimum of twelve custom designed and programmed functions such as drill, disable, bypass automatic control commands or other special functions as required by the system user.
i. The membrane switches shall also be used for the entry of multiple key sequences to be used for pass code protection inputs into logic strings, preventing un-authorized command entry.
j. Ten-digit keypad for pass code entry to perform programming and maintenance functions.

8. The system shall have capabilities allowing vectored reporting of Alarms, Supervisory, Security, Troubles and Status, to dedicated alphanumeric radio pagers. The information displayed on the pager shall identify the system, the device address, and the state of the device and the alphanumeric description of the device location. The system shall have capabilities of up to eight classifications of remote reports.

1.9 POWER SUPPLY

A. System power supply, including necessary transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. All system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.

B. Surge protection shall be supplied at the power input to each cabinet. The surge suppression shall be of the phase to neutral (normal mode suppression). Phase to ground devices, MOV based devices and pure inductive devices shall not be considered acceptable. Protection shall also be furnished for SLC and NAC circuits where exiting and entering any structure, connected prior to any system devices within the structure.
C. Standby power source shall meet the requirements for standby capacity as detailed in NFPA 72, i.e. supervisory for 24 hours and sufficient power to provide the required discharge, control and notification.

D. Transfer from AC to battery power shall be instantaneous when AC voltage drops to a point where it is not sufficient for normal operation.

E. Transfer to battery standby shall be indicated by display and recorded in the history file with time and date. Indication shall be “AC POWER FAILURE”. During battery operation, system shall process all inputs. However, LCD display shall provide five (5) seconds of backlighting for each new input condition, and then turn off LCD back light to conserve battery power. System charger shall provide recharge of batteries to full capacity in 48 hours.

1.10 SYSTEM ENCLOSURES

A. Provide the enclosure needed to hold all the cards and modules as specified with at least spare capacity for two cards. The enclosures shall be black. The outer doors shall be capable of being a left hand open or a right hand open. The inner door shall have a left hand opening. System enclosure doors shall provide ventilation for the modules or cards in the enclosure where required.

1.11 CONDUIT AND WIRE

A. Conduit and Metal Raceway

1. Conduit shall be in accordance with the National Electrical Code (NEC), local and state requirements, including City of Middletown Fire Prevention Ordinance.

2. All wiring shall be installed in conduit or metal raceway. Conduit fill shall not exceed 40% of interior cross sectional area where three or more cables are contained within a single conduit.

3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.

4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the fire alarm control panel manufacturer.

6. Conduit shall be 3/4” (19.1 mm) minimum. Metal raceway shall be sized according to the number of required conductors.

B. Wire

1. All fire alarm system wiring must be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NFPA 70, NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.

3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

5. Wiring used for the multiplex communication loop shall be twisted and shielded and installed in conduit unless specifically approved by the fire alarm equipment manufacturer. The system should permit use of IDC and NAC wiring in the same conduit with the communication loop.

6. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

7. The Fire Alarm Control panel shall be capable of T-Tapping Class B (NFPA Style 4) Signaling Line Circuits. Systems which do not allow, have restrictions to, for example, the amount of T-Taps, length of T-Taps etc., are not acceptable.

C. Terminal Boxes and Junction Boxes

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

1.12 MAIN FIRE ALARM CONTROL PANEL

A. The main FACP is either existing to be upgraded and expanded, or if a replacement is specified, the new equipment shall be Siemens FS-250, no substitutions.

1.13 SYSTEM COMPONENTS

A. Strobe Lights:

1. Shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:

   a. The maximum pulse duration shall be 2/10 of one second.

   b. Candela intensity shall meet the requirements of UL 1971.

   c. The flash rate shall meet the requirements of UL 1971.

   d. The appliance shall be placed 80 in (2,030 mm) above the highest floor level within the space, or 6 in (152 mm) below the ceiling, which ever is lower.
2. Provide flush or semi-flush mounted visual units.

B. Audible/Visual Combination Devices:
   1. Shall meet the applicable requirements of Section A listed above for audibility.
   2. Shall meet the requirements of Section A listed above for visibility.
   3. Provide flush or semi-flush mounted audio/visual units.

C. Addressable Devices - General
   1. Addressable devices shall provide an address-setting means using rotary decimal switches or a programmer provided by the fire alarm control panel manufacturer.
   2. Detectors shall be Intelligent and Addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits. Thermal detectors shall be of the Fixed Temperature type. Rate of Rise is NOT acceptable.
   3. Addressable smoke and thermal detectors shall provide dual (2) alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
   4. Smoke detector sensitivity shall be set through the Fire Alarm Control Panel and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
   5. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
   6. The detectors shall be ceiling or wall mountable and shall include a separate twist-lock base which includes a tamper proof feature. An optional base shall be available with a built-in sounder rated at 85 dBA minimum.
   7. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
   8. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

D. Addressable Pull Box (manual station)
   1. Addressable Pull Boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch. They shall use a key
operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

3. Manual Stations shall be constructed of Lexan or metal with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.

4. Stations shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

5. Addressable pull station shall be by Siemens, or approved equal.

E. Intelligent Ionization Smoke Detector

1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

2. Intelligent photoelectric smoke detector shall be by Siemens, or approved equal.

3. Thermal Detectors shall be intelligent addressable devices rated at 1350°F (580°C) and shall be a programmable fixed temperature rated at 135°F. It shall connect via two wires to the Fire Alarm Control Panel Signaling Line Circuit. Up to 99 intelligent heat detectors may connect to one SLC loop.

4. The detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.

5. Intelligent photoelectric smoke detector shall be by Siemens, or approved equal.

F. Carbon Monoxide Detector

1. The carbon monoxide detectors shall be manufactured by Ultraguard or System Sensor and shall, on command from the control panel, send data to the panel representing the multiple levels of carbon monoxide based on time weighted averages of the gas present.

2. Carbon Monoxide detectors shall be installed in the basement and one on each sleeping floor, as close to the sleeping rooms as possible. Device location to be verified by Owner.

G. Addressable Dry Contact Monitor Module

1. Addressable Monitor Modules shall be provided to connect one supervised IDC zone of conventional Alarm Initiating Devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.

2. The Monitor Module shall mount in a 4-inch square, 2-1/8" deep electrical box.
3. The IDC zone may be wired for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.

4. For difficult to reach areas, the Monitor Module shall be available in a miniature package and shall be no larger than 2-3/4" x 1-1/4" x 1/2". This version need not include Style D or an LED.

H. Two Wire Detector Monitor Module

1. Addressable Monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).

2. The Two-Wire Monitor Module shall mount in a 4” square, 2-1/8” deep electrical box or with an optional surface backbox.

3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor module is operational and in regular communication with the control panel.

I. Addressable Control Module

1. Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.

2. The Control Module shall mount in a standard 4-inch square, 2-1/8” deep electrical box, or to a surface mounted backbox.

3. The control module NAC circuit may be wired for Style Z or Style Y (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

4. The Control Module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.

5. A magnetic test switch shall be provided to test the module without opening or shorting its NAC wiring.

6. The control module shall be suitable for pilot duty applications and rated for a minimum of .6 amps at 30 VDC.

J. Isolator Module
1. Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.

2. If a wire-to-wire short occurs, the Isolator Module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section.

3. The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.

4. The Isolator Module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

1.14 BATTERIES AND EXTERNAL CHARGER

A. Battery

1. Shall be 12 volt, Gell-Cell type.

2. Battery shall have sufficient capacity to power the fire alarm system for not less than four twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

B. External Battery Charger:

1. Shall be completely automatic, with constant potential charger maintaining battery fully charges under all service conditions. Charger shall operate from a 120volt, 60hz power source.

2. Shall be fully rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the batteries.

3. Shall have protection to prevent discharge through charger.

4. Shall have protection for overloads and short circuits on both AC and DC sides.

PART 2 EXECUTION

2.1 INSTALLATION

A. Installation shall be in accordance with the NEC, NFPA 72, local and state and codes and ordinances, as shown on the drawings, and as recommended by the equipment manufacturer.
B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. 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.

2.2 BOXES, ENCLOSURES AND WIRING DEVICES

A. Boxes shall be installed plumb, level and secured firmly in position.

2.3 CONDUCTORS

A. Each conductor shall be identified as shown on the drawings at each end with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.

C. Use a consistent color code for fire alarm system conductors throughout the installation.

2.4 ACCEPTANCE TESTING

A. System on and off-site reporting functions shall be demonstrated as follows:
   1. Correct zone transmitted for each alarm input
   2. Trouble signals received for disconnection of devices

B. Secondary power capabilities shall be demonstrated as follows:
   1. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
   2. System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
   3. System battery voltages and charging currents shall be checked at the fire alarm control panel.

2.5 DOCUMENTATION

A. System documentation shall be furnished to the owner and shall include but not be limited to the following: (2) Operation & Maintenance Manuals containing a copy of the custom software program, catalog cut sheets of the devices supplied and an "as-built" drawing.
   1. System operation, installation and maintenance manuals.
2. System matrix showing interaction of all input signals with output commands.

3. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.

4. System program showing system functions, controls and labeling of equipment and devices.

2.6 TYPICAL OPERATION

A. Actuation of any manual pull station, smoke detector, heat detector or water flow switch shall cause the following operations to occur unless otherwise specified:

1. Activate all programmed notification circuits until silenced.

2. Actuate all strobe units until the panel is reset.

3. Annunciate the active initiating devices and zones.

4. Release all magnetic door holders to doors

5. Activation of any carbon monoxide detectors, sprinkler system low pressure switch, or valve tamper switch shall cause a system supervisory alarm indication.

2.7 TEST

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

B. Systems acceptance test shall be coordinated with the Owner and City of Middletown fire marshal. A test of 100% of devices is required. Test smoke shall be used to test smoke detectors and a heating appliance is required to test addressable heat detectors.

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

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

E. Verify activation of all flow switches.

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

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

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

I. Ground initiating device circuits and verify response of trouble signals.

J. Ground signaling line circuits and verify response of trouble signals.

K. Ground notification appliance circuits and verify response of trouble signals.
L. Check presence and audibility of tone at all alarm notification devices.

M. Check installation, supervision, and operation of all intelligent smoke detectors during a walk test.

N. 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.

O. When the system is equipped with optional features, the manufacturers’ manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

2.8 FINAL INSPECTION

A. At the final inspection a factory trained representative of the manufacturer of the equipment shall demonstrate that the system functions properly in every respect.

2.9 INSTRUCTION

A. Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the system manufacturers’ representatives shall provide a typewritten "sequence of operation" to the owner.

END OF SECTION 16722